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# THE UPSTREAM CAUSES OF ORAL HEALTH DISPARITIES IN BRAZIL

Brazilian population has been experiencing an overall improvement of the oral health status over the recent years.[1,2] The decline in dental caries occurrence in children and adolescents, and the rise in tooth retention among adolescents and adults may suggest a positive shift in oral health according to the last national oral health surveys.[3-5] However, periodontal disease prevalence increased among adults and the high levels of edentulism remained stable among elderly people.[1,2,6]

Once the distribution of dental diseases within and across populations does not occur at random, it is paramount to investigate the causal factors related to occurrence of oral health problems. Oral health research has a longstanding tradition of adopting the so-called individual risk factor approach to investigate the predictors of oral diseases. One of the main focus of this approach is on the role of individual health-related behaviours (eg. smoking) on oral health.[7] However, the risk factor approach has been challenged because it ignores whether unhealthy behaviours results from free choice or preference, or is influenced by the social environment where people are embeeded.[8] The latter advocates that contextual socioeconomic factors that are invisible for individuals influence the distribution of the diseases within and between societies.[8]

The "causes of the causes" of oral diseases is a comprehensive and contemporary concept that acknowledges that the determinants of health stand beyond the individual factors and social inequalities is a central element of health inequalities.[9] Therefore, the uneven distribution of oral diseases may be unnecessary and avoidable since it occurs as a consequence of the unjust and unfair distribution of social conditions that influences health, including poor living and working conditions, social deprivation and wealth concentration.[9]

Despite the positive improvements in oral health in Brazil during recent years, the distribution of oral diseases in Brazil has been characterised by strong regional inequalities.[1,2] Data from the SBBrasil Project 2010 have been used to evaluate the possible role of social inequalities on oral health. Overall, city-level measures of social inequalities including Human Development Index and contextual income inequality (measured using the Gini Index) were meaningful factors associated with dental trauma in children,[10] restorative treatment needs in adults,[11] lack of functional dentition and tooth loss in adults,[12] periodontal disease in adults and elderly people.[6] Further evidence also suggests an increase of socioeconomic inequalities in dental caries in adolescents,[13] and the persistent socioeconomic inequalities related to the lack of functional dentition in adults and older adults.[14]

The oral health improvement of Brazilian population did not occur similarly across all social groups. In fact, the oral health gap between socioeconomic groups increased over the recent years. This contrasting scenario reinforces the need for effective actions to reduce the oral health disparities between socioeconomic groups in Brazil. Dentistry should serve as a tool to tackle oral health inequalities and not the opposite. Dental professionals should reflect on their societal role to alleviate the suffering caused by dental diseases. Oral health prevention and the technological advances in dentistry benefited more people from the better-off social groups. Ultimately, challenging the current *status quo* of the dental profession is needed to promote social equity in oral health. Thus, tackling oral health inequalities requires governmental action through coherent actions by different sectors to gravitate towards equity.

The current national policy of oral health, the so-called Smiling Brazil ("Brasil Sorridente") is considered a comprehensive and ambitious oral health public policy. The complex oral health care network proposed and implemented by Smiling Brazil is essentially based on the expansion of primary dental care through the Family Health Strategy. Furthermore, dental specialty centers ("Centros de Especialidades Odontológicas" [CEOs]) were deployed as secondary care dental care units.[15] The increase in access to dental care and the greater provision of specialized dental care, since the implementation of the Smiling Brazil, mainly among socially deprived groups, is noteworthy. Nonetheless, Smiling Brazil faces two main challenges. The financial underinvestment that affects the policy implementation and its sustainability. Also, dental professionals still need training to work as part of primary health care teams. Much of the work to redress oral health inequities lies beyond the health sector. Therefore, inter-sectoral policies aiming to reduce the income gap between socioeconomic groups such as conditional cash transfer programmes (Bolsa Familia) are also important strategies to reduce oral health inequalities.[16] Current and future policy makers and health care administrators' agenda should address social inequalities to produce positive and sustainable oral health benefits, mainly among underprivileged social groups.

## REFERENCES


1. Ministério da Saúde (BR). Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Projeto SB Brasil 2003: condições de saúde bucal da população brasileira 2002-2003. Resultados principais. Brasília (DF); 2004.
2. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. SB Brasil 2010: Pesquisa Nacional de Saúde Bucal: resultados principais/Ministério da Saúde. Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. – Brasília: Ministério da Saúde, 2012.
3. Nascimento S, Frazao P, Bousquat A, Antunes JLF. Condições dentárias entre adultos brasileiros de 1986 a 2010. Rev Saúde Pública 2013; 47(Supl 3):69-77.
4. Peres MA, Barbato PR, Reis SC, Freitas CH, Antunes JL. Tooth loss in Brazil: analysis of the 2010 Brazilian Oral Health Survey. Rev Saude Publica 2013; 47(Suppl 3):78–89.
5. Roncalli AG, Sheiham A, Tsakos G, Watt RG. Socially unequal improvements in dental caries levels in Brazilian adolescents between 2003 and 2010. Community Dent Oral Epidemiol 2015; 43: 317–324.
6. Valente MIB, Vettore MV. Contextual and individual determinants of periodontal disease: Multlelvel analysis based on Andersen's model. Community Dent Oral Epidemiol 2018; 46: 161-168.
7. Baker SR, Gibson BG. Social oral epidemi(olog)2y where next: one small step or one giant leap?. Community Dent Oral Epidemiol 2014; 42: 481-494.
8. Marmot M, Bell R. Social determinants and dental health. Adv Dent Res 2011; 23:201-206.
9. Marmot M, Wilkinson RG. Social Determinants of Health. 2nd ed. Oxford University Press.
10. Vettore MV, Efhima S, Machuca C, Lamarca GA. Income inequality and traumatic dental injuries in 12-year-old children: A multilevel analysis. Dent Traumatol 2017; 33: 375-382.
11. Roncalli AG, Tsakos G, Sheiham A, de Souza G, Watt RG. Social determinants of dental treatment needs in Brazilian adults. BMC Public Health. 2014 Oct 23;14:1097.
12. Goulart Mde A, Vettore MV. Is the relative increase in income inequality related to tooth loss in middle-aged adults? J Public Health Dent 2016; 76:65-75.
13. Roncalli AG, Sheiham A, Tsakos G, Watt RG. Socially unequal improvements in dental caries levels in Brazilian adolescents between 2003 and 2010. Community Dent Oral Epidemiol 2015; 43: 317–324.
14. Andrade FB, Antunes JLF. Trends in socioeconomic inequalities in the prevalence of functional dentition among older people in Brazil. Cad Saude Publica 2018; 34:e00202017.
15. Pucca GA Jr, Gabriel M, de Araujo ME, de Almeida FC. Ten Years of a National Oral Health Policy in Brazil: Innovation, Boldness, and Numerous Challenges. J Dent Res 2015;94: 1333-1337.
16. Calvasina P, O'Campo P, Pontes MM, Oliveira JB, Vieira-Meyer APGF. The association of the Bolsa Familia Program with children's oral health in Brazil. BMC Public Health 2018; 18: 1186.



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# SUCCESS FREQUENCY OF ROOT CANAL FILLING MATERIALS MOST USED IN PEDIATRIC DENTISTRY

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**Palavras-chave:** Pulpectomia. Dente Decíduo. Obturação do Canal Radicular.

**RESUMO**

**Introdução:** Não há consenso na literatura quanto ao material obturador ideal para canais radiculares de dentes decíduos. **Objetivo**: O objetivo deste estudo foi descrever os materiais obturadores para canais radiculares mais utilizados na clínica Odontopediátrica, mostrando os índices de sucesso observados. **Fonte dos dados**: Uma busca, limitada aos últimos 10 anos e sem restrição de idioma, foi realizada em outubro de 2018 nas bases de dados PubMed, Cochrane e LILACS usando os termos "pulpectomy" e "primary teeth". Esta revisão narrativa da literatura incluiu estudos clínicos controlados randomizados em crianças submetidas a pulpectomia como tratamento endodôntico, com, no mínimo, seis meses de acompanhamento clínico e radiográfico. **Síntese dos dados**: Foram recuperados nas bases de dados 254 artigos. Após a aplicação dos critérios de inclusão e exclusão um total de 25 artigos foram incluídos nesta revisão. A pasta à base de óxido de zinco e eugenol (OZE) foi o material obturador mais utilizado para canais radiculares de dentes decíduos em pesquisa clínica Odontopediátrica, mostrando sucesso clínico e radiográfico geral que variou de 63,3% a 93,3%. **Conclusão**: A pasta à base de óxido de zinco e eugenol é o material mais utilizado para a obturação de canais radiculares de dentes decíduos, embora exista uma tendência para a utilização de pastas à base de iodofórmio com hidróxido de cálcio, que apresentam altas frequências de sucesso.

**Keywords**: Pulpectomy. Primary Teeth. Root Canal Obturation.

**ABSTRACT**

**Introduction:** There is no consensus on the literature about the best root canal filling material for primary teeth. **Objective:** The aim of this study was to describe the root canal filling materials most widely used in clinical pediatric dentistry, showing the observed success rates. **Sources of data:** A search, limited to the last 10 years and, no language restriction, was performed in October 2018 in the PubMed, Cochrane and LILACS databases using the terms "pulpectomy" and "primary teeth". This narrative literature review included clinical and randomized controlled trials conducted on children who had undergone pulpectomy as root canal therapy, with at least six months of clinical and radiographic follow-up. **Synthesis of data:** A total of 254 papers were retrieved from the databases. After applying the inclusion and exclusion criteria, 25 papers were included in this review. Zinc oxide and eugenol (ZOE) based paste was still the most widely used root canal filling material for primary teeth in pediatric clinical research, showing an overall clinical and radiographic success ranging from 63.3% to 93.3%. **Conclusion:** ZOE based paste is still the most used material for root canal filling in primary teeth, although there is a trend in the use of iodoform with calcium hydroxide pastes, which show high frequencies of success.

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# INTRODUCTION

Pulpectomy is the treatment indicated for primary teeth diagnosed with irreversible pulpitis with minimal physiological or pathological root resorption, not exceeding 1/3 of the root length, which could receive a final restoration. The rationale behind this procedure is based on cleaning, disinfecting and filling the root canal with a resorbable paste. However, the morphology of the root canal system of the primary molars is complex and makes the ideal cleanliness hard to achieve. Thus, root canal filling materials with antibacterial and anti-inflammatory properties are recommended. Until now, there has been no consensus in literature concerning the best root canal filling material for primary teeth,[1,2] although there is moderate evidence in favour of zinc oxide and eugenol (ZOE)-based paste, and iodoform with calcium hydroxide-based pastes.[2]

Since the first described root canal therapy in 1930 by Sweet who used a final procedure of canal filling with ZOE-based paste, this material has been used in primary teeth.[3] High success rates have been described for ZOE,[4–6] although this material presents a low resorbing rate, which has been associated with ectopic eruption of permanent successor teeth[7] and cytotoxicity.[8] With the aim of overcoming such drawbacks, alternative pastes have been proposed for root canal filling of primary teeth, including iodoform with calcium hydroxide-based pastes. These pastes have been used with reportedly high rates of clinical and radiographic success,[5,9] show antibacterial properties and are more easily resorbed than ZOE-based pastes.[2]

The aim of this study was to review the literature regarding the root canal filling materials most widely used in clinical pediatric dentistry, showing the clinical and radiographic success rates reported.

## Study design

Electronic searches up to October 2018 were conducted using PubMed, Cochrane Library and LILACS electronic databases. The searched terms were "pulpectomy" and "primary teeth", limited to the title and abstracts fields. A 10-year publication limit was applied in the search performed in by two review authors (MS, ABN). No language restriction was applied. Titles and abstracts and, when needed, results and full text of the retrieved papers were read and evaluated by the two review authors (MS, ABN) for the identification of eligible studies. Any differences between the two readers were solved by consensus or by a third reviewer (AVBP). According to the eligibility criteria, clinical and randomized controlled trials conducted on children who had undergone pulpectomy as root canal therapy, with at least six months of clinical and radiographic follow-up and published between October 2008 and October 2018 were included in this review. There were no restrictions regarding patient's age, gender, ethnicity, tooth type or initial pulpal diagnostic condition.

Data extraction included: references (title, authors, year of publication, geographic location), type of study (clinical, clinical controlled, randomized controlled trial), filling materials used, sample size, follow-up period, and radiographic and clinical outcome with percentage success rate. The clinical and radiographic outcome considered the established criteria of each manuscript.

## Synthesis of data

Initially, 111, 90 and 53 references were retrieved from PubMed, Cochrane library and LILACS, respectively. After the application of a 10-year post-publication limit, 82, 90 and 28 remained, and based on the inclusion and exclusion criteria, 25 papers were selected and included in this review.

The main characteristics of the selected studies were compiled (Table 1). Zinc oxide and eugenol-based paste was the most used root canal filling material (n=13). ZOE was the control material for the evaluation of pulpectomies performed with other filling materials.[5,10–13] Also, ZOE was the filling material chosen when the evaluation of other endodontic technique parameters was the main objective.[14–17] In the selected studies, the frequency of overall clinical and radiographic success ranged from 63.3%[11] to 93.3%,[18] however, no statistically significant variation was observed between the ZOE-based paste groups and the other root canal filling materials evaluated.[5,11–13,18] Likewise, ZOE was used in a study that evaluated restorative techniques.[19]

Iodoform with calcium hydroxide-based (I/CH) pastes were the root canal filling material used in nine studies.[5,6,9,10,13,18,20,21,29] This material was used as the control material in the evaluation of the pulpotomy procedure performed with other materials,[20] and in the evaluation of a biological approach, lesion sterilization and tissue repair technique, in the treatment of carious lesions with pulpal and periapical involvement using a mixture of three antibiotics (ciprofloxacin 200 mg, metronidazole 500 mg, minocycline 100 mg, mixed in a 1:1:1 ratio)[9]. Furthermore, an I/CH paste was the root canal filling material used in a study that evaluated different irrigant solutions[21]. The frequency of overall success reported ranged from 89%[5] to 100%.[18]

Calcium hydroxide was the root canal filling material used in three studies,[22–24] among which evaluated different restorative techniques,[22] and compared the outcomes of pulpectomies with those of pulpotomies with formocresol and ZOE paste as filling material.[23] Considering a long-term follow-up, a high frequency of overall success (92.3%) was observed for a calcium hydroxide-based material.[24]

***Table 1**: Characteristics of the included studies*

| Reference | Study location | Filling material | Sample size | Follow up (months) | Results (success rates) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Overall success | Clinic success | Radiographic success |
| **Chen**[29] | China | ZOE | 47 M | 18 | | 92.2% | 88.2% |
| | | I + CH (Vitapex®) | 40 M | | | 71.4% | 53.6% |
| | | ZOE+I+CH (Endoflas®) | 51 M | | | 96.2% | 92.5% |
| **Sahebalam**[30] | Iran | ZOE | 50 M | 6 | | 89.7% | 79.5% |
| **Cancio**[31] | Brazil | I | 8 | 36 | 75% | | |
| **Brustolin**[32] | Brazil | CH + ZO | 81 | 12 | 62.9% | | |
| **Tang**[33] | China | I + CH (Vitapex®) | 91 M | 18 | 79% | | |
| **Reddy**[34] | India | ZOE (intracanal medication - 3-MIX) | 30 | 12 | | 97% | 97% |
| | | ZOE (intracanal medication - formocresol) | 30 | | | 83% | 47% |
| **Aminabadi et al.**[28] | Iran | ZOE | 40 M previous perforation repared with antibiotics and simvastatin | 24 | | | 96.8% |
| | | | 40 M previous perforation repared with MTA | | | | 0% |
| **Al-Ostwani et al.**[13] | Syria | ZO + propolis | 16 M | 12 | | 93.5% | 62.5% |
| | | ZOE+I+CH (Endoflas®-chlorophenol free) | 6 M | | | 87.5% | 81.3% |
| | | I + CH (Metapex®) | 16 M | | | 87.5% | 75% |
| | | ZOE | 16 M | | | 87.5% | 56.3% |
| **Pramila et al.**[10] | India | ZOE + I (RC Fill) | 35 mandibulars M | 30 | | | 94% |
| | | I + CH (Vitapex®) | 35 mandibulars M | | | | 90% |
| | | ZOE (Pulpdent) | 36 mandibulars M | | | | 97% |
| **Rewal et al.**[12] | India | ZOE | 24 M | 9 | | 83% | 100% |
| | | ZOE+I+CH (Endoflas®) | 26 M | | | 100% | 100% |

***Table 1**: Characteristics of the included studies*

| Reference | Study location | Filling material | Sample size | Follow up (months) | Results (success rates) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Overall success | Clinic success | Radiographic success |
| **Khairwa et al.**[26] | India | ZO + aloe vera gel | 15 mandibulars M | 9 | | 86.67% | 73.34% |
| **Chandra et al.**[11] | India | ZOE | 30 M | 12 | 63.31% | | |
| | | ZO + ozonized sesame oil | 30 M | | 93.3% | | |
| **Howley et al.**[20] | USA | I + CH (Vitapex®) | 74 I | 23 | | | 73% |
| **Barcelos et al.**[15] | Brazil | ZOE | 40 T (G1=smear layer removed) | 24 | 91.2% | | |
| | | ZOE | 42 T (G2=smear layer not removed) | | 70.0% | | |
| **Louwakul & Prucksathamrongkul**[21] | Tailand | I + CH (Vitapex®) | 32 M (irrigated with saline solution) | 18 | 97% | | |
| | | | 32 M (irrigated with chlorhexidine solution 2%) | | 93% | | |
| **Tannure et al.**[16] | Brazil | ZOE | 47 T | 60 | 91.5% | | |
| **Tannure et al.**[17] | Brazil | ZOE | 18 I (G1=smear layer removed) | 36 | 82.3% | | |
| | | ZOE | 8 I (G2=smear layer not removed) | | 88.2% | | |
| **Subramaniametal.**[18] | India | ZOE | 15 M | 18 | 93.3% | | |
| | | ZOE+I+CH (Endoflas®) | 15 M | | 93.3% | | |
| | | I + CH (Metapex®) | 15 M | | 100% | | |

***Table 1***: *Characteristics of the included studies*

| Reference | Study location | Filling material | Sample size | Follow up (months) | Results (success rates) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Overall success | Clinic success | Radiographic success |
| **Ramar & Mungara**[6] | India | I + CH (Metapex®) | 30 M | 9 | 90.5% | | |
| | | ZOE + I (RC Fill) | 34 M | | 84.7% | | |
| | | ZOE + I + CH (Endoflas®) | 32 M | | 95.1% | | |
| **Nakornchai et al.**[9] | Tailand | I + CH (Vitapex®) | 25 M | 12 | | 96% | 56% |
| | | Antibiotics | 25 M | | | 100% | 76% |
| **Aminabadi & Farahani**[19] | Iran | ZOE | 144 T | 24 | | 81.5% | |
| **Zulfikaroglu et al.**[22] | Turkey | CH | 15 T amalgam | 12 | 73% | | |
| | | | 15 T resin TPH / Prime & Bond NT | | 93% | | |
| | | | 15 T Dyract / Prime & Bond NT | | 73% | | |
| | | | 15 T Dyract NRC / Prime & Bond NT | | 80% | | |
| | | | 15 T F-2000 / Prompt L-loop | | 87% | | |
| **Coser et al.**[23] | Brazil | CH (Calen®) | 23 M | 48 | | | 90% |
| **Trairatvorakul & Chunlasikaiwan**[5] | Tailand | ZOE | 27 M | 12 | 85% | | |
| | | I + CH (Vitapex®) | 27 M | | 89% | | |
| **Sari et al.**[24] | Turkey | CH (Sealapex®) | 62 T | 36 | 92.3% | | |

*Legend: ZOE = zinc oxide and eugenol; I = iodoform; CH = calcium hidroxide; PCFC = parachlorophenol; M = molars; I = incisors; T = teeth.*

Endoflas® is a root canal filling paste composed of a powder component of iodoform, zinc oxide, calcium hydroxide and barium sulphate, and a liquid consisting of eugenol and paramonochlorophenol. The standard formulation was used in three studies compared with ZOE[6,12,18,29] and two with I/CH based pastes.[6,18,29] The authors reported a frequency of overall success for Endoflas® that ranged from 93.3%%[18] to 100%.[12] A chlorophenol-free formulation was clinically evaluated[13], and 87.5% and 81.3% clinical and radiographic success rates were obtained after 12-month follow-up.

# DISCUSSION

For many years, ZOE paste has been the first-choice material for the filling of primary teeth with an indication for pulpectomy.[15] Furthermore, ZOE-based paste has remained the preferred material for root canal filling of primary teeth (85%) of the pediatric dentistry programs of U.S. dental schools, although the use of iodoform paste with calcium hydroxide has increased.[25] However, ZOE-based paste has some drawbacks, including the limited antibacterial effect, lower resorbing pace compared to physiological exfoliation of the primary teeth and irritation to the periapical tissues caused by eugenol.[2,11]

As an alternative to ZOE-based pastes, other vehicles have been added to zinc oxide powder, which is a mild astringent and topical protectant with a relatively antiseptic property. The combination of ozonated oil and zinc oxide, aimed at long-lasting antibacterial action, showed a clinical and radiographic overall success rate of 93.3% compared to the 70% obtained with ZOE-based paste.[11] When aloe vera, an anti-inflammatory, antibacterial and pain-relieving substance, was introduced the success rates observed were 100% and 73.34% for the clinical and radiographic parameters[26]. Likewise, the introduction of propolis, a natural antibacterial product, showed a higher frequency of clinical

success (93.8%) than other materials, although the radiographic success rate was lower (62.5%).[13]

Based on this literature review, the most widely used root canal filling material for primary teeth was the ZOE-based paste. Of the 25 articles in our literature search, 13 used ZOE as filling material. Our result corroborates the conclusion of two systematic reviews in the literature on ZOE-based paste for root canal filling of primary teeth. Barcelos et al.[1] compared the clinical and radiographic performance of ZOE-based paste with other root canal filling materials for primary teeth in a long-term follow-up. The overall success rates for the pulpectomies performed with the ZOE-based paste, with iodoform with calcium hydroxide and with calcium hydroxide alone were respectively 85–100%, 89–100% and 80%. Barja-Fidalgo et al.[2] compared the effectiveness of other root canal filling materials for primary teeth with the ZOE-based paste and concluded that both the latter and iodoform with calcium hydroxide were suitable materials.

Iodoform-based pastes have several favourable characteristics: i) they are effective in removing remaining infections, ii) they resorb quickly when extruded beyond the root canal apex, and iii) they are easily applied[5]. Different formulations of root canal filling materials containing iodoform are available and were identified in our search: i) iodoform, camphor, menthol and parachlorophenol;[27] ii) iodoform, zinc oxide, calcium hydroxide, barium sulphate, eugenol and paramonochlorophenol;[18] iii) iodoform, zinc oxide, calcium hydroxide, barium sulphate and eugenol;[13] iv) ZOE with iodorform;[6] and v) calcium hydroxide and iodoform.[5] In recent studies, an I/CH was used as control material for pulpotomies[20] and for the evaluation of pulpectomies that used the antibiotic paste.[9] Nakornchai et al.[9] found a similar frequency of radiographic success between the I/CH and antibiotic-based paste groups in the initial six months of follow-up. However, after 12 months, only 56% of the evaluated teeth were still filled with the I/CH paste. Trairatvorakul and Chunlasikaiwan[5] also observed the resorption of the material inside the root canals of primary teeth. Despite this I/CH drawback, the comparison of the overall success rates of the ZOE-based paste and iodoform with calcium hydroxide was 89% to 85%[5] and 89% to 100%.[1]

It is worth mentioning that the clinical and radiographic frequencies of success should be carefully analysed and compared, since there is no consensus regarding an ideal standard protocol for the pulpectomy procedure.[2] While most of the studies reported a single intervention visit,[5,6,9-13,17-19,21,22,24,26,32,33] other studies two-visits[9,15,16,23,28,29,31,34] and two did not present the information[20,30]. In addition, regarding the filling techniques, the use of lentulo spirals,[5,6,10-13,15,17,22-24,29,32,34] syringes[6,9,10,16,18,19,21,29,32,33] and K-file[32] were reported. Furthermore, the included studies presents some differences as type of study, sample size, inclusion and exclusion criteria and also clinical, radiographic and overall criteria for outcome evaluation, the comparison of results demand a certain amount of caution. However, we observed high clinical and radiographic success rates in the selected studies for all the proposed treatments.

The diversity of root canal filling materials identified in this study shows that the search for an ideal material for primary teeth is still an object of concern among pediatric dentistry researchers. Although the use of iodoform with calcium hydroxide-based pastes as a root canal filling material has increased, ZOE-based paste is still most widely used as endodontic filler for primary teeth, as a control material for other materials and for the evaluation of different technique parameters.

## CONCLUSION

In light of this literature search, it can be concluded that ZOE paste is still the most widely used root canal filling material for primary teeth, although there is a trend towards the use of iodoform with calcium hydroxide-based pastes, which presents high frequency of success.

## REFERENCES

1. Barcelos R, Santos MAP, Primo L, Luiz RR, Maia LC. Root canal filling materials for primary teeth: a systematic review. J Clin Ped Dent. 2011;35(3):241–8.
2. Barja-Fidalgo F, Moutinho-Ribeiro M, Oliveira MAA, Oliveira BH. A systematic review of root canal filling materials for deciduous teeth: is there an alternative for zinc oxide-eugenol? ISRN Dent. 2011;2011:1–7.
3. Sweet CA. Procedure for treatment of exposed and pulpless deciduous teeth. J Am Dent Assoc. 1930;17:1150–5.
4. Subramaniam P, Konde S, Mandanna DK. An in vitro comparison of root canal measurement in primary teeth. J Indian Soc Pedod Prev Dent. 2005;23:124–5.
5. Trairatvorakul C, Chunlasikaiwan S. Success of pulpectomy with zinc oxide-eugenol vs calcium hydroxide/iodoform paste in primary molars: a clinical study. Pediatr Dent. 2008;30:303–8.
6. Ramar K, Mungara J. Clinical and radiographic evaluation of pulpectomies using three root canal filling materials: an in vivo study. J Indian Soc Pedod Prev Dent. 2010;28:25–9.
7. Tannure PN, Da Silva Fidalgo TK, Barcelos R, Gleiser R, Primo LG. Ectopic eruption of permanent incisors after predecessor pulpectomy: five cases. Gen Dent. 2011;59:e162–7.
8. Azar NG, Heidari M, Bahrami ZS, Shokri F. In vitro cytotoxicity of a new epoxy resin root canal sealer. J Endod. 2000;26:462–5.
9. Nakornchai S, Banditsing P, Visetratana N. Clinical evaluation of 3Mix and Vitapex as treatment options for pulpally involved primary molars. Int J Paediatr Dent. 2010;20:214–21.
10. Pramila R, Muthu MS, Deepa G, Farzan JM, Rodrigues SJL. Pulpectomies in primary mandibular molars: a comparison of outcomes using three root filling materials. Int Endod J. 2016;49:413–21.
11. Chandra SP, Chandrasekhar R, Uloopi KS, Vinay C, Kumar NM. Success of root fillings with zinc oxide-ozonated oil in primary molars: preliminary results. Eur Arch Paediatr Dent. 2014;15:191–5.

12. Rewal N, Thakur AS, Sachdev V, Mahajan N. Comparison of endoflas and zinc oxide eugenol as root canal filling materials in primary dentition. J Indian Soc Pedod Prev Dent. 2014;32:317–21.
13. Al-Ostwani AO, Al-Monaqel BM, Al-Tinawi MK. A clinical and radiographic study of four different root canal fillings in primary molars. J Indian Soc Pedod Prev Dent. 2016; 34: 55–59.
14. Bawazir OA, Salama FS. Clinical evaluation of root canal obturation methods in primary teeth. Pediatr Dent. 2006; 28: 39–47.
15. Barcelos R, Tannure PN, Gleiser R, Luiz RR, Primo LG. The influence of smear layer removal on primary tooth pulpectomy outcome: a 24-month, double-blind, randomized, and controlled clinical trial evaluation. Int J Paediatr Dent. 2012;22:369–81.
16. Tannure PN, Barcelos R, Götze GR, Azevedo CP, Gleiser R, Primo LG. Pulpectomies with smear layer removal in primary anterior teeth: five years of follow-up [Pulpectomias com remoção de smear-layer em dentes decíduos anteriores: cinco anos de acompanhamento]. Pesqui Bras Odontopediatria Clin Integr. 2011;11:251–56.
17. Tannure PN, Azevedo CP, Barcelos R, Gleiser R, Primo LG. Long-term outcomes of primary tooth pulpectomy with and without smear layer removal: a randomized split-mouth clinical trial. Pediatr Dent. 2011;33(4):316–20.
18. Subramaniam P, Gilhotra K. Endoflas, zinc oxide eugenol and metapex as root canal filling materials in primary molars: a comparative clinical study. J Clin Pediatr Dent. 2011;35(4):365–9.
19. Aminabadi NA, Farahani RMZ. The efficacy of a modified omega wire extension for the treatment of severely damaged primary anterior teeth. J Clin Pediatr Dent. 2009;33(4):283–8.
20. Howley B, Seale MSNS, Mcwhorter MSDAG, Kerins MSC, Boozer KB, Lindsey D. Pulpotomy versus pulpectomy for carious vital primary incisors: randomized controlled trial. Pediatr Dent. 2012; 34(5):112–9.
21. Louwakul P, Prucksathamrongkul W. The effect of 2% chlorhexidine as root canal irrigant in pulpectomies of primary molars. Pediatr Dent. 2012;34(7):e192–6.
22. Zulfikaroglu BT, Atac AS, Cehreli ZC. Clinical performance of Class II adhesive restorations in pulpectomized primary molars: 12-month results. J Dent Child (Chic). 2008;75(1):33–43.
23. Coser RM, Gondim JO, Aparecida Giro EM. Evaluation of 2 endodontic techniques used to treat human primary molars with furcation radiolucency area: a 48-month radiographic study. Quintessence Int. 2008;39(7):549–57.
24. Sari S, Okte Z. Success rate of Sealapex in root canal treatment for primary teeth: 3-year follow-up. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008;105(4):e93–6.
25. Dunston B, Coll JA. A survey of primary tooth pulp therapy as taught in US dental schools and practiced by diplomates of the American Board of Pediatric Dentistry. Pediatr Dent. 2008;30(1):42–8.
26. Khairwa A, Bhat M, Sharma R, Satish V, Maganur P, Goyal AK. Clinical and radiographic evaluation of zinc oxide with aloe vera as an obturating material in pulpectomy: an in vivo study. J Indian Soc Pedod Prev Dent. 2014;32(1):33–8.
27. Holan G. Long-term effect of different treatment modalities for traumatized primary incisors presenting dark coronal discoloration with no other signs of injury. Dent Traumatol. 2006;22(1):14–7.
28. Aminabadi NA, Huang B, Sciences H, Agheli S, Jamali Z, Shirazi S. A randomized trial using 3Mixtatin compared to MTA in primary molars with inflammatory root resorption: a novel endodontic biomaterial. J Clin Pediatr Dent. 2016;40(2):95–102.
29. Chen X, Liu X, Zhong J. Clinical and radiographic evaluation of pulpectomy in primary teeth: a 18-months clinical randomized controlled trial. Head Face Med. 2017;Oct 27;13(1):12. doi: 10.1186/s13005-017-0145-1.
30. Sahebalam R, Sarraf A, Jafarzadeh H, Jouybari-Moghaddam M, Seyed-Musavi S. Clinical and Radiographic Success of Electrosurgical Pulpectomy in Primary Teeth. Bull Tokyo Dent Coll. 2017; 58(2):77-83. doi: 10.2209/tdcpublication.2016-0006.
31. Cancio V, Carvalho Ferreira D, Cavalcante FS, Rosado AS, Teixeira LM, Braga Oliveira Q, et al. Can the Enterococcus faecalis identified in the root canals of primary teeth be a cause of failure of endodontic treatment? Acta Odontol Scand. 2017; Aug;75(6):423-428. doi: 10.1080/00016357.2017.1328742. Epub 2017 Jun 5.
32. Brustolin JP, Mariath AA, Ardenghi TM, Casagrande L. Survival and Factors Associated with Failure of Pulpectomies Performed in Primary Teeth by Dental Students. Braz Dent J. 2017;Jan-Feb;28(1):121-128. doi: 10.1590/0103-6440201601009. Epub 2016 Dec 12.
33. Tang Y, Xu W. Therapeutic effects of Pulpotomy and Pulpectomy on deciduous molars with deep caries. Pak J Med Sci 2017; Nov-Dec;33(6):1468-1472. doi: 10.12669/pjms.336.13488.
34. Reddy GA, Sridevi E, Sai Sankar AJ, Pranitha K, Pratap Gowd MJS, Vinay C. Endodontic treatment of chronically infected primary teeth using triple antibiotic paste: An *in vivo* study. J Conserv Dent 2017; Nov-Dec;20(6):405-410. doi: 10.4103/JCD.JCD_161_17.

# EROSIVE TOOTH WEAR – WHY CLINICIANS SHOULD BE AWARE OF THIS CONDITION

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**Palavras-chave:** Erosão Dentária. Diagnóstico. Prevenção.

**RESUMO**

**Introdução:** O Desgaste Dentário Erosivo é definido como um processo químico-mecânico que leva a uma perda cumulativa de tecido dentário duro, sem que ocorra o envolvimento de bactérias. **Objetivo**: atualizar os cirurgiões-dentistas sobre os principais tópicos a respeito do Desgaste Dentário Erosivo. **Fonte de dados:** principais bases científicas (PubMed, Lilacs) nos últimos 10 anos, com as palavras-chave: erosão dentária, diagnóstico e prevenção. Foram selecionados os artigos clássicos sobre o tema para a realização da revisão integrativa de literatura. **Síntese de dados**: A prevalência de Desgaste Dentário Erosivo tem sido reportada na literatura em porcentagens que variam de 10% a 80% em crianças e de 4% a 82% em adultos. A abordagem clínica do Desgaste Dentário Erosivo deve incluir um diagnóstico precoce, a avaliação dos diferentes fatores etiológicos, a identificação do risco e a proposta de medidas preventivas para retardar a progressão dessa condição. Essas medidas incluem a aplicação de fluoretos, o uso de dentifrícios com baixa abrasividade, monitoramento clínico e, em casos mais graves, a aplicação de selantes e procedimentos restauradores. Pacientes diagnosticados com transtornos alimentares ou com refluxo gastroesofágico são considerados um dos grupos de risco mais importantes para o desenvolvimento dessa condição. **Conclusão:** Os clínicos devem estar atentos a essa condição de prevalência crescente, uma vez que a perda de estrutura dentária é irreversível, promovendo medidas preventivas eficazes, desde os estágios iniciais, contribuindo assim para o controle e redução do Desgaste Dentário Erosivo entre seus pacientes.

**Keywords:** Tooth Erosion. Diagnosis. Prevention.

**ABSTRACT**

**Introduction:** Erosive tooth wear (ETW) is defined as a chemical-mechanical process leading to the cumulative loss of hard dental tissue without the involvement of bacteria. **Objective:** to give to clinicians an overview about most important ETW topics. **Data source:** main scientific data base (PubMed, Lilacs) in the last 10 years, with the keywords: dental erosion, diagnosis and prevention. Classical articles were selected for the realization of an integrative literature review. **Data synthesis**: the prevalence of ETW has been reported to range from 10% to 80% in children and 4% to 82% in adults. The management of ETW should include early diagnosis, the evaluation of different etiological factors, risk identification and the proposal of preventive measures to avoid the progression of the condition. These measures include fluoride exposure, use of low abrasive toothpastes, clinical monitoring, and in more severe cases sealant application and restorations. Patients suffering from eating disorders with purging behaviour and gastroesophageal reflux disease are considered the most important risk groups. **Conclusion**: Clinicians should be aware of this condition with growing prevalence, once substance loss is an irreversible condition, providing prompt preventive measures during the early stages that are essential to reduce ETW.

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# INTRODUCTION

Erosive tooth wear (ETW) is defined as a chemical-mechanical process leading to the cumulative loss of hard dental tissue without the involvement of bacteria.[1,2] Recently, some authors claimed to modify the denomination into 'biocorrosion', which embraces the chemical, biochemical, and electrochemical degradation of tooth substance caused by endogenous and exogenous acids, proteolytic agents, as well as the piezoelectric effects only on dentin. Beside this effort, ETW is the most known term, used on the recent European Consensus.[1]

Enamel dissolution occurs both at the enamel/acid interface, as well as within a partly demineralized thin softened layer of enamel, in a process called near-surface demineralization,[3] leading to loss of minerals, and consequently, loss of tooth substance. Therefore, ETW is clinically characterized as shiny, silky- glazed, but sometimes dull, excessively smooth tooth surfaces, with the absence of perikymata.[4,5]

The prevalence of ETW has been reported to range from 10% to 80% in children and 4% to 82% in adults.[6] Regarding deciduous teeth in children up to 7 years old, some results from a systematic review indicate that the prevalence of ETW into the dentin increases significantly with age.[7] In Brazilian teenagers ETW prevalence ranged from 7.2% to 38.2%.[8,9] The large variation in the results of the studies seems to be mainly due to the studied differences, different indexes used to ETW detection, as well as to the adjustments of acidic beverage consumption.[6]

The most important sources are dietary acids (acidic foods and drinks) and gastric acids (regurgitation and reflux disorders).[10,11] It is increasingly recognized as a common condition with complications such as tooth sensitivity, altered aesthetics and loss of occlusal vertical dimension.[6]

The management of ETW should include an early diagnosis, the evaluation of different etiological factors, risk identification and the proposal of preventive measures to delay the progression of the condition.[12] Considering that the substance loss is an irreversible condition, prompt preventive measures, during the early stages, are essential to reduce ETW.[13] On this paper, we aimed to resume the main aspects about Erosive Tooth Wear, through a integrative review of the literature based on most recent papers, classic researchers about ETW, to help clinicians to deal with this condition, with growing prevalence.

# DATA SOURCE

Main scientific data base (PubMed, Lilacs) published in the last 10 years, with the keywords: dental erosion, diagnosis and prevention. Classical articles were selected for the realization of an integrative literature review.

# DATA SYNTHESIS

## DIAGNOSIS

The first step to deal with this condition is an accurate diagnosis. During an initial phase, teeth could look as shinier as sound ones, thus the condition may not be detected by most of clinicians. Diagnosis requires a thorough knowledge of both morphological patterns typical of this type of wear and the factors that are likely to contribute to the development of ETW. An accurate anamneses, including findings related to dietary habits (including beverages) and medical background are essential to target risk groups.

On past several indexes were used to measure and follow up the teeth surfaces. In 2008, a new scoring system, the Basic Erosive Wear Examination (BEWE), has been designed to provide a simple tool for use in general practice, teaching and researches and to allow comparison to other more discriminative indices.[14] The grading includes four levels which is neither too precise nor too crude, and the threshold values should be easy to learn and to calibrate. This index has less scores, which improves the use on epidemiological researches, but still can discriminate small changes on toot surface, being also helpful to use at clinical practice, providing accurate information about patient condition during time.[14] The most severely affected surface in each sextant is recorded with a four-level score and the cumulative score classified and matched to risk levels which guide the management of the condition (Tables 1 and 2, Figure 1).

When ETW reaches dentin, the lesions progression increase, once dentin is less mineralized than enamel. The dentine is exposed to the oral environment, which may explain the cases of hypersensitivity. The appearance of lesion, as well as cupping and grooving on occlusal surfaces, are considered typical signs of 'early' erosive tooth wear.

Erosive tooth wear lesions in restored teeth are known by margin degradation and restorations rising above the level of the adjacent tooth surface. This process starts at enamel and could develop until dentin is exposed (rounding of cusps and grooves).[1] Differential diagnosis should include ETW lesions and Non-Carious Cervical Lesions (NCCLs). With respect to ETW lesions, the cervical margin of enamel is preserved, once the crevicular fluid protects this area against acid attack, while most of triangular shape lesions of NCCLs are located on enamel-dentin junction.[2,5]

The outermost layer of aprismatic enamel and the absence of perikymata in deciduous teeth make the diagnosis of tooth wear in its early stages difficult in daily practice. Optical assessment of ETW has been tested to improve diagnosis. The mode of action of these devices is based on the fact that abrasion of eroded teeth results in the partial removal of the softened enamel tissue and an increase in the specular reflection intensity due to smoothing of the etched enamel surfaces.[15] This tool had been tested in extracted permanent and deciduous teeth, with good results in intra and inter examiners values, especially in permanent teeth.[16] More studies should be developed to improve the performance in deciduous teeth and to test at clinical conditions. Besides the accurate clinical examination, important information about patient should be investigated.

***Table 1***: *Criteria for grading erosive wear (Barlett, Ganss, Lussi, 2008):*

| Score | Description |
|---|---|
| 0 | No erosive tooth wear |
| 1 | Initial loss of surface texture |
| 2* | Distinct defect, hard tissue loss < 50% of the surface area |
| 3* | Hard tissue loss ≥ 50% of the surface area |

*Note:*in scores 2 and 3 dentine often is involved*

***Table 2***: *Risk levels as a guide to clinical management (Barlett, Ganss, Lussi, 2008):*

| Risk level | Cumulative BEWE score of all sextants | Clinical Management |
|---|---|---|
| None | Less than or equal to 2 | Routine maintenance and observation. Repeat at 3-year intervals |
| Low | Between 3 and 8 | Oral hygiene and dietary assessment, and advice, routine maintenance and observation. Repeat at 2-year intervals. |
| Medium | Between 9 and 13 | Oral hygiene and dietary assessment, and advice, identify the main aetiological factor(s) for tissue loss and develop strategies to eliminate respective impacts. Consider fluoridation measures or other strategies to increase the resistance of tooth surfaces Ideally, avoid the placement of restorations and monitor erosive wear with study casts, photographs, or silicone impressions. Repeat at 6–12-month intervals. |
| High | 14 and over | Oral hygiene and dietary assessment, and advice, identify the main aetiological factor(s) for tissue loss and develop strategies to eliminate respective impacts. Consider fluoridation measures or other strategies to increase the resistance of tooth surfaces. Ideally, avoid restorations and monitor tooth wear with study casts, photographs, or silicone impressions. Especially in cases of severe progression consider special care that may involve restorations. Repeat at 6–12- month intervals. |

*Note: The cut-off values are based on experience and studies of one of the authors (A. L.) and could to be reconsidered.*

## Erosive tooth wear: targeting risk groups and patient-related risk factors

The risk for developing erosive lesions varies depending on a person's background, behaviour, medical variables and dietary practices. Among patients suffering from eating disorders with purging behaviour and gastroesophageal reflux disease (GERD) a clear impact on ETW prevalence and severity can be detected.[17]

Regarding exogenous causes, it has been stated a possible dose- response relationship between ETW and the consumption of acidic diets.[18,19] However, some people who consume dietary acids develop erosive lesions and some do not.[20] These individual variations could be addressed to saliva protecting effect and oral hygiene habits. The same controversial results apply for the association between drugs and medication intake or occupational acid exposure and ETW prevalence.[18]

The lack of well-designed controlled epidemiological studies makes it difficult to find strong evidences related to the likelihood of developing ETW for all risk groups.[17,18,21] Dental professional must pay special attention in such groups and carry out a diagnostic protocol, in order to prevent further health implications.

## Intrinsic source of acid

### *Gastroesophageal reflux disease*

According to a recent longitudinal study, nearly 60% of patients diagnosed with ETW present significant gastroesophageal reflux disease (GERD), despite other minor reflux symptoms.[22] A current study conducted in India, among pediatric patients suffering from GERD, detected that the occlusal

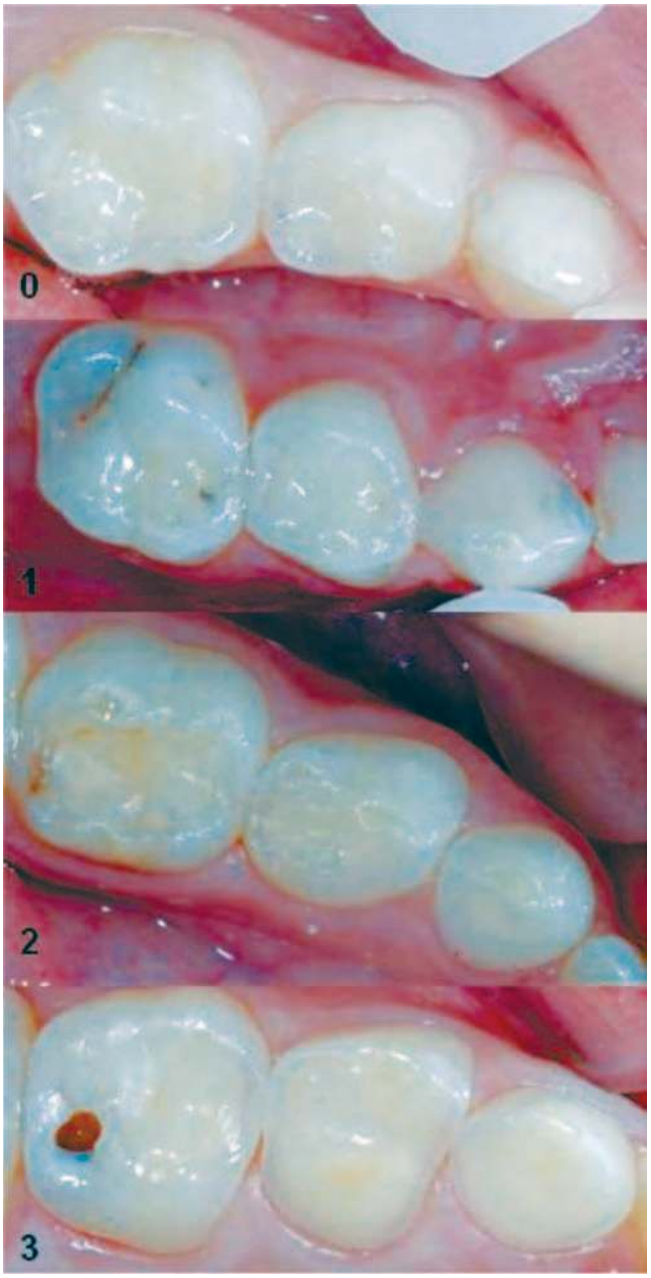


***Figure 1:*** *Deciduous teeth classified as BEWE Scores.*

surfaces of maxillary primary molars and mandibular permanent molars were mostly affected by ETW.[23] The presence of ETW, especially in posterior teeth, can be a vital sign to suspect of GERD and refer the patient to proper diagnosis.

Regarding the dental implications caused by GERD, Figure 2 shows the upper and lower arches of a ten-year-old Caucasian boy, patient at the Pediatric Clinic at the Faculty of Dentistry of Federal University of Minas Gerais, Brazil. The child was complaining of recurrent pain, particularly in posterior teeth, while eating hot and cold foods and when brushing his teeth.

According to his parents, the child had been under medical supervision by a gastroenterologist since the age of 6, when he was diagnosed with GERD. His medical treatment consisted in lifestyle changes, such as in sleeping position and the use of antacids. Besides the presence of reflux, an important finding regarding the patient's oral hygiene is worth mentioning: his mother reported that since she noticed his molars were no longer with a white color, she started brushing them harder to "get them rid of that yellowish dirt". The erosive lesions were being erroneously confused with dental plaque. Figure 3 shows the patient's toothbrushes, indicating that an excessive force was used to brush the teeth, leading to more surface loss.



***Figure 2:*** *Upper and lower dental arches of a 10-year-old patient showing typical images of erosive tooth wear lesions on deciduous teeth secondary to gastroesophageal reflux.*



***Figure 3:*** *The toothbrushes used by the patient with erosive tooth wear*

*Eating disorders*

Nowadays, beauty standards spread in the media are reinforcing self- insecurity, especially among young people. Body dissatisfaction and the obsession with physical attractiveness are contributing to harmful behaviours, developed as attempts to lose or control body weight.[24] In this scenario emerge eating disorders with the highest rates of morbidity and mortality of any mental disorder among adolescents [25], who go untreated, reach only partial recovery or do not recover. [26]

Dental implications such as ETW have been reported as oral manifestations associated with eating disorders, its risk behaviour and purging practices.[27-29] Bulimic behaviour directly causes ETW due to compensatory methods, such as self-induced vomiting (SIV) practices[30] and acidic food choices.[19] According to a systematic review, several studies have identified significantly higher values of ETW among diagnosed patients suffering from eating disorders compared to control groups.[30] Due to dental implications, dentists may be capable of suspecting eating disorders and contributing to early referral for specific treatment.[30,31] However, it has been detected a need for dentists with communication skills to provide an open and empathic recognition approach toward patients with eating disorders.[31]

*Celiac disease*

Celiac disease (CD) is the world's most common food intolerance genetic disorder, affecting nearly 1% of people worldwide.[32] Patients suffering from CD develop an immune response that is subsequently triggered by the ingestion of gluten. The disease presents many clinical manifestations, ranging from severe malabsorption to minimally symptomatic or non-symptomatic features. The first recognizable symptom is often an oral manifestation, instead of the typical gastrointestinal symptoms.[33]

Oral manifestations, such as a delay in dental eruption, a reduction of salivary flow, and an increased likelihood of dental enamel defects in both deciduous and permanent teeth may be observed in cases of CD.[34,35] Those patients may also present reflux and vomiting symptoms,[36] which represent concurrent factors for the development of ETW. Therefore, oral examination can be an important auxiliary tool for the identification of cases of the disease.

Figure 4 shows a 23-year-old Caucasian male, who was referred to a private dental service by a physician, due to his dental implications. The patient had been diagnosed with CD and silent gastroesophageal reflux three years before the dental consultation. He had adhered to a strict gluten-free diet, was not under medication, but consumed approximately one liter of soda daily. Thus, the association of intrinsic and extrinsic sources of acids may explain the large tooth surface loss affecting his upper and lower dental arches.




***Figure 4:*** *(a) Upper and lower dental arches of a 23-year-old patient showing erosive tooth wear lesions in permanent teeth secondary to celiac disease, silent gastroesophageal reflux and daily consumption of carbonated beverages; (b) Typical high-resolution image of erosive lesions on posterior mandibular teeth (c) palatal and occlusal surfaces of maxillary premolar teeth are mainly affected.*

## Extrinsic sources of acid

*Diet*

The frequency and pattern of consumption of acidic diets have been pointed out as the major etiological factors in the prevalence and incidence of ETW.[20,37,38] Even though, there is scientific evidence supporting that some dietary components such as acid snacks/sweets, carbonated beverages and natural fruit juices increase the prevalence of ETW, whereas milk presents a protective effect.[39] The erosive potential of foods may be modulated by:

• its frequency of consumption[21] (e.g. greater frequency of carbonated and sports drink consumption has been associated with higher incidence of ETW,[40] and the frequency of drinking natural fruit juices was associated with higher prevalence of this condition);[41]

• Contact time of erosive foods/drinks with the teeth;[21]

• When/ how the food is eaten (e.g. swishing of soft drinks before swallowing, acidic food intake between meals).[42,43]

Despite knowing that acidic foods, such as citric fruits seem to have an association with ETW, it must be clear that the consumption of fruits should not be discouraged, when it is part of a balanced diet. The World Health Organization recommends a consumption of at least 400 grams of fruits and vegetables per day, in order to avoid the onset of chronic conditions.[44]

Therefore, monitoring dietary habits is clinically valuable and should be focused on reducing daily intake of acidic drinks,[43] discouraging dietary acids between meals/ bedtime and abolishing habits that increase the contact time of the acid with oral cavity.[21,43] The consumption of dairy products particularly after an acidic intake and use of straws correctly positioned (posteriorly positioned toward the back of the mouth) are also advisable.[21] Those advices are even more important considering the risk groups mentioned in the section of 'intrinsic sources of acid', once the diet can exacerbate the tooth surface loss caused by the medical condition.

It is important to know when, how, how often and how much a particular drink or foodstuff is ingested. Therefore, an accurate clinical examination and anamnesis must be conducted by the clinician, to identify possible erosion- related risk factors and plan strategies to control them.[45] It is known that behaviour changes are not easily achieved but offering alternatives and targeted behavioural interventions may increase treatment success.[20]

*Legal drugs and medications - the hidden etiological factors*

Among the numerous causative factors for ETW, it is fundamental to take into consideration different drugs prescribed for patients that might have been overlooked or underestimated and are 'hidden' aetiological factors.[46,47] Several therapeutic medications have the potential to indirectly or directly cause ETW.[46]

Some medicines reported to have a causative role in ETW due to their inherent acidity secondary to prolonged use are listed below:

• Medications available in effervescent and dispersible form; [48]

• Oral supplements dispensed as chewable and effervescent tablets (e.g. Vitamin C and minerals); [49,50]

• Acetylsalicylic acid (Aspirin); [51]

• Asthma medications.[17,52]

In addition, there are some medications that differently from the drugs previously mentioned have an indirect association with ETW secondary to their side effects, such as medications that cause reduced salivary flow, or drugs likely to cause gastroesophageal reflux or induce vomiting.[46]

Scientific evidence associating ETW with the use of these medicaments is still lacking. However, regular and prolonged use of some medications might bear the risk of causing this condition.[47] It is the responsibility of clinicians to clarify this issue among patients and colleagues making them aware of drugs that may contribute to negative potential effects towards oral health.[46]

*Occupational exposure*

Acid exposure might also be identified in occupational environment due to acidic vapours and chemicals (e.g. battery, ammunition and galvanizing factories) and acidic liquids (e.g. wine tasters, professional swimmers).[45] Consequently, more attention should be given to workers submitted to such conditions to maintain the overall health of those risk groups.[53]

Many points were raised in this review with respect to extrinsic and intrinsic potential risk factors for ETW. However, researchers have suggested that susceptibility to erosive wear differs among individuals due to factors in the

oral environment and sustainability of the enamel.[54] Therefore, the clinicians should keep in mind that for certain patients, only minimal acidic challenges may be sufficient to cause dental implications, while other people might never develop erosive lesions, even with prolonged exposure to acids.[54]

With respect to patient-related risk factors it is also worth mentioning the importance of buffer capacity and salivary flow. It has been stated that erosive potential related to tooth enamel is positively correlated with buffering properties in two aspects: the strength of buffering influences the rate of neutralization by saliva and the duration of an erosive challenge.[3] Buffering also has a role in the intrinsic capacity of the product to erode dental tissues. Moreover,

the rate of dissolution of enamel seems to be related to titratable acidity and buffer capacity, but the relationship between these variables dependent on acid type and pH. [3]

It is also important to stress that patients who suffers from xerostomia and oral dryness as a consequence of medicines should be aware of the potential negative effects such as reduced salivary flow rate/ or buffer capacity of the saliva that increases the risk for erosive tooth wear.[3,15]

## PREVENTION AND TREATMENT

With respect to ETW prevention, the benefits of toothpaste compounds containing fluoride are greater than the adverse effects, such as abrasivity. Various active ingredients have been tested with respect to their ability to form acid-resistant precipitates on dental surfaces.[5] When compared to non-fluoride toothpastes, fluoride-containing toothpastes have better preventive effects against ETW. However, in order to develop toothpastes that promote the formation of more acid-resistant precipitates, other formulations have been tested using amine or stannous fluoride compounds, as well as phosphates or biopolymer additives.[55]

Some *in vitro* studies evaluated the effect of commercial toothpastes that claim to provide anti-erosive effects compared to conventional fluoride toothpastes.[56,57] Conventional NaF toothpastes were able to reduce erosive tissue loss even in severe erosive conditions but had limited efficacy with respect to brushing abrasion. The formulations that claimed anti-erosive effects were not superior; however, tin-containing toothpaste had promising anti- erosion potential, which was counteracted by abrasion effects.[57] The abrasiveness of toothpastes play an important role, especially at early stages of ETW, by presenting lower relative dentin abrasivity (RDA) values could be more important than which kind of fluoride the toothpaste contain.[56]

Even though toothbrushing is fundamental for maintaining good oral health, it also may have a negative impact on tooth wear, particularly with respect to ETW.[58] To evaluate how patients brush their teeth, if they use too much strength and even the type of toothbrushes (with soft or hard bristle) are important steps to prevent abrasion. Enamel seems to be prone to suffering from the type of toothbrush bristle, duration and method of brushing.[2,42] Therefore, it is important to advise a change in detrimental brushing habits to prevent ETW, instead of asking patients to wait before brushing their teeth.[2] In fact, recent findings have shown that after erosive challenges, no specific waiting period prior to tooth brushing can avoid ETW, in other words postponing toothbrushing is not clinically advisable.[21]

Although toothpastes and mouthrinses are the most common products of daily use to prevent ETW, the application depends on patient compliance. In some severe cases, this could not be enough to stop ETW progression. In this situation, another treatment measures can be implemented, applying some acid-protective layers on affected surfaces. Depending on the filler content and the abrasion stability of the resin coatings, adhesives and fissure sealants have proved to prevent enamel and dentine wear for limited periods of time.[59] As the resin coating of fissure sealants is significantly thicker than the coating of a bonding agent, surface sealants provided a longer duration of protection against erosive wear. Clinically, the coating of exposed dentine on palatal surfaces of anterior teeth with a bonding agent lasted for 3 months,[60] while a fissure sealant remained on teeth for approximately 6–9 months.[61]

The loss of tooth structure could cause tooth sensitivity, aesthetics impairment and loss of occlusal vertical dimension, leading to restorative treatment indication. On the other hand, teeth with previous restorations can be exposed to erosive and abrasive challenges, which could interfere with its durability.[6] Despite ETW being an emerging theme in recent studies, there are aspects that have yet to be better explored, especially regarding the properties of adhesive systems, restorative materials and their application in deciduous teeth. In a recent *in vitro* study, different adhesive protocols were tested, with no significant difference among conventional adhesive systems or self-etching adhesives, with or without fluoride, regarding microleakage evaluation.[62]

More studies should be done to evaluate the stability of restorations in eroded substrate, to guide treatment decisions. By now, we should advice clinicians to postpone as much as possible restorative procedures, especially in young patients, until the main etiological factor of ETW were not controlled. Furthermore, whenever restorative procedures are required, adhesive materials with minimal sound substrate removal should be indicated.

# CONCLUSIONS

In order to provide the best preventive and therapeutic measures for patients, dentists must primarily investigate all risk factors related to the patient, bearing in mind concealed factors (like silent gastroesophageal reflux) as well as other important aspects associated with the erosive potential of drinks and foodstuff such as the concentration of relevant mineral constituents (calcium and phosphates) that leads to the lack of a unique 'critical pH' value concerning dental erosion. These risk factors should then be coupled with the evident signs of erosive tooth wear observed during the clinical examination. Preventive measures should be initiated as early as possible to reduce the erosive challenge and to increase protective and defensive factors, thus

bringing the equilibrium back to the oral environment.

It is important to recognize that mineral and surface loss in ETW is an irreversible process, and due to the large longevity of sound teeth with dental caries decreasing prevalence, these teeth could be exposed for a long period to acid and abrasive challenges. In this scenario, recognize the initial signs of ETW and control this condition as soon as possible will improve oral health in long term to our patients.

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# REFERENCES

1. Carvalho TS, Colon P, Ganss C, Huysmans MC, Lussi A, Schlueter N, et al. Consensus report of the European Federation of Conservative Dentistry: erosive tooth wear—diagnosis and management. *Clin Oral Investig*. 2015 Sep;19(7):1557-61. Doi: 10.1007/s00784-015-1511-7

2. Lussi A, Carvalho TS. Erosive tooth wear: a multifactorial condition of growing concern and increasing knowledge. *Monogr Oral Sci*. 2014;25:1- 15. Doi: 10.1159/000360380

3. Shellis RP, Barbour ME, Jesani A, Lussi A. Effects of buffering properties and undissociated acid concentration on dissolution of dental enamel in relation to pH and acid type. *Caries Res*. 2013;47(6):601-11. Doi: 10.1159/000351641

4. Lussi A, Schlueter N, Rakhmatullina E, Ganss C. Dental erosion—an overview with emphasis on chemical and histopathological aspects. *Caries Res*. 2011;45 Suppl 1:2-12. Doi: 10.1159/000325915

5. Ganss C, Lussi A. Diagnosis of erosive tooth wear. *Monogr Oral Sci*. 2014;25:22-31. Doi: 10.1159/000359935

6. Taji S, Seow WK. A literature review of dental erosion in children. *Aust Dent J*. 2010 Dec;55(4):358-67. Doi: 10.1111/j.1834-7819.2010.01255.x

7. Kreulen CM, Van 't SA, Rodriguez JM, Bronkhorst EM, Creugers NH, Bartlett DW. Systematic review of the prevalence of tooth wear in children and adolescents. *Caries Res*. 2010;44(2):151-9. Doi: 10.1159/000308567

8. Vargas-Ferreira F, Praetzel JR, Ardenghi TM. Prevalence of tooth erosion and associated factors in 11-14-year-old Brazilian schoolchildren. *J Public Health Dent*. 2011;71(1):6-12. Doi: 10.1111/j.1752-7325.2010.00194.x

9. Mangueira DF, Sampaio FC, Oliveira AF. Association between socioeconomic factors and dental erosion in Brazilian schoolchildren. *J Public Health Dent*. 2009;69(4):254-9. Doi: 10.1111/j.1752-7325.2009.00131.x

10. Lussi A, Jaeggi T, Zero D. The role of diet in the aetiology of dental erosion. *Caries Res*. 2004;38 Suppl 1:34-44. Doi: 10.1159/000074360

11. Bartlett D. Intrinsic causes of erosion. *Monogr Oral Sci*. 2006;20:119-39. Doi: 10.1159/000093359

12. Carvalho TS, Lussi A, Jaeggi T, Gambon DL. Erosive tooth wear in children. *Monogr Oral Sci*. 2014;25:262-78. Doi: 10.1159/000360712

13. Carvalho TS, Lussi A. Combined effect of a fluoride-, stannous- and chitosan-containing toothpaste and stannous-containing rinse on the prevention of initial enamel erosion-abrasion. *J Dent*. 2014 Apr;42(4):450-9. Doi: 10.1016/j.jdent.2014.01.004

14. Bartlett D, Ganss C, Lussi A. Basic Erosive Wear Examination (BEWE): a new scoring system for scientific and clinical needs. Clin Oral Investig. 2008 Mar;12:65-68. Doi: 10.1007/s00784-007-0181-5

15. Lussi A, Bossen A, Hoschele C, Beyeler B, Megert B, Meier C, et al.
Effects of enamel abrasion, salivary pellicle, and measurement angle on the optical assessment of dental erosion. *J Biomed Opt*. 2012 Sep;17(9):97009-1. Doi: 10.1117/1.JBO.17.9.097009

16. Carvalho TS, Assuncao CM, Jost F, Burgin WB, Rodrigues JA, Lussi A. In vitro validation of a hand-held optical reflectometer to measure clinically observed erosive tooth wear. *Lasers Med Sci*. 2016. Aug;31(6):1105-12. Doi: 10.1007/s10103-016-1957-0

17. Schlueter N, Luka B. Erosive tooth wear - a review on global prevalence and on its prevalence in risk groups. *Br Dent J*. 2018 Mar;224(5):364-70. Doi: 10.1038/sj.bdj.2018.167

18. Schlueter N, Tveit AB. Prevalence of erosive tooth wear in risk groups. *Monogr Oral Sci*. 2014;25:74-98. Doi: 10.1159/000359938

19. Rosten A, Newton T. The impact of bulimia nervosa on oral health: A review of the literature. *Br Dent J*. 2017 Nov;223(7):533-9. Doi: 10.1038/sj.bdj.2017.837

20. O'Toole S, Mullan F. The role of the diet in tooth wear. *Br Dent J.* 2018 Mar;224(5):379-83. Doi: 10.1038/sj.bdj.2018.127

21. Buzalaf MAR, Magalhaes AC, Rios D. Prevention of erosive tooth wear: targeting nutritional and patient-related risks factors. *Br Dent J*. 2018 Mar;224(5):371-8. Doi: 10.1038/sj.bdj.2018.173

22. Wilder-Smith CH, Materna A, Martig L, Lussi A. Longitudinal study of gastroesophageal reflux and erosive tooth wear. *BMC Gastroenterol*. 2017 Oct;17(1):113. Doi: 10.1186/s12876-017-0670-1

23. Sarath Kumar KS, Mungara J, Venumbaka NR, Vijayakumar P, Karunakaran D. Oral manifestations of gastroesophageal reflux disease in children: A preliminary observational study. *J Indian Soc Pedod Prev Dent*. 2018 Apr;36(2):125-9. Doi: 10.4103/JISPPD.JISPPD_1182_17

24. Craike M, Young JA, Symons CM, Pain MD, Harvey JT, Eime RM, et al. Trends in body image of adolescent females in metropolitan and non- metropolitan regions: a longitudinal study. *BMC Public Health*. 2016 Nov;16(1):1143. Doi: 10.1186/s12889-016-3815-1

25. Smink FR, van HD, Hoek HW. Epidemiology of Eating Disorders: Incidence, Prevalence and Mortality Rates. *Curr Psychiatry Rep*. 2012 Aug;14(4):406-14. Doi: 10.1007/s11920-012-0282-y

26. Campbell K, Peebles R. Eating Disorders in Children and Adolescents: State of the Art Review. *Pediatrics* 2014 Sep;134(3):582-92. Doi: 10.1542/peds.2014-0194

27. Johansson AK, Norring C, Unell L, Johansson A. Eating disorders and oral health: a matched case-control study. *Eur J Oral Sci.* 2012 Feb;120(1):61-8. Doi: 10.1111/j.1600-

0722.2011.00922.x
28. Hermont AP, Pordeus IA, Paiva SM, Abreu MH, Auad SM. Eating disorder risk behavior and dental implications among adolescents. *Int J Eat Disord.* 2013 Nov;46(7):677-83. Doi: 10.1002/eat.22132
29. Ximenes R, Couto G, Sougey E. Eating disorders in adolescents and their repercussions in oral health. *Int J Eat Disord*. 2010 Jan;43(1):59-64. Doi: 10.1002/eat.20660
30. Hermont AP, Oliveira PA, Martins CC, Paiva SM, Pordeus IA, Auad SM. Tooth erosion and eating disorders: a systematic review and meta- analysis. *PLoS One* 2014;9(11):e111123. Doi: 10.1371/journal.pone.0111123
31. Dynesen AW, Gehrt CA, Klinker SE, Christensen LB. Eating disorders: experiences of and attitudes toward oral health and oral health behavior. *Eur J Oral Sci*. 2018 Dec;126(6):500-6. Doi: 10.1111/eos.12578
32. Lebwohl B, Sanders DS, Green PHR. Coeliac disease. *Lancet* 2018 Jan 6;391(10115):70-81. Doi: 10.1016/S0140-6736(17)31796-8
33. Karlin S, Karlin E, Meiller T, Bashirelahi N. Dental and Oral Considerations in Pediatric Celiac Disease. *J Dent Child (Chic)* 2016;83(2):67-70.
34. Cruz IT, Fraiz FC, Celli A, Amenabar JM, Assuncao LR. Dental and oral manifestations of celiac disease. *Med Oral Patol Oral Cir Bucal*. 2018 Nov;23(6):e639-e645. Doi: 10.4317/medoral.22506.
35. Bucci P, Carile F, Sangianantoni A, D'Angio F, Santarelli A, Lo ML. Oral aphthous ulcers and dental enamel defects in children with coeliac disease. *Acta Paediatr.* 2006 Feb;95(2):203-7. Doi: 10.1080/08035250500355022
36. Khatib M, Baker RD, Ly EK, Kozielski R, Baker SS. Presenting Pattern of Pediatric Celiac Disease. *J Pediatr Gastroenterol Nutr.* 2016 Jan;62(1):60-3. Doi: 10.1097/MPG.0000000000000887.
37. Shahbaz U, Quadir F, Hosein T. Determination of Prevalence of Dental Erosion in 12 - 14 Years School Children and Its Relationship with Dietary Habits. *J Coll Physicians Surg Pak.* 2016 Jul;26(7):553-6. Doi: 2368
38. Huang LL, Leishman S, Newman B, Seow WK. Association of erosion with timing of detection and selected risk factors in primary dentition: a longitudinal study. *Int J Paediatr Dent.* 2015 May;25(3):165-73. Doi: 10.1111/ipd.12109.
39. Salas MM, Nascimento GG, Vargas-Ferreira F, Tarquinio SB, Huysmans MC, Demarco FF. Diet influenced tooth erosion prevalence in children and adolescents: Results of a meta-analysis and meta-regression. *J Dent.* 2015 Aug;43(8):865-75. Doi: 10.1016/j.jdent.2015.05.012.
40. Kitasako Y, Sasaki Y, Takagaki T, Sadr A, Tagami J. Multifactorial logistic regression analysis of factors associated with the incidence of erosive tooth wear among adults at different ages in Tokyo. *Clin Oral Investig.* 2017 Nov;21(8):2637-44. Doi: 10.1007/s00784-017-2065-7.
41. Mafla AC, Ceron-Bastidas XA, Munoz-Ceballos ME, Vallejo-Bravo DC, Fajardo-Santacruz MC. Prevalence and Extrinsic Risk Factors for Dental Erosion in Adolescents. *J Clin Pediatr Dent*. 2017;41(2):102-11. Doi: 10.17796/1053-4628-41.2.102.
42. Shrestha D, Rajbhandari P. Prevalence and Associated Risk Factors of Tooth Wear. *JNMA J Nepal Med Assoc.* 2018 Jul;56(212):719-23. Doi: 10.31729/jnma.3644
43. O'Toole S, Bernabe E, Moazzez R, Bartlett D. Timing of dietary acid intake and erosive tooth wear: A case-control study. *J Dent.* 2017 Jan;56:99-104. Doi: 10.1016/j.jdent.2016.11.005.
44. Li H, Zou Y, Ding G. Dietary Factors Associated with Dental Erosion: A Meta-Analysis. *PLoS One* 2012;7(8). Doi:10.1371/journal.pone.0042626.
45. Kanzow P, Wegehaupt FJ, Attin T, Wiegand A. Etiology and pathogenesis of dental erosion. *Quintessence Int.* 2016 Apr;47(4):275-8. Doi: 10.3290/j.qi.a35625.
46. Thomas MS, Vivekananda Pai AR, Yadav A. Medication-related dental erosion: a review. *Compend Contin Educ Dent.* 2015 Oct;36(9):662-6.
47. Hellwig E, Lussi A. Oral hygiene products, medications and drugs - hidden aetiological factors for dental erosion. *Monogr Oral Sci.* 2014;25:155-62. Doi: 10.1159/000359942.
48. Maguire A, Baqir W, Nunn JH. Are sugars-free medicines more erosive than sugars-containing medicines? An in vitro study of paediatric medicines with prolonged oral clearance used regularly and long-term by children. *Int J Paediatr Dent.* 2007 Jul;17(4):231-8. Doi: 10.1111/j.1365-263X.2007.00826.x
49. Bahal P, Djemal S. Dental erosion from an excess of vitamin C. *Case Rep Dent.* 2014;2014:485387. Doi: 10.1155/2014/485387
50. Wegehaupt FJ, Lunghi N, Hogger VM, Attin T. Erosive potential of vitamin and vitamin+mineral effervescent tablets. *Swiss Dent J.* 2016;126(5):457-65.
51. Grace EG, Sarlani E, Kaplan S. Tooth erosion caused by chewing aspirin. *J Am Dent Assoc.* 2004 Jul;135(7):911-4. Doi: 10.14219/jada.archive.2004.0337
52. Santos NM, Flores IL, Mariath, AZS, Rodrigues JA. Erosive tooth wear in an asthmatic child: a case report. *Rev Científ CRO-RJ.* 2018 Aug; 3(2): 47-51.
53. Bansal M, Singh S, Bector A, Dogra M. Effect of dental erosion on oral health among employees of battery-manufacturing units in Baddi, Himachal Pradesh, India. *J Educ Health Promot.* 2018;7:26. Doi: 10.4103/jehp.jehp_51_17.
54. Uhlen MM, Mulic A, Holme B, Tveit AB, Stenhagen KR. The Susceptibility to Dental Erosion Differs among Individuals. *Caries Res*. 2016;50(2):117-23. Doi: 10.1159/000444400.
55. Magalhães AC, Wiegand A, Buzalaf MA. Use of dentifrices to prevent erosive tooth wear: harmful or helpful? *Braz Oral Res*. 2014;28:1-6. Doi: 10.1590/S1806-83242013005000035.
56. Assunção CM, Lussi A, Almeida RJ, Carvalho TS. Efficacy of toothpastes in the prevention of erosive tooth wear in permanent and deciduous teeth. *Clin Oral Investig*. 2018; May doi: 10.1007/s00784-018- 2434-x.
57. Ganss C, Lussi A, Grunau O, Klimek J, Schlueter N. Conventional and anti-erosion fluoride toothpastes: effect on enamel erosion and erosion- abrasion. *Caries Res*. 2011;45(6):581-9. Doi: 10.1159/000334318.
58. Wiegand A, Schlueter N. The role of oral hygiene: does toothbrushing harm? *Monogr Oral Sci*. 2014;25:215-9. Doi: 10.1159/000360379.
59. Buzalaf MA, Magalhães AC, Wiegand A. Alternatives to fluoride

in the prevention and treatment of dental erosion. *Monogr Oral Sci* 2014;25:244-52. Doi: 10.1159/000360557.

60. Sundaram G, Wilson R, Watson TF, Bartlett D. Clinical measurement of palatal tooth wear following coating by a resin sealing system. *Oper Dent*. 2007 Nov;32(6):539-43. Doi: 10.2341/06-177.

61. Bartlett D, Sundaram G, Moazzez R. Trial of protective effect of fissure sealants, in vivo, on the palatal surfaces of anterior teeth, in patients suffering from erosion. *J Dent.* 2011 Jan;39(1):26-9. Doi: 10.1016/j.jdent.2010.09.007.

62. Assunção CM, Goulart M, Essvein TE, Santos NMD, Erhardt MCG, Lussi A, Rodrigues, JÁ. Effect of erosive challenges on deciduous teeth undergoing restorative procedures with different adhesive protocols - an in vitro study. *J Appl Oral Sci*. 2018 Jan;26:e20170053. Doi: 10.1590/1678-7757-2017-0053.

# DO LAYPEOPLE , STUDENTS AND ORTHODONTISTS HAVE SIMILAR CONCEPTS REGARDING FACIAL AESTHETICS ?

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**Palavras-chave:** Face. Cefalometria. Ortodontia.

**RESUMO**

**Introdução:** O ortodontista não se preocupa apenas em estabelecer a oclusão funcional, mas também em proporcionar ao paciente um perfil harmonioso, uma das principais motivações daqueles que procuram por tratamento. **Objetivo:** Analisar os perfis faciais considerados agradáveis de indivíduos leucodermas brasileiros, buscando verificar suas características em comum e, assim, orientar os ortodontistas quanto aos objetivos finais do tratamento ortodôntico em relação à estética facial. **Métodos:** Fotografias de perfil de 100 indivíduos brasileiros leucodermas adultos foram avaliadas por 15 leigos, 15 estudantes de ortodontia e 15 ortodontistas. Foram realizados traçados e análises cefalométricas dos perfis que obtiveram as melhores avaliações, incluindo medidas lineares, angulares e de proporções faciais. **Resultados:** Verificou-se uma considerável semelhança entre as simulações dos perfis faciais construídos de acordo com o resultado da avaliação de cada grupo de julgadores. Este resultado foi atribuído à influência da mídia, que de alguma forma contribuiu para homogeneizar os padrões de estética facial. **Conclusão:** Apesar da grande semelhança em relação aos conceitos estéticos apresentados pelos avaliadores, os leigos parecem preferir perfis mais côncavos quando comparados aos demais.

**Keywords:** Face. Cephalometry. Orthodontics.

**ABSTRACT**

**Introduction:** A harmonious profile is one of the objectives of the orthodontic planning. It is as important as to establish functional occlusion, since facial aesthetics is not only a concern for the orthodontist, but also for individuals who want to undergo orthodontic treatment. **Objective:** To analyze the facial profile considered pleasant for the white Brazilians, verify their common characteristics and, thus, guide the orthodontists in relation to facial aesthetics. **Methods:** Facial profile photographs from 100 adult white Brazilians were analyzed and evaluated by 15 lay people, 15 orthodontic students and 15 orthodontists. Tracings and cephalometric analysis were made from the best rated facial profiles, including linear and angular measurements and facial proportions. **Results:** Considerable similarities were found between the simulated profiles which were shaped according to each group's outcome. These results can be attributed to the influence of the media that, somehow, contributed to homogenize the population's standards related to facial esthetics. **Conclusion:** Despite the great similarity in relation to the aesthetic concepts showed by the evaluators, lay people seem to prefer more concave profiles when compared with the other groups.

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## INTRODUCTION

Orthodontic treatment can change the position of teeth and modify the skeletal pattern of patients. The relationships between soft and hard tissues, that can influence the facial profile, have been thoroughly studied.[1-3] There are strong but complex relationships between these structures. In addition, the characteristics of facial soft tissues can also differ according to the ethnic group studied.[4,5]

According to Steiner, the separate evaluation of the soft tissue from dental and skeletal relationships can produce misleading results.[6] Therefore, aesthetic analysis of the profile is very relevant for the orthodontic diagnosis, often determining or changing the treatment plan.[7,8]

Facial aesthetics is not only a concern for the orthodontist, but also forindividuals who want to undergo orthodontic treatment. One of the major motivations forthese individuals is the desire to improve their facial appearance.[8,9]

Patient photographs are commonly used to evaluate profile esthetics,[10] although the concept of beauty is undeniably personal and subjective. In this way, it is of great importance to determine the preferences of different groups of evaluators.

The present study examined the common characteristics of pleasant facial profiles considered by laypeople, students and orthodontists. The aim was to establish a pattern of facial aesthetics that can guide orthodontists regarding the ultimate goals of the orthodontic treatment for white Brazilian patients.

## MATERIALS AND METHODS

The study was approved by the Universidade Federal Fluminense Ethic Research Committee (filled under number 963.688/15) and conducted in accordance with the National Health Council Resolution 196 (10th October 1996).

One hundred profile photographs (10 x 15 cm) and lateral cephalometric radiographs were obtained from white adult Brazilian patients from the Universidade Federal Fluminense Orthodontic Clinic, including 44 males and 56 females. These individuals were between 18 and 53 years old, with an average age of 23 years and 3 months. They were randomly selected according to their identificationnumber, in crescent order, independent of the class of malocclusion presented. Low quality photographs and radiographs were excluded from the sample. The photographs and radiographs were obtained before the beginning of the orthodontic treatment.

An album with photographs, numbered 1 to 100, was gathered to evaluate the facial profiles. The sequence of the photos in the album was also done according to the patients' identification number. On each page two photos were presented.

The sample size calculation of the number of evaluators was based on the prior study of facial profile analysis published by Hockley et al.[10] The calculation was conducted usingthe same formula used in thesample calculation of cross-sectional studies, with the aid of the SPSS program. A confidence level of 95% and a critical value of 1.96 were adopted. Considering that the error of the method was estimated to 20%, the power of the research was established as 80%. As a result, 45 evaluatorswerethe minimum necessary to include in this survey. The 45 evaluators were divided as followed: 15 lay people (group 1; without dentaltraining), 15 orthodontic students (group 2) and 15 orthodontists (group 3).

All the evaluators were 18 years old or older. The careers of the laypeople group had no relation with Dentistry. Mathematics, Business and Nutrition students were invited to be inthis group. The student group should have completed at least oneyear of the post graduatecourse in Orthodontics. The orthodontist group consisted of graduate professionals, with exclusive orthodontic private practice in the cities of Niterói and Rio de Janeiro.

Each evaluator was given, along with the album, an evaluation form with a clarification of the objectives of the study and how to proceed with the conceptualization of facial aesthetics. There were five possible concepts: excellent, good, fair, poor and bad. Each evaluator was asked tomark only one option for each photo. Later these concepts were transformed into quantitative data, ranging from 5 to 1.

Tracing wasperformed on the lateral cephalometric radiographs of the five individuals who obtained the best scores in each group of evaluators. The cephalometric variables used to evaluate facial profile structures were:

**1-Upper and lower lip evaluation: linear distance from the most prominent point onthe upper and lower lip to the following lines:**

- S line: drawn from a point situated in the middle of the lower edge of the nose until the soft tissue Pogonion.[6]
- Aesthetic Plane: drawn from the tip of the nose until the soft tissue Pogonion.[11]
- Subnasal-Pogonion: drawn from the Subnasal point until the soft tissue Pogonion.[12]

**2-Outline of the maxillary groove:**

- Maxillary groove angle: formed by the union of the Subnasal point, labial sulcus and upper lip.[13]
- Maxillary groove depth: linear distance from the maxillary groove until a perpendicular line to the Frankfurt Horizontal Plane, tangent to the vermilion of the upper lip.[14]

**3-Outline of the mandibular groove:**

• Mandibular groove angle: formed by the union of the lower Labrale point, lower labial sulcus and soft tissue Pogonion.[13]
• Mandibular groove depth: linear distance from the mandibular sulcus to the H line, which unites the most prominent point of the upper lip with the soft tissue Pogonion.[14]

**4-Powell's Aesthetic Triangle. [15]**

• Nasofrontal angle: formed by the intersection of the tangent line of the Glabella with a tangent line to the nasal dorsum.
• Nasofacial angle: formed by the intersection of the Facial Plane with a tangent line to the nasal dorsum.
• Nasomental angle: formed by the intersection of Ricketts' Aesthetic Plane with a tangent line to the nasal dorsum.
• Mentocervical angle: formed by the intersection of the Facial Plane with a tangent line to the lower border of the mandible.

**5-Nasolabial angle: formed by the intersection of the tangent lines of the base of the nose and of the upper lip.[16,17]**

**6-Vertical proportions:**

• Lower Facial Height (ANS - Me): Percentage of the linear distance between the Anterior Nasal Spine and the Menton, while the Total Facial Height corresponds to the distance between the Nasion and the Menton.[18]
• Study of the middle and lower thirds of the face: Nasion is the upper limit of the middle third of the face, while the Subnasal point is its lower limit. The lower third of the face corresponds to the distance from the Subnasal until the Menton (Sn - Me). The Stomion subdivides this distance into two unequal parts (Sn - St and St - Me).[13]

**Statistics**

Arithmetic means and standard deviations of the cephalometric variables studied were obtained for each group.

# RESULTS AND DISCUSSION

Despite its subjectivity, facial aesthetics is one of the main motivating factors for seeking orthodontic treatment. Therefore, it seems logical that a standard of what is considered a nice profile will assist the orthodontist in diagnosis and orthodontic planning.

Our results (Table 1) showed that the three evaluating groups preferred a lower facial third with upper and lower lips very close to Steiner's S line. [6]The best profiles selected ranged from slightly convex to concave. In group 1, the evaluators selected more concave profiles when compared to groups 2 and 3. The plastic surgeons, orthodontists and lay people recruited by Fortes et al also preferred slightly convex or concave profiles when they evaluated white adult Brazilians.[19]

It should be noted that, in a recent study, Chagas et al. found that white adult Brazilians have a slightly more convex facial profile than the US standard.[5] The apparent contradiction between the real and the idealized Brazilian profiles is probably a reflectionof an external influence. The Brazilian evaluators seemed to have similar aesthetic concepts than laypeople, dentists and ortho-surgical patients from the United Kingdom, who considered straight profiles as more attractive.[20]

The linear distance from the lips to the aesthetic plane and the relationship between the lips and the Subnasal-Pogonion plane were within the normal range suggested by Ricketts and Burstone, respectively.[11-13]An analogue result was evidenced regarding the angle and the depth of the maxillary groove.[14] However, the profiles selected by the lay group showed higher values for the angle and the depth of the mandibular groove when compared with the other groups, which also suggests a preference for a slightly more concave profile.

The values obtained for Powell's Aesthetic Triangle, for the ratio between the Lower Facial Height and the Total Facial Height, and for the proportions of the Lower Facial Height were quite similar to the established normal values.[8,15,16]

On the other hand, the data related to the nasolabial angle showed lower values when compared to the ones recommended by McNamara and Scheideman et al, indicating atendency for maxillary protrusion.[16, 17] In the laypersongroup, protrusion was associated with a thicker soft tissue Pogonion, which produced a more concave profile. Similar results were found in a study by Khosravanifard et al., the evaluators in the study preferred straight facial profiles and a slightly protruded maxilla, when adult Iranians were evaluated.[17]

The evaluations made by the students and graduate orthodontists showed higher scores when compared to the ones bythe lay group. Lay people generally demonstrate moredifficulty in assessing only the harmony and balance of the facial profile, without considering concepts of beauty, such as skin imperfections, acne and hair styles.[21]

Aiming to assist the visualization of the research results, cephalometric tracings were simulated with the mean profile values obtained from each of the three evaluating groups (Figure 1). A strong similarity was found between the facial profiles, showing a great consistency of opinion. This fact can probably be explained by the influence of the media. All evaluators have access to television, internet and magazines. Patterns of facial beauty have become quite homogeneous and all seem to have the same references to facial aesthetics, explaining the closeness between their preferences.[22]

***Table 1***: *Arithmetic means and standard deviations related from the five best rated profiles.*

| Variables | Group 1 | | Group 2 | | Group 3 | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD |
| S-UL (mm) | - 1.5 | 2.23 | - 0.4 | 1.08 | - 1.4 | 1.51 |
| S-LL (mm) | - 0.9 | 2.01 | 0.4 | 1.85 | 0.4 | 1.78 |
| Aesthetic Plane–UL (mm) | 4.4 | 1.71 | 4.2 | 1.03 | 4.9 | 2.10 |
| Aesthetic Plane–LL (mm) | 2.8 | 1.82 | 2.0 | 1.69 | 1.9 | 2.13 |
| Sn.Pog'–UL (mm) | 3.3 | 2.22 | 4.7 | 1.71 | 3.3 | 1.20 |
| Sn.Pog'–LL (mm) | 2.0 | 2.31 | 3.8 | 2.07 | 3.5 | 2.09 |
| Maxillary groove angle (°) | 34.0 | 7.64 | 30.2 | 15.70 | 37.2 | 13.10 |
| Maxillary groove depth (mm) | 4.1 | 1.51 | 4.0 | 0.61 | 3.6 | 0.96 |
| Mandibular groove angle (°) | 52.2 | 15.00 | 45.4 | 12.34 | 48.0 | 7.38 |
| Mandibular groove depth (mm) | 6,4 | 2.10 | 5.4 | 1.91 | 4.8 | 1.35 |
| Nasofrontal angle (°) | 106.0 | 8.48 | 121.2 | 18.99 | 126.0 | 16.49 |
| Nasofacial angle (°) | 35.8 | 1.64 | 34.8 | 1.48 | 36.2 | 4.38 |
| Nasomental angle (°) | 128.0 | 2.82 | 127.2 | 3.76 | 124.0 | 4.35 |
| Mentocervical angle (°) | 101.2 | 12.67 | 99.8 | 10.96 | 98.2 | 10.96 |
| Nasolabial angle (°) | 94.8 | 7.12 | 91.6 | 10.01 | 102.4 | 8.87 |
| Lower Facial Height: ANS-Me (%) | 55.8 | 0.44 | 57.4 | 1.34 | 56.4 | 1.81 |
| Lower third: Sn - Me (%) | 53.6 | 1.51 | 54.0 | 1.87 | 52.4 | 1.94 |
| Sn – St(%) | 37.6 | 2.51 | 35.2 | 3.34 | 35.2 | 4.60 |
| St – Me (%) | 62.4 | 2.51 | 64.8 | 3.34 | 64.8 | 4.60 |

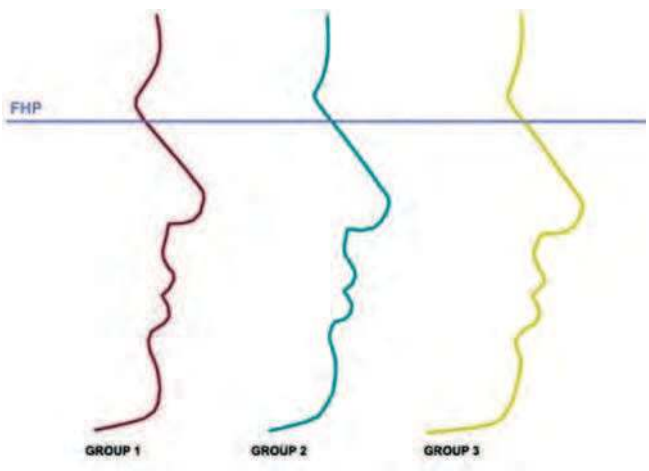


***Figure 1***: *Cephalometric tracings simulated in accordance to the mean values obtained from individuals selected by each group.*

## CONCLUSION

Despite the great similarity in relation to the aesthetic concepts showed by the components of the three groups of evaluators, lay people seem to prefer more concave profiles when compared with the other groups.

## REFERENCES

1-Huggins DG, McBride LJ. The influence of upper incisor position on soft tissue facial profile. Br J Orthod 1975; 2:141-146.

2-Ackerman JL, Proffit WR. Soft tissues limitations in orthodontics: Treatment planning guidelines. Angle Orthod 1997; 67:327-336.

3-Rodrigues MF, Vilella OV, Mucha JN. Alterações dos tecidos moles decorrentes do tratamento ortodôntico. Ortodon Gaúch 1998; 3:24-34.

4-Talbert L, Kau CH, Christou T, Vlachos C, Sou N. A 3D analysis of Caucasian and African American facial morphologies in a US population. J Orthod 2014; 41:19-29.

5-Chagas TF, Martins MM, Mucha JN. The facial profile in Brazilian adults. Braz J Oral Sci 2017;16:e17040.

6-Steiner CC. Cephalometrics for you and me. Am J Orthod Dentofacial Orthop 1953;39:729-755.

7- Foster EJ. Profile preferences among diversified groups. Angle Orthod 1973;43:34-40.

8- Bullen RN, Kook YA, Kim K, Park JH. Self perception of the facial profile: an aid in treatment planning for orthognathic surgery. J Oral Maxillofac Surg 2014;72:773-778.

9- Angle EH. Malocclusion of the teeth. 7th ed. Philadelphia: SS White Dental Manufacturing Co. 1907.

10- Hockley A, Weinstein M, Borislow AJ, Braitmand LE. Photos vs silhouettes for evaluation of African American profile

esthetics. Am J Orthod Dentofacial Orthop 2012;141:161-168.

11- Ricketts RM. Perspectives in the clinical application of cephalometrics. Angle Orthod 1981;51:115-150.

12- Burstone CJ. The integumental profile. Am J Orthod 1959;29:93-104.

13- Burstone CJ. Lip posture and its significance in treatment planning. AmJ Orthod 1967;53:262-284.

14- Holdaway, RA. A soft tissue cephalometrics analysis and its use in orthodontic treatment planning. Part I. Am J Orthod 1983;84:1-28.

15- Powell N, Humphreys B. Proportions of the esthetic face. 1st ed. New York: Thieme Stratton. 1984.

16- McNamara JA. A method of cephalometric evaluation. Am J Orthod 1984;86:449-469.

17- Scheideman GB, Bell WH, Legan HL, Finn RA and Reisch JS. Cephalometric analysis of dentofacial normals. Am J Orthod 1980;78:404-420.

18- Wylie W. The assessment of anteroposterior dysplasia. Angle Orthod 1947;17:97-109.

19- Fortes HNR, Guimarães TC, Belo IML, da Matta ENR, Photometric analysis of esthetically pleasant and unpleasant facial profile. Dental Press J Orthod 2014;19:66-75.

20- Naini FB, Donaldson ANA, McDonald F, Cobourne MT. Assessing the inuence of lower facial prole convexity on perceived attractiveness in the orthognathic patient, clinician, and layperson. Oral Surg Oral Med Oral Pathol Oral Radiol 2012;114:303-311.

21- Khosravanifard B, Rakhshan V, Raeesi E. Factors inuencing attractiveness of soft tissue prole. Oral Surg Oral Med Oral Pathol Oral Radiol 2013;115:29-37.

22- Theobald AH, Wong BK, Quick AN, Thomson WM. The impact of the popular media on cosmetic dentistry. N Z Dent J 2006;102:58-63.

# SELF-PERCEIVED MALOCCLUSION OF NON-ORTHODONTIC PATIENTS AFFECTS ORAL HEALTH-RELATED QUALITY OF LIFE?

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**Palavras-chave**: Qualidade de Vida. Má Oclusão. Ortodontia. Auto-avaliação. Estética.

**RESUMO**

**Objetivo**: Este estudo transversal teve como objetivo avaliar o impacto da má oclusão autopercebida na qualidade de vida relacionada à saúde bucal (OHRQoL) e também avaliar se a autoavaliação estética é semelhante à avaliação profissional. **Métodos**: Foram avaliados 63 adultos com idades entre 18 e 36 anos (28,68 ± 4,99), 42 mulheres e 21 homens, sem histórico de tratamento ortodôntico. A OHRQoL foi avaliada utilizando a versão brasileira do questionário Oral Health Impact Profile (OHIP-14). A percepção da má oclusão foi avaliada utilizando-se o componente estético do Índice de Complexidade, Resultado e Necessidade (ICON) e o nível socioeconômico foi avaliado com os Critérios de Classificação Econômica do Brasil. A análise estatística foi realizada pelo teste de Mann-Whitney, correlações de Spearman e teste de Wilcoxon, com p<0,05. **Resultados**: A pontuação média geral e desvio padrão para o OHIP-14 foi de 5,17 (±6,50). Houve fraca correlação entre o componente estético percebido pelos participantes e a avaliação de sua OHRQoL. Apenas os domínios psicológicos (desconforto psicológico e incapacidade psicológica) apresentaram correlações significativas, porém pobres. O sexo e o nível socioeconômico não afetaram a percepção estética da má oclusão e a OHRQoL. Houve diferença significativa entre as avaliações profissionais e dos participantes. **Conclusão**: Correlações fracas e significativas entre a má-oclusão autopercebida e a OHRQoL foram encontradas em participantes que não procuravam tratamento ortodôntico, onde os maiores impactos foram observados nos domínios desconforto psicológico e incapacidade psicológica. A má-oclusão estética percebida pelos participantes foi significativamente menos relevante do que a avaliação profissional neste grupo estudado.

**Keywords**: Quality of Life. Malocclusion. Orthodontics. Self Concept. Aesthetics.

**ABSTRACT**

**Purpose**: This cross-sectional study evaluates the impact of self-perceived malocclusion on oral health-related quality of life (OHRQoL) and also whether aesthetic self-assessment is similar to professional evaluation. **Methods**: this cross-sectional study gathered 63 adults aged 18–36 years (28.68 ± 4.99), 42 women and 21 men, with no history of orthodontic treatment. OHRQoL was evaluated using the Brazilian short version of the Oral Health Impact Profile questionnaire (OHIP-14). Perception of malocclusion was evaluated using the aesthetic component of the Index of Complexity, Outcome and Need (ICON), socioeconomic status and the Economic Classification Criteria of Brazil. Statistical analysis was conducted using the Mann–Whitney test, Spearman correlations and Wilcoxon test, with $p < 0.05$. **Results**: the overall average score and standard deviation for OHIP-14 was 5.17 (± 6.50). There was a weak correlation between the aesthetic component perceived by the participants and their evaluation of quality of life. Only the psychological domains (psychological discomfort and psychological disability) showed significant poor correlations. Gender and socioeconomic status did not affect aesthetic perception of malocclusion and OHRQoL. There was a significant difference between the professional assessments and those of participants. **Conclusion**: significant weak correlations between self-perceived malocclusion and OHRQoL were found in participants who were not seeking orthodontic treatment; the greatest impacts were seen in the domains of psychological discomfort and psychological disability, and aesthetic self-perceived malocclusion was significantly less relevant than the professional evaluation in this studied group.

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## INTRODUCTION

Malocclusion is considered a public health problem due to its high prevalence, and therefore it is essential to understand its psychosocial effects and the implications for oral health-related quality of life (OHRQoL).

Measurement of OHRQoL aims to obtain information from patients to increase the understanding of the clinician who will provide treatment, to give an idea of how a disease changes OHRQoL, and the factors that are involved. This increases interaction and improves the relationship between professional and patient in order to achieve the best treatment, bringing the reality of the patient to the concept of health.[1]

Severe malocclusion has already been reported in the literature as an important factor that decreases OHRQoL,[2-9] and the correction of malocclusion is positive in improving OHRQoL.[9,10] The link between malocclusion and OHRQoL is complex and still poorly understood. The decision to seek orthodontic treatment is based not only on the severity of malocclusion, but also on the desire of patients to improve their appearance and self-esteem.[11]

Aesthetics are subjective, and the aesthetic perception of treatment need varies from patient to patient. This study evaluates whether the self-perception of a patient regarding their malocclusion affects their OHRQoL, and whether self-evaluation of the aesthetic need for treatment is similar to assessment by an oral health care provider.

## MATERIALS AND METHODS

Sample size calculation was performed in a pilot study with 10 randomly selected participants using BioEstat 5.3 software (Belém, PA, Brazil); the mean and standard deviation of the differences, with a margin of error (1 and 2.4, respectively), were used in the calculation. The bilateral test was applied, and test power of 90% and alpha level of 0.05 were used. The test pointed out the need for 62 participants.

Systematic convenience sampling was used, in which participants were selected in dental clinics from Universidade Federal Fluminense (UFF), following dental appointment schedules between February and June 2015. All patients attending these clinics had undergone previous periodontal treatment when necessary, guaranteeing their periodontal health.

From a total of 192 dental appointments, 63 young adults met the inclusion criteria and were invited to take part in this study. Consent was obtained from each person after the nature and purpose of the study had been explained. The inclusion criteria were: 1 – age between 18 and 35 years, 2 – no history of orthodontic treatment, 3 – no history of chronic periodontal disease, and 4 – no chronic medical conditions or craniofacial anomalies. Forty-two female individuals and 21 male individuals were selected for the study, with a mean age of 28.68 years (± 4.99).

Individuals were given a self-managed questionnaire in order to gather OHRQoL and sociodemographic information.

The Brazilian short version of the Oral Health Impact Profile questionnaire (OHIP-14) was used.[12] OHIP-14 consists of 14 questions related to the frequency of malocclusion impacting 14 daily activities, and items are organized into seven domains related to functional limitation, physical pain, physical disability, psychological discomfort, psychological disability, social disability and handicap. A five-point ordinal scale was used to rate the frequency of a particular event: 0 – never; 1 – hardly ever; 2 – occasionally; 3 – fairly often; 4 – very often/every day. OHIP-14 scores can range from 0 to 56, and domain scores can range from 0 to 8. Additive scores were calculated by adding up the response codes for each item. High scores indicated poor OHRQoL.

The aesthetic component of the Index of Complexity, Outcome and Need (ICON)[13] was used to evaluate the aesthetic perception of malocclusion which was obtained as a subjective judgment, comparing the participant with the occlusion attractiveness scale. The scale ranges from 1 to 10, 10 being less attractive.[14] Participant self-evaluations and professional evaluations were undertaken.

Socioeconomic status was evaluated using the Economic Classification Criteria of Brazil,[15] an economic segmentation tool that uses a survey of household characteristics such as the existence and amount of household items of comfort, level of the family head's education, and access to public services to define the population. The criteria assign points for each characteristic, and an overall score is obtained. Correspondence between test score ranges of the strata and economic classification defined by A1, B1, B2, C1, C2 and D-E is then assessed as shown in Table 1.

The data and the relationships between self-perception of malocclusion and OHRQoL were analyzed using BioEstat software version 5.3 (Belém, PA, Brazil).

Spearman correlation tests were used to evaluate the correlation between the aesthetic needs perceived by the participants and the evaluation of their OHRQoL. It was also used to evaluate if there was a correlation between socioeconomic level and self-perception of malocclusion, and between OHRQoL and socioeconomic level.

The Mann–Whitney test was used to evaluate if there were significant differences between the genders regarding the aesthetic self-perception of malocclusion and the evaluation of OHRQoL.

The Wilcoxon test was applied to evaluate the aesthetic perception of malocclusion by the professional (evaluator) and the participants.

All procedures performed in this study were in accordance with the ethical standards of the institutional research committee (approval number 912.379).

***Table 1***: *Economic classification criteria[15] used for socioeconomic evaluation*

| | | | | | |
|---|---|---|---|---|---|
| **Possession of items** | | | | | |
| **Quantity of items** | | | | | |
| | 0 | 1 | 2 | 3 | 4 or + |
| Toilets | 0 | 3 | 7 | 10 | 14 |
| Domestics | 0 | 3 | 7 | 10 | 13 |
| Automobiles | 0 | 3 | 5 | 8 | 11 |
| Microcomputer | 0 | 3 | 6 | 8 | 11 |
| Dishwasher | 0 | 3 | 6 | 6 | 6 |
| Refrigerator | 0 | 2 | 3 | 5 | 5 |
| Freezer | 0 | 2 | 4 | 6 | 6 |
| Washing machine | 0 | 2 | 4 | 6 | 6 |
| DVD | 0 | 1 | 3 | 4 | 6 |
| Microwave | 0 | 2 | 4 | 4 | 4 |
| Motorcycle | 0 | 1 | 3 | 3 | 3 |
| Clothes dryer | 0 | 2 | 2 | 2 | 2 |
| **Level of education of the household head** | | | | | |
| Illiterate/primary incomplete II | | | | | 0 |
| Fundamental I complete/fundamental II incomplete | | | | | 1 |
| Fundamental incomplete/elementary II incomplete | | | | | 2 |
| Full medium/incomplete university | | | | | 4 |
| Graduated | | | | | 7 |
| **Access to public services** | | | | | |
| | | | | No | Yes |
| Piped water | | | | 0 | 4 |
| Paved street | | | | 0 | 2 |
| **Cuts for establishment of socioeconomic status** | | | | | |
| Class | | | | | Total points |
| A | | | | | 45–100 |
| B1 | | | | | 38–44 |
| B2 | | | | | 28–37 |
| C1 | | | | | 23–28 |
| C2 | | | | | 17–22 |
| D-E | | | | | 0–16 |

***Table 2***: *Distribution of gender, socioeconomic status and aesthetic component of ICON score*

| **Category** | **N** | **%** |
|---|---|---|
| Gender | | |
| Male | 21 | 33.33 |
| Female | 42 | 66.66 |
| Socioeconomic status | | |
| A | 6 | 9.52 |
| B1 | 10 | 15.87 |
| B2 | 16 | 25.39 |
| C1 | 11 | 17.46 |
| C2 | 11 | 17.46 |
| D-E | 9 | 14.28 |
| ICON[a] aesthetic component (self-evaluation) | | |
| ≤ 4 | 55 | 87.30 |
| > 4 | 8 | 12.70 |
| ICON aesthetic component (professional evaluation) | | |
| ≤ 4 | 36 | 57.14 |
| > 4 | 27 | 41.86 |

***Table 3**: Median, interquartile range and range observed in OHIP-14 and its domains and ICON aesthetic components (self- and professional evaluation)*

| OHIP-14 domain | Mean (standard deviation) | Median (interquartile range) | Range Observed | *p* value[a] |
|---|---|---|---|---|
| 1. Functional limitation | 0.10 (0.54) | 0 (0) | 0–4 | |
| 2. Physical pain | 0.65 (1.21) | 0 (1) | 0–4 | |
| 3. Psychological discomfort | 0.66 (1.23) | 0 (1) | 0–4 | |
| 4. Physical disability | 0.19 (0.65) | 0 (0) | 0–4 | |
| 5. Psychological disability | 0.73 (1.35) | 0 (1) | 0–4 | |
| 6. Social disability | 0.22 (0.77) | 0 (0) | 0–4 | |
| 7. Handicap | 0.08 (0.47) | 0 (0) | 0–4 | |
| OHIP-14 total | 5.17 (6.50) | 3 (5.5) | 0–33 | |
| ICON aesthetic component (self-evaluation) | 2.98 (1.55) | 3 (1) | 1–9 | .0002* |
| ICON aesthetic component (professional evaluation) | 3.98 (1.97) | 4 (2.5) | 1–9 | |

***Note**: [a]Wilcoxon test; OHIP-14: Oral Health Impact Profile; ICON: Index of Complexity, Outcome and Need*

***Table 4**: Spearman correlation between ICON aesthetic components (self-evaluation) and OHIP-14 scores*

| | 1. Functional limitation | 2. Physical pain | 3. Psychological discomfort | 4. Physical disability | 5. Psychological disability | 6. Social disability | 7. Handicap | OHIP-14 total |
|---|---|---|---|---|---|---|---|---|
| *r* | 0.1333 | -0.0157 | 0.3499 | 0.0177 | -0.2500 | 0.0751 | 0.0703 | 0.3417 |
| *p* | 0.1365 | 0.8614 | <0.0001* | 0.8441 | 0.0047* | 0.4033 | 0.4338 | 0.0061* |

Note:* *Statistically significant*

# RESULTS

A total of 63 young adults with a mean age of 28.68 years (± 4.99) joined the study. As shown in Table 2, approximately two-thirds of the 63 subjects were females (66.66%). Participants were from different social levels, covering all socioeconomic statuses and were well distributed, with 32 (50.78%) of higher status (A, B1 and B2) and 31 (49.10%) of lower status (C1, C2 and D-E). The self-evaluations of the ICON aesthetic component reported eight (12.70%) individuals with an aesthetic need for orthodontic treatment (ICON > 4), and professional evaluation reported 27 (41.86%).

Table 3 shows the mean, standard deviation, median, interquartile range and range observed in OHIP-14 and its domains and the ICON aesthetic component (self- and professional evaluation) for all 63 subjects. The overall mean score and standard deviation (SD) for OHIP-14 was 5.17 (± 6.50). Domain 5 (psychological disability) was most affected, with a mean score of 0.73 (± 1.35). Domain 7 (handicap) was less affected, with a mean score of 0.08 (± 0.47).

There was a weak correlation between the aesthetic component perceived by the participants and the evaluation of their quality of life (Table 4). Only the psychological domains (psychological discomfort and psychological disability) showed significant correlations, but they were considered poor.

There was no significant difference between the genders ($p = 0.8554$) regarding the aesthetic self-perception of malocclusion, and no significant difference between the genders in relation to the assessment of quality of life ($p = 0.0802$).

The Spearman rank-order correlation coefficients between socioeconomic status and the ICON aesthetic component (self-evaluation) and between socioeconomic status and OHIP-14 showed no correlation ($r = 0.0423$; $p = 0.7421$ and $r = 0.1803$; $p = 0.1573$, respectively).

In relation to the aesthetic perception of malocclusion and the professional evaluation, there was a significant difference between the professional assessments and those of participants ($p = 0.0002$) (Table 3).

# DISCUSSION

Many studies have already evaluated the effect of malocclusion on OHRQoL.[3-9,16-18] However, many researchers evaluated malocclusion through clinical examination

performed by professionals, or normative parameters that conceptualize the complexity level of malocclusion, also performed by professionals. Aesthetics are subjective, and aesthetic perception of the need for treatment varies from patient to patient. Some patients have severe malocclusions and are not concerned with their aesthetic appearance, while others have light malocclusions and are concerned about its impact on their quality of life.[13,16,19] The novelty of this study lies in the fact that the main evaluation was that of the participants. This evaluation involved self-perception of their own malocclusion.

Another important point was that the population studied was not waiting to start orthodontic treatment, and so were probably not concerned with their aesthetic appearance, which could have a negative impact on their OHRQoL. The small number of participants who declared that they did not need aesthetic treatment (ICON d" 4) compared to those who needed aesthetic treatment (ICON > 4) confirmed this point.

It was also possible to identify a low impact of malocclusion on the OHRQoL of those participants who were not seeking orthodontic treatment. The OHIP-14 index can range from 0–56; in this study, the variation found was 0–33, with a mean of 5.17 (± 6.50). Studies that evaluated patients waiting for orthodontic treatment found higher values in their evaluation of OHRQoL.[9,17]

A positive correlation between the aesthetic perception of their own malocclusion and a worsening of their OHRQoL was observed, as also reported by Bellot-Arcís et al. concerning college students.[20] However, this correlation was classified as low. Silvola et al.[2] and Taylor et al.[11] did not associate greater perception of malocclusion with the worsening of OHRQoL. Only psychological domains showed a significant correlation with the OHRQoL evaluation, although they were weak, agreeing with Bellot-Arcís et al.[20] who showed a significant linear relationship between aesthetic self-perception of a smile and psychological impact on the individual.

The psychological component has already been reported by other authors as an important factor in OHRQoL.[16,21,22] Aesthetic and social problems negatively impact OHRQoL and should be taken into account in order to evaluate the needs and goals of orthodontic treatment.

No difference was found between the genders in relation to the perception of malocclusion. Nevertheless, this result has to be interpreted cautiously, since the sample was not matched by gender. Feu et al.[22] also did not find a difference in the demand for orthodontic treatment between men and women. Other authors found no differences between the genders in the evaluation of OHRQoL,[10,17] although some reported that women have a keener aesthetic perception than men.[23-26]

The socioeconomic level of the participants did not affect their ratings. This was also reported by Palomares et al.,[10] showing no effect of socioeconomic status in relation to OHRQoL. However, studies with more robust samples that focused on the influence of socioeconomic factors in OHRQoL showed a negative impact in OHRQoL associated with a low socioeconomic level. Vettore and Aqeeli found in a large sample of Brazilians that adults living in cities with low socioeconomic development were more likely to report negative impact in OHRQoL,[27] and Piovesan et al. reported that poorer scores of OHRQoL were observed in children whose mothers had not completed primary education and in those with lower household income.[28]

The mean evaluation of aesthetic need for malocclusion by the professional (appraiser) was higher than the mean for the participants (Table 2), indicating a more careful evaluation, with a significant difference between these evaluations. Similarly, Silvola et al.[2] identified differences between evaluators and lay people, with a tendency for professionals to detect malocclusion more easily. Feu et al.[22] found a weak correlation between the aesthetic need for orthodontic treatment, according to the professional appraiser and according to the participant. Prahl-Andersen [29] found differences between the aesthetic need for orthodontic treatment as evaluated by lay people and professionals and stressed the importance of taking into account the patient's self-perception at the time of the orthodontic treatment.

There was a difficulty in finding a valid index for the specific population studied which could evaluate OHRQoL regarding orthodontic problems. There are still flaws in the use of the OHIP-14 index regarding malocclusion. It is very difficult in the subjective area to detach aesthetic smile perceptions such as changes in color, shape of teeth, pigmentations, deficient restorations and inadequate prostheses of aesthetic smile perception from the malocclusion itself. Although the examiner clarified to all participants that their answers should be based on the positioning of the teeth and the fitting of the dentition, to the lay population it hard to dissociate smile characteristics from malocclusion. Therefore, it is important for future studies that an index to evaluate OHRQoL, concerning only malocclusion problems, is created and validated. Liu, McGrath and Hagg[16] noted that this new instrument must include more questions with answers based on psychological origin since they are relevant in the evaluation.

This research revealed that the patient's view is different from that of the orthodontist, especially when an

issue is more subjective, such as the aesthetic factor. As the participants were a group not seeking orthodontic treatment, the results showed less importance of the aesthetic perception of their malocclusion and also that there was a low negative impact on OHRQoL for these participants, despite a correlation between aesthetic self-perception of malocclusion and OHRQoL. It was also noted that the only domains that showed significant correlations were psychological, strengthening evidence for the subjectivity of issues related to the aesthetics of malocclusion. It is understood, therefore, that there is a need to listen more to patients regarding their perception of malocclusion and the impact of this on their OHRQoL, using subjective criteria in a complementary way to the normative indices which establish the need for orthodontic treatment.

The participants in our research were young adults. The demand for orthodontic treatment has been greatly increasing in this age group, probably for aesthetic reasons. So, more studies to evaluate their OHRQoL are needed. The present results showed the importance of listening to the patient's needs before proposing an orthodontic treatment plan.

On the other hand, our study did not compare individuals seeking orthodontic treatment with those that were not. Comprehensive research comparing these two different groups would be very welcome.

Significant weak correlations between self-perceived malocclusion and OHRQoL were found in young adults who were not seeking orthodontic treatment. The domains of psychological discomfort and psychological disability presented the greatest impacts. As the aesthetic self-perceived malocclusion was significantly less relevant than the professional evaluation, dentists, and specifically orthodontists, should take it in account when addressing this kind of patient.

## REFERENCES

1. WHO, World Health Organization. Young people's health—a challenge for society. Report of a WHO study group on young people and health for all. Technical Report Series 731. Geneva: WHO. 1986.

2. Silvola AS, Varimo M, Tolvanen M, Rusanen J, Lahti S, Pirttiniemi P. Dental esthetics and quality of life in adults with severe malocclusion before and after treatment. Angle Orthod. 2014 Jul;84(4):594-9. doi: 10.2319/060213-417.1.

3. Ashari A, Mohamed AM. Relationship of the Dental Aesthetic Index to the oral health-related quality of life. Angle Orthod. 2016 Mar;86(2):337-42. doi: 10.2319/121014-896.1.

4. Barbosa TS, Gavião MBD, Leme MS, Castelo PM. Oral health-related quality of life in children and preadolescents with caries, malocclusions or temporomandibular disorders. Oral Health Prev Dent. 2016 Nov;14(5):389. doi:10.3290/j.ohpd.a36097.

5. Choi SH, Kim JS, Cha JY, Hwang CJ. Effect of malocclusion severity on oral health-related quality of life and food intake ability in a Korean population. Am J Orthod Dentofacial Orthop. 2016 Mar;149(3):384-90. doi: 10.1016/j.ajodo.2015.08.019.

6. Choi SH, Kim BII, Cha JY, Hwang CJ. Impact of malocclusion and common oral diseases on oral health-related quality of life in young adults. Am J Orthod Dentofacial Orthop. 2015 May;147(5):587-95. doi: 10.1016/j.ajodo.2014.12.025.

7. Twigge E, Roberts RM, Jamieson L, Dreyer CW, Sampson WJ. The psycho-social impact of malocclusions and treatment expectations of adolescent orthodontic patients. Eur J Orthod. 2016 Dec;38(6):593-601.

8. Kragt L, Dhamo B, Wolvius EB, Ongkosuwito EM. The impact of malocclusions on oral health-related quality of life in children-a systematic review and meta-analysis. Clin Oral Investig. 2016 Nov;20(8):1881-94.

9. Kang JM, Kang KH. Effect of malocclusion or orthodontic treatment on oral health-related quality of life in adults. Korean J Orthod. 2014 Nov;44(6):304-11. doi: 10.4041/kjod.2014.44.6.304.

10.Palomares NB, Celeste RK, Oliveira BH, Miguel JA. How does orthodontic treatment affect young adults' oral health-related quality of life? Am J Orthod Dentofacial Orthop. 2012 Jun;141(6):751-8. doi: 10.1016/j.ajodo.2012.01.015.

11. Taylor KR, Kiyak A, Huang GJ, Greenlee GM, Jolley CJ, King GJ. Effects of malocclusion and its treatment on the quality of life of adolescents.

12.Oliveira BH, Nadanovsky P. Psychometric properties of the Brazilian version of the oral health impact profile-short form. Community Dent Oral Epidemiol. 2005 Aug;33(4):307-14.

13. Daniels C, Richmond S. The development of the Index of Complexity, Outcome and Need (ICON). J Orthod. 2000 Jun;27(2):149-62.

14. Evans R, Shaw W. Preliminary evaluation of an illustrated scale for rating dental attractiveness. Eur J Orthod. 1987 Nov;9(4):314-8.

15. Critérios de Classificação Econômica Brasil (CCEB) [Internet]. São Paulo: Associação Brasileira de Empresas de Pesquisa (ABEP); 2015 [cited 2018 May 7]. Available from: http://www.abep.org/Servicos/Download.aspx?id=11.

16. Liu Z, McGrath C, Hägg U. The impact of malocclusion/orthodontic treatment need on the quality of life: a systematic review. Angle Orthod. 2009 May;79(3):585-91. doi: 10.2319/042108-224.1.

17. Masood Y, Masood M, Zainul NN, Araby NB, Hussain SF, Newton T. Impact of malocclusion on oral health related quality of life in young people. Health Qual Life Outcomes. 2013 Feb 26;11:25. doi: 10.1186/1477-7525-11-25.

18. Hassan AH, Amin Hel-S. Association of orthodontic treatment needs and oral health-related quality of life in young adults. Am J Orthod Dentofacial Orthop. 2010 Jan;137(1):42-7. doi: 10.1016/j.ajodo.2008.02.024.

19. Locker D. Oral health and quality of life. Oral Health Prev Dent.

2004;2 Suppl 1:247-53.
20. Bellot-Arcís C, Montiel-Company JM, Pinho T, Almerich-Silla JM. Relationship between perception of malocclusion and the psychological impact of dental aesthetics in university students. J Clin Exp Dent. 2015 Feb 1;7(1):e18-22. doi: 10.4317/jced.52157.
21. Chen M, Feng ZC, Liu X, Li ZM, Cai B, Wang DW. Impact of malocclusion on oral health-related quality of life in young adults. Angle Orthod. 2015 Nov;85(6):986-91. doi: 10.2319/101714-743.1.
22. Feu D, Miguel JAM, Celeste RK, Oliveira BH. Effect of orthodontic treatment on oral health-related quality of life. Angle Orthod. 2013 Sep;83(5):892-8. doi: 10.2319/100412-781.1.
23. Bauer J, Vasilache I, Schlegel AK, Wichmann M, Eitner S. Esthetics and psyche part 1: assessment of the influence of patients' perceptions of body image and body experience on selection of existing natural tooth color. Int J Prosthodont. 2012 Jan-Feb;25(1):36-43.
24. Samorodnitzky-Naveh GR, Grossman Y, Bachner YG, Levin L. Patients' self-perception of tooth shade in relation to professionally objective evaluation. Quintessence Int. 2010 May;41(5):e80-3.
25. Johnston C, Hunt O, Burden D, Stevenson M, Hepper P. Self-perception of dentofacial attractiveness among patients requiring orthognathic surgery. Angle Orthod. 2010 Mar;80(2):361-6. doi: 10.2319/051209-252.1.
26. Hassel AJ, Wegener I, Rolko C, Nitschke I. Self-rating of satisfaction with dental appearance in an elderly German population. Int Dent J. 2008 Apr;58(2):98-102.
27.Vettore MV, Aqeeli A. The roles of contextual and individual social determinants of oral health-related quality of life in Brazilian adults. Qual Life Res. 2016 Apr;25(4):1029-42. doi: 10.1007/s11136-015-1118-0.
28.Piovesan C, Antunes JL, Guedes RS, Ardenghi TM. Impact of socioeconomic and clinical factors on child oral health-related quality of life (COHRQoL). Qual Life Res. 2010 Nov;19(9):1359-66. doi: 10.1007/s11136-010-9692-7.
29. Prahl-Andersen B. The need for orthodontic treatment. Angle Orthod. 1978 Jan;48(1):1-9.

# KIDNEY DISEASE, INCREASED BODY MASS INDEXES, AND ANTERIOR TEETH TREATMENT NEEDS

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**Palavras-chave**: Índice de Massa Corporal. CKD. Obesidade. Qualidade de Vida. Nutrição

**RESUMO**

**Objetivo**: O objetivo dessa série de avaliações foi testar a hipótese de que pessoas com doença renal têm mais necessidades de tratamento dos dentes anteriores. Esse efeito seria independente do risco aumentado de ser obeso. **Métodos**: Através do projeto da Faculdade de Odontologia da Universidade de Pittsburgh entitulado *Dental Registry and DNA Repository*, foi avaliada a história de tratamento em dentes anteriores em pacientes com doença renal. Quatro mil novecentos e oitenta e três indivíduos foram estudados. **Resultados**: Cento e três indivíduos reportaram ter doença renal e 1.424 pessoas tinham história de tratamento em dentes anteriores. Indivíduos com doença renal tiveram mais tratamento em dentes anteriores (p=0.001). Pessoas que reportaram doença renal também tiveram uma maior freqüência de obesidade, todavia necessidade de tratamento em dentes anteriores foi maior em indivíduos com doença renal, independente do índice de massa corporal. **Conclusão**: Doença renal crônica aumenta a necessidade de tratamrnto dos dentes anteriores, o que aumenta a chance de perda dentária e sugere que um protocol diferente para tartar pessoas com doença renal crônica seja uma medida justificada.

**Keywords**: Body Mass Index. CKD. Obesity. Quality of Life. Nutrition.

**ABSTRACT**

**Objective**: The purpose of this study was to test the hypothesis that individuals with kidney disease will have more dental issues affecting their anterior teeth. This effect on oral health would be independent from the effects of their higher frequency of obesity. **Methods**: Using the University of Pittsburgh School of Dental Medicine Dental Registry and DNA Repository project, anterior teeth treatment history was evaluated for patients with kidney disease. Four thousand nine hundred and eighty-three individuals were evaluated. Individuals with kidney disease were compared to individuals who did not present the condition. **Results**: One hundred and three individuals reported kidney disease and 1,424 had history of treatment of anterior teeth. Individuals with kidney disease had significant more anterior teeth treatments (p=0.001). Individuals who reported kidney disease also had a higher frequency of overweight individuals, but anterior teeth restoration needs were higher in all individuals with kidney disease, independent of their body mass index. **Conclusion**: Chronic kidney disease increases treatment needs of anterior teeth and potentially leads to worse oral health outcomes and warrants changes in protocols for treatment of individuals with chronic kidney disease.

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## INTRODUCTION

Correlations between the loss of renal function early in life and developmental defects in enamel later in time have been reported in the literature a few times.[1-5] Children that show early deterioration of renal function are also affected by enamel hypoplasia in both their primary, and later, their permanent teeth. This defective enamel development has been attributed to issues involving the metabolism of vitamin D, which is known to affect the formation of teeth, and can be disrupted by renal osteodystrophy.[6] An important ion that is regulated by the kidneys is calcium. Nephrocalcinosis is a recessive autosomal disorder that is attributed to the impaired regulation of calcium, leading to its precipitation in the urinary collecting system. It was deduced that it is due to a mutation on the *FAM20A* gene, which was previously only thought to be associated with amelogenesis imperfecta, which is a disorder of the formation of enamel.[7-9]

Another factor affecting enamel in children is obesity. It was found that adolescents that were obese and overweight were 3.7 times more likely to develop caries in a three-year study.[10] Obesity has also proven to increase major risk factors for chronic kidney disease, like diabetes mellitus and hypertension. When adjustments were made for studying obesity and kidney disease for mediators of cardiovascular and metabolic effects from obesity,[11] obese participants still had poorer renal outcomes than those who were not obese. This implies that obesity may affect the function of kidneys in ways that are unrelated to these cardiovascular and metabolic complications. But there are also side effects of obesity that directly impact the kidneys. These include increased production of adiponectin, leptin, and resistin, among others. The changes in kidneys that occur due to obesity ultimately lead to glomerulomegaly and focal or segmental glomerulosclerosis. Obesity-related glomerulopathy has increased 10-fold between the years 1986 and 2000.[11]

Due to aesthetic procedures that hide the effects of the enamel defects previously mentioned, enamel alterations are sometimes more difficult to detect in adults. We aimed to determine if individuals with self-reported history of kidney disease, and later an increased body mass index (BMI), had more often the need for restoring anterior maxillary incisors, with the idea that dental treatments in anterior maxillary teeth are the consequence of a combination of improving aesthetic appearance and/or dealing with higher caries experience because potentially the enamel structure is weakened and more susceptible to demineralization under acidic challenge.

## MATERIALS AND METHODS

At the time of this analysis, 4,983 subjects from the University of Pittsburgh School of Dental Medicine Dental Registry and DNA Repository [University of Pittsburgh Institutional Review Board (IRB) approval #0606091] were available for study. Starting in September of 2006, all individuals that seek treatment at the University of Pittsburgh School of Dental Medicine have been invited to be part of the registry. These individuals give written informed consent authorizing the extraction of information from their dental records. Information includes demographics, underlying medical history, dental history, medication intake, oral and dental diagnosis, and dental treatment needs. Of these patients, 103 of them reported having kidney disease.

Then, the individuals that possessed Body Mass Indexes (BMIs; N=2,763) were split into four different categories. The 'Underweight' category was made up of participants with BMIs less than 18. The 'Normal Weight' category was comprised of participants with BMIs that ranged from 18 to 24.9. 'Overweight' participants had BMIs between 25 and 29.9. Lastly, the group of participants whose BMIs were 30 and above were placed into the 'Obese' category. All of the participants were then further separated by which restorations they had, if any. The first restoration category includes 1 Surface, Anterior (tooth) (D2330), the second was 2 Surfaces, Anterior (tooth) (D2331), the third was 3 Surfaces, Anterior (tooth) (D2332), and the fourth category was 4+ Surfaces, or Incisal Angle involvement (D2335). Finally, these analyses were made considering if they had kidney disease or not. Chi-square was used to determine statistically significant differences with an alpha of 0.05.

## RESULTS

Individuals with self-reported kidney disease (N=103) were for the most part males (58%), Whites [76%; others were Black (18%) or other groups (3%)], and had a mean age of 53.4 years. These data are similar to the data on the overall Dental Registry and DNA Repository project, which has 48% males, 65% Whites, 18% Blacks and the rest are other groups, and mean age of 43 years. Of the total 4,880 individuals without kidney disease, a total of 1,380 individuals had composite resins in anterior maxillary teeth (28%), in contrast with 44 (43%) individuals among those being in the subgroup of patients with kidney disease (N=103). **Table 1** illustrates these results found from comparing the frequencies of individuals affected with kidney disease and those not affected with kidney disease compared to the frequencies of individuals with a certain type of restoration or at least one

***Table 1***: *Distribution of individuals based on kidney disease status and type of composite resin restoration in anterior teeth.*

| Composite Resin Type | Individuals Affected by Kidney Disease N = 103 | | Individuals without Kidney Disease N = 4,880 | | P-values |
|---|---|---|---|---|---|
| | N | Relative Frequency | N | Relative Frequency | |
| 1 Surface, Anterior (D2330*) | 27 | 0.26 | 483 | 0.10 | 0.0000001 |
| 2 Surfaces, Anterior (D2331*) | 29 | 0.28 | 668 | 0.14 | 0.00003 |
| 3 Surfaces, Anterior (D2332*) | 20 | 0.20 | 521 | 0.11 | 0.005 |
| 4+ Surfaces, or Incisal Angle (D2335*) | 11 | 0.11 | 356 | 0.07 | 0.19 |
| Any Type of Composite Resin | 44 | 0.43 | 1,380 | 0.28 | 0.001 |

*Note: *Codes used for insurance purposes in the United States. Chi-square was used for all comparisons. Differences between the total N and individual lines are due to the fact the patients may have more than one type of restoration in their mouths.*

occurrence of any type of composite resin. There were significantly more individuals with 1, 2, and 3 Surface Anterior restorations who also had kidney disease than those with 1, 2, and 3 Surface Anterior restorations with no kidney disease. In addition, those with kidney disease were about 1.5 times more likely to have any type of composite resin over those with no kidney disease.

The increased anterior teeth treatment needs were higher in individuals with kidney disease, independent of their BMI. Table 2 shows the occurrences of different types of resin composites based on the BMI definitions, and the comparison between BMIs (as categorized by underweight, normal weight, overweight, and obese) and the occurrence of kidney disease. For each BMI category, statistically significant results were found that illustrate that as BMI increases, the occurrence of kidney disease increases also.

# DISCUSSION

The frequency of individuals with any type of composite resin in the total study population was 28.58%, so the expected number of individuals in the group affected by kidney disease would have been expected to be around 29. Instead, the number was 44 (a frequency of 42.72%). Individuals with kidney disease had 53.57% more anterior composite resin restorations in comparison to individuals without kidney disease (p=0.001). The medical history data accessible for this project is self-report and this can be seen as a limitation for the study although we have no evidence to believe that in general people would not disclose that information to their dentists.

These results show that patients who have kidney disease will more often need anterior composite resin restorations that are possibly surrogates of enamel aesthetic concerns (i.e. enamel hypoplasia) or higher caries experience, as compared to the total population of patients who were in our study. In children, a strong correlation was shown in the primary dentition between the presence of enamel hypoplasia in maxillary incisors and caries experience in the same teeth.[12] The correlation between enamel hypoplasia and dental caries can also be seen in very-low birth weight children,[13] and in adolescents from India that were born from adolescent mothers.[14] Therefore, the higher frequency of maxillary incisors with composite resin restorations in individuals with kidney disease may also reflect a higher susceptibility to dental caries, which may be explained by a dental enamel more susceptible to acid demineralization. Our group has suggested that a genetic component exist for higher susceptibility to dental enamel to acquire caries lesions.[15-18] The fact that other factors that impact the development of enamel such as the presence of kidney disease also likely impact the susceptibility for dental caries, hence the multifactorial nature of the disease, which is likely influenced by more than one gene aside from the well-established environmental component.[19]

Furthermore, the results show that patients who have higher BMIs tend to have higher restoration frequencies. For an example, individuals in the obese category were 1.24 times more likely to have any type of composite resin rather than individuals who were not obese. They were 1.18 times more likely to have any type of restoration than individuals who were overweight, 1.21 times more likely to have any type of restoration than individuals who were normal weight, and 2.09 times more likely to have any type of restoration than individuals who were underweight. However, it remains important to understand that dental caries and BMI share several predisposing factors that may skew data, including diet, socioeconomic status, and lifestyle.[20]

As expected, we found an association between kidney disease and patients' BMI. The underweight population was 5.8 times less likely to also have kidney disease than the not-underweight population. The normal weight population was 3.0 times less likely to also have kidney disease than the not-normal weight population. On the other hand, the

***Table 2**: Distribution of individuals based on Bode Mass Index (BMI), kidney disease status and type of BMI vs. Composite Resin, Summary of Findings for:*

**BMI vs. Composite Resin, Summary of Findings for Underweight Individuals**

| Composite Resin Type | Underweight Individuals N = 156 | | Not Underweight IndividualsN = 2,607 | | P-values |
|---|---|---|---|---|---|
| | N | Relative Frequency | N | Relative Frequency | |
| 1 Surface, Anterior (D2330*) | 20 | 0.13 | 549 | 0.21 | 0.01 |
| 2 Surfaces, Anterior (D2331*) | 21 | 0.13 | 615 | 0.24 | 0.003 |
| 3 Surfaces, Anterior (D2332*) | 17 | 0.11 | 426 | 0.16 | 0.07 |
| 4+ Surfaces, or Incisal Angle (D2335*) | 12 | 0.08 | 286 | 0.11 | 0.2 |
| Any Type of Composite Resin | 36 | 0.22 | 1058 | 0.41 | 0.000007 |

**BMI vs. Composite Resin, Summary of Findings for Normal Weight Individuals**

| Composite Resin Type | Normal Weight Individuals N = 998 | | Not Normal Weight IndividualsN = 1,765 | | P-values |
|---|---|---|---|---|---|
| | N | Relative Frequency | N | Relative Frequency | |
| 1 Surface, Anterior (D2330*) | 190 | 0.39 | 379 | 0.21 | 0.13 |
| 2 Surfaces, Anterior (D2331*) | 211 | 0.29 | 425 | 0.24 | 0.25 |
| 3 Surfaces, Anterior (D2332*) | 143 | 0.21 | 300 | 0.17 | 0.07 |
| 4+ Surfaces, or Incisal Angle (D2335*) | 112 | 0.11 | 186 | 0.11 | 0.58 |
| Any Type of Composite Resin | 377 | 0.38 | 716 | 0.41 | 0.0000001 |

**BMI vs. Composite Resin, Summary of Findings for Overweight Individuals**

| Composite Resin Type | Overweight Individuals N = 810 | | Not Overweight IndividualsN = 1,953 | | P-values |
|---|---|---|---|---|---|
| | N | Relative Frequency | N | Relative Frequency | |
| 1 Surface, Anterior (D2330*) | 175 | 0.39 | 394 | 0.20 | 0.4 |
| 2 Surfaces, Anterior (D2331*) | 181 | 0.29 | 455 | 0.23 | 0.0000001 |
| 3 Surfaces, Anterior (D2332*) | 130 | 0.21 | 313 | 0.16 | 0.0000001 |
| 4+ Surfaces, or Incisal Angle (D2335*) | 72 | 0.11 | 226 | 0.12 | 0.04 |
| Any Type of Composite Resin | 314 | 0.39 | 779 | 0.40 | 0.58 |

**BMI vs. Composite Resin, Summary of Findings for Obese Individuals**

| Composite Resin Type | Obese Individuals N = 799 | | Not Obese Individuals N = 1,964 | | P-values |
|---|---|---|---|---|---|
| | N | Relative Frequency | N | Relative Frequency | |
| 1 Surface, Anterior (D2330*) | 186 | 0.23 | 383 | 0.20 | 0.2 |
| 2 Surfaces, Anterior (D2331*) | 231 | 0.29 | 405 | 0.21 | 0.000003 |
| 3 Surfaces, Anterior (D2332*) | 151 | 0.19 | 292 | 0.15 | 0.009 |
| 4+ Surfaces, or Incisal Angle (D2335*) | 104 | 0.13 | 194 | 0.10 | 0.01 |
| Any Type of Composite Resin | 367 | 0.46 | 726 | 0.37 | 0.00001 |

**Body Mass Index vs. Kidney Disease, Summary of Findings on Restoration Frequency**

| BMI | Individuals Affected by Kidney Disease N = 96 | | Individuals without Kidney Disease N = 2,667 | | P-values |
|---|---|---|---|---|---|
| | N | Relative Frequency | N | Relative Frequency | |
| Underweight (BMI < 18) | 1 | 0.01 | 158 | 0.06 | 0.04 |
| Normal Weight (BMI 18 – 24.9) | 15 | 0.16 | 983 | 0.37 | 0.0000001 |
| Overweight (BMI 25 – 29.9) | 33 | 0.34 | 777 | 0.29 | 0.0000001 |
| Obese (BMI > 30) | 47 | 0.49 | 752 | 0.28 | 0.0000001 |

*Note: *Codes used for insurance purposes in the United States. Chi-square was used for all comparisons. Differences between the total N and individual lines are due to the fact the patients may have more than one type of restoration in their mouths.*

overweight population was 1.3 times more likely to also have kidney disease than the not-overweight population. Lastly, the obese population was 2.4 times more likely to also have kidney disease than the not-obese population. These results support previous findings that suggest associations between kidney disease and elevated BMIs.[11]

The choice of analysis is worth mentioning. We did not perform a regression analysis because the goal was not to understand which among the independent variables were related to the dependent variable, and to explore these relationships, maybe even to infer causal effects. We know that obesity increases the chance of having kidney disease. The demonstration that the presence of an underlying kidney disorder leads to higher frequencies of restorative treatment of maxillary anterior teeth should be enough to provide evidence that individuals with chronic kidney disorders require personalized attention and likely different treatment approaches and preventive strategies to help stop worsening of oral health status.

Affection of anterior maxillary teeth that requires dental restorations could be the consequence of altered salivary flow.[21,22] Whereas anterior mandibular teeth are covered by the tongue and still may have more contact with saliva, decreased salivary flow may affect maxillary teeth more prominently, leading to higher experience of caries lesions and more dental treatment needs.

In conclusion, individuals with chronic kidney disease have more treatment needs of the anterior maxillary teeth. The identification of individuals with "caries predisposing enamel" not only would allow for personalizing preventive strategies, but also provide support for the popular belief of a correlation between "weak teeth" and having many "cavities."

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# REFERENCES

1. Oliver WJ, Owings CL, Brown WE. Shapiro BA. Hypoplastic enamel associated with
the nephrolic syndrome. Pediatrics 1961;32:399-406.
2. Bublitz A, Machal E, Scharer K, Komposch G, Mehls O. Changes in dental development in pediatric patients with chronic kidney disease. Proc Eur Dial Transplant Assoc 1981;18:5l7-23.
3. Woodhead JC, Nowak AJ, Crall JJ, Robillard JE. Dental abnormalities in children with
chronic renal failure. Pediatr Dent 1982;4:281-5.
4. Wolff A, Stark H, Sarnat H, Binderman I. Eisenstein B, Drukker A. (1983) The dental status of children with chronic renal failure. Int J Pediatr Nephrol 1983;6:127-32.
5. Scheutzel P, Ritter W. Zahn- und Kieferveranderungen bei chronischer Niereninsuffizienz im KIndesalter. Dtsch Zahnarzll Z 1989;44:115-8.
6. Koch, MJ, Bührer R, Pioch T, Schärer K. Enamel hypoplasia of primary teeth in chronic renal failure. Pediatr Nephrology 1999;13:68-72.
7. O'Sullivan J, Bitu CC, Daly SB, Urquhart JE, Barron MJ, Bhaskar SS, Martelli-Junior H, dos Santos Neto PE, Mansilla MA, Murray JC, Coletta RD, Black GC, Dixon MJ. Whole- exome sequencing identifies FAM20A mutations as a cause of amelogenesis imperfecta and gingival hyperplasia syndrome. Am J Hum Genet 2011;88:616–20.
8. Cho SH, Seymen F, Lee KE, Lee SK, Kweon YS, Kim KJ, Jung SE, Song SJ, Yildirim M, Bayram M, Tuna EB, Gencay K, Kim JW. Novel FAM20A mutations in hypoplastic amelogenesis imperfecta. Hum Mutat 2012;33: 91–4.
9. Jaureguiberry G, De la Dure-Molla M, Parry D, Quentric M, Himmerkus N, Koike T, Poulter J, Klootwijk E, Robinette SL, Howie AJ, Patel V, Figueres ML, Stanescu HC, Issler N,
Nicholson JK, Bockenhauer D, Laing C, Walsh SB, McCredie DA, Povey S, Asselin A, Picard A, Coulomb A, Medlar AJ, Bailleul-Forestier I, Verloes A, Le Caignec C, Roussey G, Guiol J, Isidor B, Logan C, Shore R, Johnson C, Inglehearn C, Al-Bahlani S, Schmittbuhl M, Clauss F, Huckert M, Laugel V, Ginglinger E, Pajarola S, Spartà G, Bartholdi D, Rauch A, Addor MC, Yamaguti PM, Safatle HP, Acevedo AC, Martelli-Júnior H, dos Santos Netos PE, Coletta RD, Gruessel S, Sandmann C, Ruehmann D, Langman CB, Scheinman SJ, Ozdemir-Ozenen D, Hart TC, Hart PS, Neugebauer U, Schlatter E, Houillier P, Gahl WA, Vikkula M, Bloch-Zupan A, Bleich M, Kitagawa H, Unwin RJ, Mighell A, Berdal A, Kleta R. Nephrocalcinosis (enamel renal syndrome) caused by autosomal recessive FAM20A mutations. Nephron Physiology 2012;122:1-6.
10. Basha S, Mohamed RN, Swamy HS, Ramamurthy PH, Sexena V. Caries incidence among obese adolescents: A 3-year prospective study. Oral Health Prev Dent 2017;15:65-71.
11. Kovesdy CP, Furth SL, Zoccali C, World Kidney Day Steering Committee. Obesity and kidney disease: hidden consequences of the epidemic. Future Sci OA 2017;3:FSO159.
12. Pascoe L, Seow WK. Enamel hypoplasia and dental caries in Australian Aboriginal children: prevalence ad correlation between two diseases. Pediatr Dent 1994;16:193-9.
13. Lai PY, Seow WK, Tudehope DI, Rogers Y. Enamel hypoplasia and dental caries in very-low birthweight children: a case-controlled, longitudinal study. Pediatr Dent 1997;19:42-9.
14. Fotedar S, Sogi GM, Sharma KR. Enamel hypoplasia and its correlation with dental caries in 12 and 15 years old school children in Shimla, India. Indian Assoc Public Health Dent 2014;12:18-22.
15. Shimizu T, Ho B, Deeley K, Briseño-Ruiz J, Faraco IM Jr, Schupack BI, Brancher JA, Pecharki GD, Küchler EC, Tannure PN, Lips A, Vieira TC, Patir A, Yildirim M, Poletta FA, Mereb JC, Resick JM, Brandon CA, Orioli IM, Castilla EE, Marazita ML, Seymen F, Costa MC, Granjeiro JM, Trevilatto PC, Vieira AR. Enamel formation genes influence enamel microhardness before and after cariogenic challenge. PLoS One 2012;7:e45022.
16. Weber ML, Hsin H-Y, Kalay E, Bro~Xová DS, Shimizu T, Bayram M, Deeley K, Küchler EC, Forella J, Ruff TD, Trombetta VM, Sencak RC, Hummel M, Briseño-Ruiz J, Revu SK, Granjeiro JM, Antunes LS, Abreu FV, Costa MC, Tannure PN, Koruyucu M, Patir A, Poletta FA, Mereb JC, Castilla EE, Orioli IM, Marazita ML, Ouyang H, Jayaraman T, Seymen F, Vieira AR. Role of estrogen related receptor beta (ESRRB) in DFN35B hearing impairment and dental decay. BMC Med Genet 2014;15:81.
17. Bayram M, Deeley K, Reis MF, Trombetta VM, Ruff TD, Sencak RC,

Hummel M, Dizak PM, Washam K, Romanos HF, Lips A, Alves G, Costa MC, Granjeiro JM, Antunes LS, Küchler EC, Seymen F, Vieira AR. Genetic influences on dental enamel that impact caries differ between the primary and permanent dentitions. Eur J Oral Sci 2015;123:327-34.
18. Vieira AR, Gibson CW, Deeley K, Xue H, Li Y. Weaker dental enamel explains dental decay. PLoS ONE 2015;10:e0124236.
19. Vieira AR, Modesto A, Marazita ML. Caries: Review of human genetics research. Caries Res 2014;48:491-506.
20. Chopra A, Rao NC, Gupta N, Vashisth S, Lakhanpal M. The predisposing factors between dental caries and deviations from normal weight. N Am J Med Sci 2015;7:151-9.
21. Martins C, Siqueira WL, Oliveira E, Nicolau J, Primo LG. Dental calculus formation in children and adolescents undergoing hemodialysis. Pediatr Nephrol 2012;27:1961-6.
22. Martins C, Siqueira WL, Guimarães Primo LS. Oral and salivary flow characteristics of a group of Brazilian children and adolescents with chronic renal failure. Pediatr Nephrol 2008;23:619-24.

# EVALUATION OF THE ACCURACY BETWEEN SPLINTING AND NON-SPLINTINGIMPRESSION TECHNIQUES FOR MULTIPLE IMPLANTS

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**Palavras-chave:** Técnica de Moldagem Odontológica. Implantes Dentários. Próteses Dentárias Fixadas por Implante.

**RESUMO**

**Introdução:** Entre os fatores determinantes para a longevidade de uma prótese implanto suportada, está o processo exato e meticuloso de moldagem dos implantes osseointegrados, implicando diretamente no assentamento passivo da prótese. **Objetivo:** Comparar a precisão das técnicas de moldagem com e sem união dos transferentes isolando os fatores que podem estar associados ao ajuste passivo. **Métodos:** A partir de um grupo controle composto por um modelo mestre (em resina acrílica quimicamente ativada) mandibular desdentado com quatro implantes de conexão externa posicionados paralelamente e unidos por uma barra metálica. Foram confeccionadas dez moldeiras em resina acrílica quimicamente ativada (todas abertas). Dez impressões foram feitas com silicone de condensação *Xantopren* ®, e vertidas com gesso tipo IV, *Durone* ®, divididas em dois grupos: Grupo 1 (n=5) – Pilares *multi unit* não unidos e Grupo 2 (n=5) – Pilares *multi unit* unidos por uma barra confeccionada com fio dental e resina acrílica autopolimerizável, *Palavit G* ®, através de um molde de silicone de adição, *Elite Double* ® *Zhermack*. Em seguida, a barra foi seccionada e reunida. Os dez modelos de transferência foram mensurados no centro da face vestibular de cada um dos implantes através de uma lupa estereoscópica (*Physis*®) com ampliação de 60 vezes. Os resultados foram tabulados e submetidos à análise estatística não paramétrica, teste *Kruskal-Wallis* (p<0,05). **Resultados:** As médias aritméticas encontradas foram de 22,44 µm (±7) para grupo controle, 26,86 µm (±10) para técnica direta com esplintagem e 24,70 µm (±13) para técnica direta sem esplintagem. **Conclusão:** Não foi identificado diferenças estatísticas significantes entre as técnicas experimentadas.

**Keywords:** Dental Impression Technique. Dental Implants. Implant-Supported Dental Prosthesis.

**ABSTRACT**

**Introduction:** Among the determinant factors for the implant-supported prosthesis longevity is the exact and comprehensive process of impression which results is the passive prosthesis fitting. **Objective:** To compare the accuracy of transfer coping impression techniques with or without splinting, after the isolation of the factors associated to the passive fitting. **Method:** Based on the control group composed by an edentulous mandibular master model (self-cured acrylic resin) with four external hexagon parallel implants splinting with a metallic bar, four customized open trays were constructed with self-cured acrylic. Ten impressions were made with condensation silicone (*Xantopren*®), poured with type IV plaster (*Durone* ®), and then divided into two groups: Group 1 (n=5) – non-splinting *multi unit* transfer copings; and Group 2 (n=5) – splinting *multi unit* transfer copings with a bar constructed with self-cured acrylic resin (*Palavit G* ®) and dental floss, with the aid of an addition silicon mold (*Elite Double* ® *Zhermack)*. Next, the bar was cut and splinted again. The ten transfer molds were measured at the center of the labial surface of each implant with the aid of Stereoscopic Magnifying Glass (*Physis*®) with x60 magnification. The results were tabulated and submitted to non-parametric statistics through *Kruskal-Wallis test* (p<0.05). **Results:** The means were: 22.44 µm (±7) for control group, 26.86 µm (±10) for direct splinting, and 24.70 µm (±13) for direct non-splinting technique. **Conclusion:** No statistically significant differences were found between the tested techniques.

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# INTRODUCTION

Currently, the indication of implant-supported prostheses is partial or total tooth loss because of the success of osseointegration.[1-2] This success relies on the comprehensive prosthetic planning to provide the correct distribution of masticatory forces on the prosthesis.[3-4] The periodontium supports the teeth, while dental implants are functionally ankylosed and in direct contact with bone resulting in lack of mobility and intolerance to movements.[5] The periodontal ligament supports little wrong tooth positions and can move up to 100 µm within the ligament space, thus compensating occlusal maladjustment, horizontal, vertical, and rotational masticatory forces, while an osseointegrated dental implant has extremely limited movements up to 10 µm.[6] Accordingly, the forces over a maladapted prosthesis spread over the superstructure, leading to mechanical and biological failures, as occlusal imbalance, prosthesis fracture, thread fractured, implant fracture, pain, plaque accumulation, marginal bone loss, loosening, and even loss of osseointegration.[1-5,7-10] Although a complete passive adjustment is practically impossible,[2] it is possible to avoid failure by observing the following clinical and laboratorial steps in detail: impression technique, impression tray type, characteristic of the impression material, plaster expansion, parallel or angulated implants, maxilla or mandible, implant connection, transfer coping type, implant and abutment alloy.[3,6,8,11-12] The impression must reproduce the anatomic details precisely and establish the transfer correctly.

Over the years, the literature has reported on the choice for the best impression materials and techniques to achieve the passive adaptation to assure the treatment success. Some studies reported the best impression material,[1-5,7-8,10,12-24] the best technique (direct open tray vs indirect close tray),[5-6,11,15-17,22-24] and the best tray.[2,4,6-7,9,11-12,14,18-22,25-27] However, the literature lacks consensus on the best transfer technique, with or without splitting of transfer copings,[1-21,23,26,28]. By analyzing a systematic review from 1990 to 2012, 30 studies observed the effect of the splinting, 13 (> 43%) found the best splinting technique, and other 13 (> 43%) reported no difference between techniques.[24] Some laboratorial studies concluded that the splinting technique with or without sectioning had small distortion than the non-splinting technique.[4,6,10,18,20,21] On the other hand, other *in vitro* studies point out that either splinting or non-splinting transfer coping techniques are statistically similar.[5,9,12,17,19,26] This study aimed to evaluate transfer coping impression technique with splinting comparing with transfer coping impression technique without splinting, by observing some possible interferences such as: the resin type used for splinting,[1-9,11,13,15,17-19,21,26,29,30] customization of the splinting bar,[14,17] and control of resin polymerization shrinkage.[2,4,6-8,14,17-21,23,27]

# MATERIALS AND METHODS

## • Master model

Adopting a control group, an edentulous mandibular master model was constructed with chemically-activated acrylic resin (Jet; Artigos Odontológicos Clássico Ltd, São Paulo, Brazil). Four 4x10 mm external hexagonal implants (INP; Sistema de Implantes Nacional e de Próteses Comércio Ltda, São Paulo, Brazil) associated with mult-unit chromium cobalt alloy abutments were placed parallelly on the anterior area.

On the top of the master model, four mult-unit caps (Rotacional C, INP – Sistemas de Implantes Nacional e de Próteses Comércio Ltda, São Paulo, Brazil) were splinted through 1-mm stainless steel orthodontic wire (*Remanium – Sisprodent* Produtos odontológicos), 0.45-mm metallic orthodontic ligatures (Morelli Ortodontia), and acrylic resin (*Dencor Lay*, Artigos Odontológicos Clássico, Ltd). Also, fixture rods were place bilaterally to support the impression tray (Figure 1).

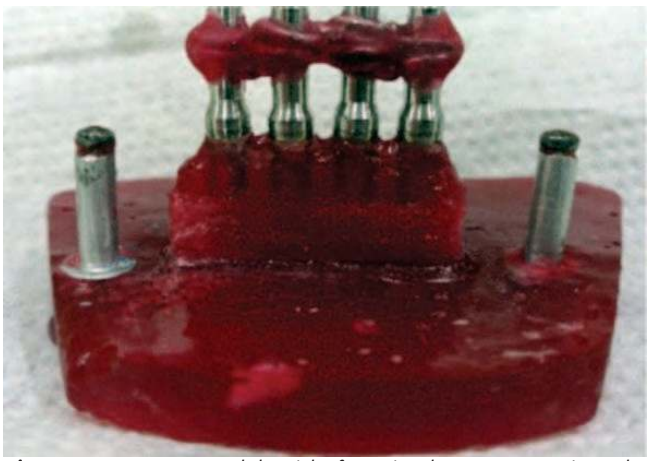

***Figure 1:*** *Master model with four implants supporting the superstructure.*

## • Customized trays

After the construction of the master model (control group – C), 5-mm thick condensation silicone (*Optosil® Heraeus Kulzer*) was poured on the implant to assure a uniform thickness of the impression material and a correct placement of the trays during the procedure. Next, two structures were obtained to support the construction of all trays with general dimensions (base, height, width, deepness, and contour) marked with pink wax (n. 7, Lysandra® - Produtos Odontológicos Ltd.). Following, the impression was performed with condensation silicone (*Xantopren®, Heraeus Kulzer*) with catalyzer (*Activator, Heraeus Kulzer*).

Ten 3-mm width open trays were constructed with chemically-activated resin (Jet; Artigos Odontológicos Clássico Ltd, São Paulo, Brazil). These were used to perform all impressions for the studied techniques.

**• Samples**

Group 1 – Transfer coping impression technique without splinting: the *multi-unit* transfer copings were inserted into the implants separately and the threads tightened manually.

Group 2 – Transfer coping impression technique with splinting: the four transfer copings were splinted through a standard bar. The components were relieved by wax (PK, Kota ind, SP, Brazil), involved by a n. 7 wax box. Addition silicone (*Elite Double ® Zhermack*) was poured onto this set. After five minutes, the wax relieving was removed, and the customized silicone mold was obtained. Dental floss (Oral B, Sp, Brazil) was used to splint the transfer copings and the acrylic resin (*Palavite G ® Heraeus*) was inserted and guided through nylon technique. After the resin setting, the bar was sectioned with the aid of flexible double-face diamond disc (Discoflex, KG Sorensen, São Paulo, Brazil) by half and laterally between the implants (Figure 2). Then, the bar was splinted again, laterally, with the same acrylic resin. Elapsed five minutes for setting, the bar was splinted in the middle (Figure 3).

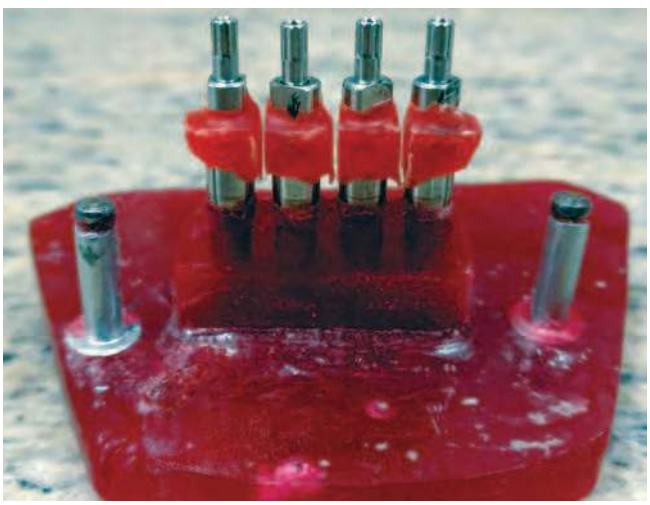

***Figure 2***: *Splinting bar cut between the implants*

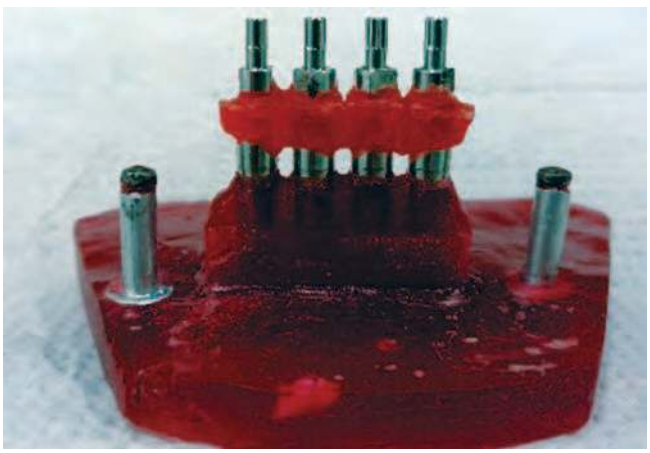

***Figure 3***: *Re-splinting of the acrylic resin bar.*

Two increments of resin were necessary to splint each 4 sections of the bars. Thus, we obtained five bars with same length, height, and width (27 mm x 4 mm x 6 mm). The operator was previously calibrated by executing 20 increments, attempting to standardize a 3-mm resin amount at every increment. All increments were visually analyzed with the aid of a digital caliper (Leetools, Sp, Brazil).

**• Impression technique**

All impression trays and the master mold received a layer of universal adhesive (*Zhermack®*, RO, Italy). Elapsed 15 minutes, the condensation silicone (*Xantopren®, Heraeus Kulzer*) with catalyzer (*Activator, Heraeus Kulzer*) was manually mixed according to the manufacturer's instructions on glass plate with the aid of flexible metal spatula. With the aid of a silicone syringe (Polidental, SP, Brazil), the impression material was inserted into the tray placed on the master mold. Elapsed the setting time recommended by the manufacturer, the open-tray threads (*Mult Unit* Digital, Sp, Brazil) were loosened and the impression released. Then, the transfer copings (*Mult Unit* Reto HE 4x4, SP, Brazil) were manually tightened in the proper positions on the impression.

**• Working casts**

Immediately after the impressions, type IV dental plaster (*Durone®*) was poured. After one-hour setting, the impressions were released. After the working cast cutting, all tested, and control casts received the master superstructure fixed by thread *Mix* (Mult Unit M 1.4x3.5) under 20 Ncm torque on each implant, calibrated with the aid of torque wrench (INP, SP, Brazil). This enabled the evaluation of the passive fitting.

**• Scanning procedure**

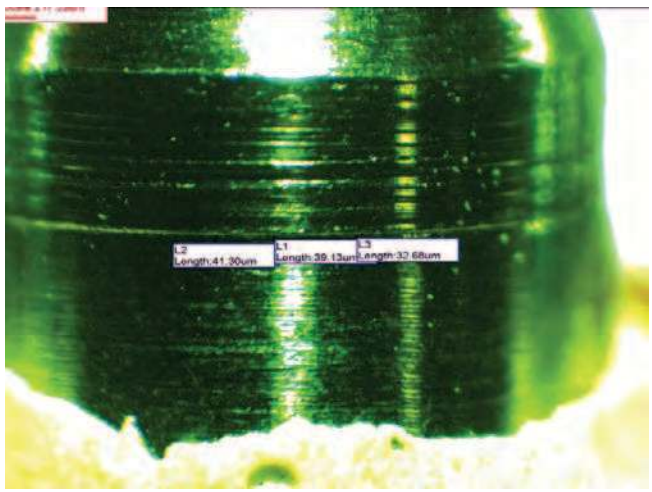

***Figure 4***: *Measurement of the distance between the implant and the superstructure for one sample.*

After receiving the superstructure, all models (including the master model) were placed on a Stereoscopic Magnifying Glass (*Physis*®) with x60 magnification to analyze the vertical dimensional between each implant and the master superstructure. This analysis started from a landmark on the center of the labial face of the implants. The image of all implant surfaces was scanned by a single operator who identified the beginning and ending of each gap between the implant and the superstructure. Each measurement was performed three times (Figure 4). The values were tabulated totalizing 20 samples for group 1, 20 samples for group 2, and four samples for control group.

**• Statistical analysis**

The statistical analysis was performed through BioEstat 5.0 software. Dixon test evaluated the normal distribution. Data failed the normal distribution and Kruskal-Wallis for independent samples with level of significance of 5% was used.

# RESULTS

Table 1 displays the mean and standard deviation of the vertical distances between the implant and superstructure in the master model (C), Transfer coping impression technique without splinting (G1), and Transfer coping impression technique with splinting (G2). No statistically significant differences (p=0.32598) occurred between groups (Kruskal-Wallis for independent samples).

***Table 1**: Mean and standard deviation (µm) of the vertical measurements between the implant and superstructure.*

| | |
|---|---|
| Control | 22.44±7.71µm |
| G1 | 26.89±10.22µm |
| G2 | 26.89±10.22µm |

# DISCUSSION

The impression of multiple implants by transfer coping is the first step to obtain the passive and accurate prosthesis over osseointegrated implants. The impression goal is to record and transfer the relationship of abutments and implants to the working cast. Thus, the impression has to be a faithful replica of the clinical data of the patient to be transferred to the laboratory, which accounts for the prosthesis construction. Therefore, the dentist should search for the best techniques to assure the exact implant and abutment sites.[3,9,12]

Searching for decreasing the errors in the impression of multiple implants, the literature reports new techniques, such as the direct splinting impression, whose main goal is to link the transfer copings so that no distortion occurs inside the impression.[3,9,16] Currently, different methods are used to splint the copings: acrylic resin with dental floss,[2,6-8,9,17-21] pre-manufactured resin bar,[1,3-4,25] plaster,[11] and composite resin.[2,8] The self-cured acrylic resin is the method of choice.[24] The most used self-cured acrylic resins have been *Pattern Resin* and *Duralay*.[4,7] Although the resin maintains the position of the transfer copings, the resin volume would result in polymerization shrinkage that would lead to distortion. The evaluation of the volumetric shrinkage of self- and light-cured resins showed 5.07% of shrinkage for resin Pattern and 5.72% for resin Duralay, 20 minutes after setting.[30] With that in mind, the literature[2,4,6-8,14,17,19-21,23,27] advise to cut the bar after setting and to splint it again with the same material to prevent shrinkage. Except for two studies,[8,19] the literature (> 83%) reports noteworthy results after the cutting of the splinting bar.

By understanding that the shrinkage value is proportional to the resin amount, this present study standardized the splinting bar thickness with the aid of a silicone mold, which agreed with two previous studies.[14,17] Also, we standardized the number of increments through the nylon technique on the three sectioned areas. Thus, we controlled the resin amount both in the splinting bar constructing and re-splinting.

Based on previous study, we used the self-cured acrylic resin *Palavit G* (*®Heraeus*) because of the volumetric shrinkage lower than (6.5%) that of the acrylic resin *Duralay* (7.9%), after 17 minutes of setting.[9] Some authors reported different setting times for the acrylic resin before and after the cutting of the splinting bar: 17 minutes,[4,7,17,21] 15 minutes,[14] 5 minutes,[23,27] and 4 minutes.[2,8,19] In this study, we waited five minutes for the acrylic resin setting because the ideal impression technique should have some characteristics as: patients' comfort, easiness, accurate impression, and minimum time period.[3]

The use of customized trays show better results than that of conventional trays because of the uniform thickness of the first, which assured a uniform thickness of the impression material.[6] The literature reports sixteen studies using customized trays[1-2,4,6-7,9,11-12,18-22,25,26] and seven using conventional trays.[1,3,5,8,11,13,21] Furthermore, nine studies compared the direct with the indirect technique, and almost unanimously they reported better results with the open tray technique,[6,11-12,15-17,24,27] except for one study that reported no statistically significant differences.[5] Based on this information, this present study used the open tray technique.

Eighteen studies evaluated the accuracy of the Transfer coping impression technique with splinting in angulated and parallel implants. Three studies compared and reported that the indirect technique was the most indicated.[11,21,27] The comparison between the transfer coping

impression technique with and without splinting showed best results for the technique with splinting,[3,4,6,13,16-17] except for eight studies (> 44%) that did not find statistically significant differences.[5,7,9,12,17,19,26] By comparing the systematic review of studies from 1990 to 2012, the evidences for the splinting impression technique were inconclusive because 13 studies reported better results, but other 13 (> 43%) did not find statistical differences.[24] The results of this present *in vitro* study agree with the literature.

Only three studies compared the accuracy of the transfer coping impression technique with and without splinting in angulated implants.[6,17,21] In angles higher than 15º, the splinting of the transfer copings reported the best results.[17,24] It is worth noting that this study used a mandible with parallel implants, which agrees with other studies.

This study design was standardized to avoid the factors associated to the impression of implants that may be related to the passive fitting of the definitive prosthesis. The null hypothesis of statistical differences was rejected because no statistically significant differences were found.

The transfer coping impression technique without splinting showed the smallest (10.94 µm) vertical and the greatest (57.24 µm) distance between the implant and the superstructure. The means were: 22.44 µm (±7) for control group (GC), 26.86 µm (±10) for transfer coping impression technique with splinting (G1), and 24.70 µm (±13) for transfer coping impression technique without splinting (G2). Although G2 had the sample with smallest distortion, it had a larger variation than G1 (191.60 µm / 56.04%; 104.62 µm / 38.04% respectively). However, despite of the more unstable results of non-splinting technique compared with more similar and regular results of the splinting technique, no statistically significant differences occurred between groups (p=0.3598 H= 2.0443, two degrees of freedom).

Considering that the perfectly passive fitting is barely reached, the literature reports an acceptable biological vertical distance between 91 and 150µm.[1,3,5,12,20] The studies evaluating the transfer coping impression technique with and without splinting showed vertical distance means ranging from 32 to 39 µm (control group), 25 to 99 µm (with splinting), and 39 to 205 µm (without splinting).[3,5-7,13,16,17,23] Based on the acceptable vertical distance and the comparison of the means (Table 2), the results of this present study was very satisfactory.

***Table 2:*** *Comparison of the vertical measurement means of this present study (A) with those of the scientific literature (B).* [3,5-7,13,16,17,23]

| | (A) | (B) |
|---|---|---|
| Control | 22.44µm | 32 to 39µm |
| G1 | 26.89µm | 25 to 99µm |
| G2 | 24.70µm | 39 to 205µm |

It can be concluded that no statistically significant differences occurred between the transfer coping techniques with and without splinting for multiple parallel implants. Both techniques had clinically acceptable vertical distances. Both techniques can be used in clinical daily practice, if carefully managed.

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# REFERENCES

1. Gupta S, Narayan AI, Balakrishnan D. In vitro comparative evaluation of different types of Impression trays and impression materials on the accuracy of open tray implant impressions: A pilot study. Int J Dent. 2017 Feb; 2017:8pages.
2. Selvaraj S, Dorairaj J, Mohan J, Simon P. Comparison of implant cast accuracy of multiple implant impression technique with different splinting materials: An in vitro study. J Indian Prosthodont Soc. 2016 Apr-Jun; 16(2):167-75.
3. Avila ED, Moraes FM, Castanharo SM, DelAlcqua MA, Mollo FAJ. Effect of splinting in accuracy of two implant impression techniques. J Oral Implantol. 2014 Dec; 40(6):633-9.
4. Ghanem RA, Nassani MZ, Baroudi K, Fattah A. Dimensional accuracy of different techniques used for complete-arch multi-implant impressions. J Investig Clin Dent. 2016 Aug; 7(3):225-31.
5.Pera F, Pesce P, Bevilacqua M, Setti P, Menini M. Analysis of different impression techniques and materials on multiple implants through 3-dimensional laser scanner. Implant Dent. 2016 Apr; 25(2):232-7.
6.Shankar QR, Sahoo S, Krishna MH, Kumar OS, Kumar TS, Narula S. Accuracy of implant impressions using various impression techniques and impression materials. J Of Dental Implants. 2016; 6:29-36.
7.Beyabanaki E, Shamshiri AR, Alikhasi M, Monzavi A. Effect of splinting on dimensional accuracy of impressions made of implants with different subgingival alignments. J Prosthodont. 2017 Jan; 26(1):48-55.
8.Di Fiori A, Meneghello R, Savio G, Sivolella S, Katsoulis J, Stellini E. in vitro implant impression accuracy using a new photopolymerizing SDR splinting material. Clin Implant Dent Relat Res. 2015 Oct; 17(2):721-9.
9.Perez-Davidi M, Levit M, Walter O, Eilat Y, Rosenfeld P. Clinical accuracy outcomes of splinted and nonsplinted implant impression methods in dental residency settings. Quintessence Internacional, 2016; 47(10):843-852.
10.Pujari M, Garg P, Prithviraj DR. Evaluation of accuraccy of casts of multiple internal connection implant prosthesis obtained from different impresion materials and techniques: An in vitro study. J Oral Implantol. 2014 Apr; 40(2):137-45.
11.Patil R, Kadam P, Oswal C, Paril S, Jajoo S, Gachake A. A comparative analysis of the accuracy of implant master casts fabricated from two different transfer impression techniques. J Int Soc Prev Community Dent. 2016 Mar-Apr; 6(2):142-8.

12.Papaspyridakos P, Hirayama H, Chen C, Ho C, Chronopoulos V, Weber H. Full-arch implant xed prostheses: a comparative study on the effect of connection type and impression technique on accuracy of t. Clin Oral Implants Res. 2016 Sep; 27(9):1099-105.
13.Avila ED, Barros LAB, Del Acqua MA, Castanharo SM, Mollo FAJ. Comparison of the accuracy for three dental impression techniques and index: an in vitro study. J Prosthodont Res. 2013 Oct; 57(4):268-74.
14.Buzayan M, Baig MR; Yunus N. Evaluation of accuracy of complete-arch multiple-unit abutment-level dental implant impressions using different impression and splinting materials. Int J Oral Maxillofac Implants. 2013 Nov-Dec; 28(6):1512-20.
15.Fernandez MA, Mendoza CYP, Platt JÁ, Levon JA, Hovijitra ST, Nimmo A. A comparative study of the accuracy between plastic and metal impression transfer copings for implant restorations. J Prosthodont. 2013 Jul; 22(5):367-76.
16.Stimmelmayar M, Beuer F, Edelhoff D, Guth JG. Implant impression techniques for the edentulous jaw: A summary of three studies. J Prosthodont. 2016 Feb; 25(2):146-50.
17.Tsagkalidis G, Tortopidis D, Mpikos P, Kaisarlis G, Koidis P. Accuracy of 3 different impression techniques for internal connection angulated implants. J Prosthet Dent. 2015 Oct; 114(4):517-23.
18. Faria JCB, Concílio LRS, Neves AC, Miranda E, Teixeira ML. Evaluation of the accuracy of different transfer impression techniques for multiple implants. Braz Oral Res. 2011 Mar-Apr; 25(2):163-7.
19.Faria JCB, Cruz FL, Concílio LRS, Neves AC. Influence of diferente materials and techniques to transfer molding in multiple implants. Acta Odontol latinoam. 2012; 25(1):96-102
20.Al Quran F, Rashdan AB, Abu Zomar AA, Wainer S. Passive fit and accuracy of three dental implant impression techniques. Quintessence International. 2012 Feb; 43(2):119-125.
21.Kurtulmus-yilmaz S, Ozan O, Ozcelik TB, Yagiz A. Digital evaluation of the accuracy of impression techniques and materials in angulated implants. J Dent. 2014 Dec; 42(12):1551-9.
22.Siadat H. Alikhasi M, Beyabanaki E, Rahimian S. Comparison of different impression techniques when using the aII-on-four implant treatment protocol. Int J Prosthodont. 2016 May-Jun; 29(3):265-70.
23.Stimmelmayar M, Erdelt K, Happe A, Sschlee M, Beuer F. Evaluating the discrepancy of two different impression techniques of four implants in an edentulous jaw. In vitro study. Clin Oral Investig. 2013 Nov; 17(8):1929-35.
24.Baig M. Accuracy of impressions of mutiple implants in the edentulous arch: A systematic r eview. Int J Oral Maxillofac Implants. 2014 Jul-Aug;29(4):869-80.
25.Revilla-Leon M, Sánches-Rubio JL, Oteo-Calatayud J, Ozcan M. Impression technique for a complete-arch prothesis with multiple implants using additive manufacturing Technologies. J Prosthet Dent. 2017 Jun; 117(6):714-720.
26.Sabouhi M, Bajoghli F, Abolhasani M. Evaluation of the three-dimensional accuracy of implant impression techniques in two simulated clinical conditions by opticals. Int J Oral Maxillofac Implants. 2015 Jan-Feb; 30(1):26-34.
27.Stimmelmayar M, Guth JF, Erdelt K, Happe A, Schlee M, Beuer F. Clinical study evaluating the discrepancy of two different impression techniques of four implants in an edentulous jaw. Clin Oral Investig. 2013 Nov; 17(8):1929-35.
28.Moreira AH, Rodrigues NF, Pinho AC, Fonseca JC, Vilaça JL. Accuracy comparison of implant impression techniques: A systematic review. Clin Implant Dent Relat Res. 2015 Oct; 17(2):751-64.
29.Mojon P, Oberholzer JP, Meyer JM, Belser UC. Polymerization shrinkage of index and pattern acrylic resins. J Prosthet Dent. 1990 Dec; 64(6):684-8.
30.Gibbs SB, Versluis AV, Tantbirojn D, Ahuja S. Comparison of polymerization shrinkage of pattern resins. College of Dentistry, J Prosthet Dent. 2014 Aug; 112(2):293-8.

# CRANIOFACIAL TRAUMA IN OLDER ADULTS VICTIMS OF ROAD TRAFFIC ACCIDENTS: A CROSS-SECTIONAL STUDY

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**Palavras-chave:** Idoso. Acidentes de Trânsito. Traumatismos Maxilofaciais.

**RESUMO**

**Objetivo:** Caracterizar e avaliar a ocorrência de trauma craniofacial causado por acidentes de transporte em idosos atendidos em um centro de referência. **Métodos:** Estudo transversal e retrospectivo, sendo a amostra composta por 117 prontuários médicos de indivíduos com idade igual ou superior a 60 anos hospitalizados por acidentes de transporte. Foram coletados dados referentes ao sexo, faixa etária, dia da semana e horário, tipo de acidente de transporte, lesão em tecido mole, existência de lesões múltiplas, lesão na cabeça e face, ocorrência de fratura e tipo de osso acometido, ocorrência de traumatismo crânio-encefálico e óbito durante os meses de janeiro a dezembro de 2011. Os dados foram analisados por meio da estatística descritiva e inferencial (teste Qui-quadrado), sendo adotado um nível de significância de 5%. **Resultados:** As vítimas eram homens (74,4%), entre 60 a 69 anos (61,5%). A maioria dos acidentes ocorreram durante dias úteis (68,4%), a noite (38,5%) e envolviam pedestres (45,3%). Verificou-se associação estatisticamente significante entre o gênero e o tipo de acidente de transporte (p=0,004). Lesões em tecidos moles acometeram 76,9% das vítimas e 39,3% apresentavam lesões múltiplas. A ocorrência de injúrias na cabeça e na face foi de 17,9% para cada região. As fraturas no crânio acometeram 6% das vítimas, enquanto as fraturas na maxila representaram 4,3% dos casos. A ocorrência de óbito foi de 9,4%. A análise bivariada mostrou associação estatisticamente significante entre a presença de trauma na face e a ocorrrência de traumatismo crânio-encefálico (p=0,034). **Conclusão:** Os acidentes de transporte acometem pedestres do sexo masculino, na faixa etária de 60 a 69 anos, no período noturno e acarretam lesões múltiplas. As vítimas apresentam injúrias nas regiões da cabeça e da face, com elevada ocorrência de fratura óssea. Verificou-se associação estatisticamente significante entre a presença de trauma na face e a ocorrrência de traumatismo cranioencefálico.

**Keywords:** Aged. Accidents. Traffic. Maxillofacial Injuries.

**ABSTRACT**

**Aim:** To characterize and evaluate the occurrence of craniofacial trauma caused by road traffic accidents in older adults attended at a reference center. **Methods:** This is a cross-sectional and retrospective study comprising 117 medical records of individuals aged 60 years or more hospitalized due to road traffic accidents. Data regarding gender, age group, day of week and time of occurrence, type of road traffic accident, soft tissue injury, multiple lesions, head and face injury, occurrence of fracture and type of bone involved, occurrence of cranial-encephalic trauma and death were collected during the period January-December 2011. Data were analyzed through descriptive and inferential statistics (Chi-square test), with a significance level set at 5%. **Results:** Victims were mostly males (74.4%), aged 60-69 years (61.5%). The majority of accidents occurred during weekdays (68.4%), at night (38.5%) and involved pedestrians (45.3%). There was a statistically significant association between gender and road traffic accident (p = 0.004). Soft tissue lesions accounted for 76.9% of victims and 39.3% had multiple lesions. The incidence of head and face injuries was 17.9% for each region. Fractures in the skull affected 6% of victims, while fractures in the maxilla represented 4.3% of cases. The occurrence of death was 9.4%. The bivariate analysis showed a statistically significant association between presence of trauma in the face and the occurrence of cranial-encephalic trauma (p = 0.034). **Conclusion:** Road traffic accidents affect male pedestrians in the age range of 60-69 years, at night and cause multiple lesions. Victims present injuries in the regions of head and face, with high occurrence of bone fracture. Statistically significant association was observed between presence of trauma in the face and occurrence of traumatic brain injury.

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## INTRODUCTION

According to the Statute of the Elderly, a person is considered elderly when he / she is 60 years or older.[1] Between 2005 and 2015, this population group increased by about 45% compared to the previous period in total of the Brazilian population[2], revealing an increase in the life expectancy in this population group, resulting from greater number of basic care services in the country, as well as the improvement in the quality of these services.[3]

It is well known that several natural functions such as motor, cognitive and sensory decline with time in this population[4], causing hospital admissions due to external causes, such as falls and road traffic accidents[5], since they are associated with greater vulnerability due to advanced age.[6]

Among external causes responsible for hospital admissions of older adults, road traffic accidents stand out and are characterized by involving pedestrians, motorcyclists, drivers and passengers in vehicles.[7] Responsible for about 1.24 million deaths worldwide each year[6], road traffic accidents are among the main causes of death in the young and adult population, contributing even to increase the mortality rates of the elderly population.[8]

In Brazil, the elderly population is not usually a priority in the approach related to accidents with external causes due to the predominance of young people involved in higher number of accidents.[9] However, road traffic accidents can lead older adults to death even by injuries considered mild, due to their lower capacity for recovery, characteristic of advanced age caused by preexisting diseases.[10] In addition, being the fifth cause of death in the elderly population, aging directly influences mortality and morbidity rates of trauma in the country,[9] being about 25% higher in this age group compared to the age group of 20-59 years.[5]

Road traffic accidents represent an important public health problem, which has a major impact on the profile of illness and death in the population.[11] Thus, knowing the profile of older adults hospitalized due to road traffic accidents and the characteristics of these accidents is a way of making possible the adoption of preventive and assistance strategies by managers directed to this population.

In addition, it is a way of making possible the recovery of accident victims and the reduction of deaths due to road traffic accidents. Therefore, the present study aims to characterize and evaluate the occurrence of craniofacial trauma caused by road traffic accidents in older adults attended at a reference center.

## MATERIALS AND METHODS

This cross-sectional and retrospective study was carried out based on medical records of individuals aged 60 years or more hospitalized for external causes at the "Senador Humberto Lucena" Emergency and Trauma Hospital, a public reference institution for the emergency care of trauma victims, located in the city of João Pessoa, Paraíba. The sample consisted of 117 medical records of patients aged 60 years and older hospitalized due to road traffic accidents from January to December 2011.

The collection instrument consisted of a form developed from the information contained in medical records, in which demographic data (gender and age group) and those related to the accident (day of week, time of occurrence [moorning, afternoon, evening and night] and type of road traffic accident [pedestrian, cyclist, motorcyclist and vehicle occupant]), injuries (lesion in soft tissue [yes/no], presence of multiple lesions [yes/no], presence of head and face injury [yes/no], occurrence of bone fracture [yes/no] and type of bone involved, presence of cranial-encephalic trauma (CET) [yes/no] and death [yes/no] were recorded. Multiple lesions were defined as lesions that affected more than one region of the body. Two duly trained researchers performed data collection in the Medical and Statistical Archive Sector (SAME) of the aforementioned hospital.

In the data analysis, descriptive and inferential statistics techniques were used. Statistical techniques involved obtaining absolute and percentage distributions. Bivariate analyzes were performed between gender and the type of accident, between the presence of multiple lesions and cranial-encephalic trauma and between facial trauma and cranial-encephalic trauma. For the bivariate analyses, the chi-square test was used, with significance level of 5%. Data were analyzed through the Statistical Package for the Social Sciences software, version 18.0.

This study followed all the ethical guidelines recommended by the international scientific community and by the Brazilian legislation. The ethics committee of human research from the State University of Paraiba has previously approved the study (CAAE nº 05480133000-11).

## RESULTS

During the evaluation period, 426 hospital admissions were registered in patients aged 60 and over, of whom 117 (27.5%) were hospitalized due to road traffic accidents. There was a predominance of male individuals (74.4%) aged 60-69 years (61.5%). Male to female ratio in road traffic accident was 2.9:1; a higher ratio was seen in motorcycle (8.7:1) and bike (5:0) accidents and a lower ratio in vehicle occupant (1:1). A percentage of 68.4% of accidents occurred during the week, 38.5% during the night and 45.3% involving pedestrians (Table 1). The bivariate analysis revealed

statistically significant association between gender and type of road traffic accident (p = 0.004).

The presence of soft tissue lesions was identified in 76.9% of victims and 39.3% had multiple lesions. The incidence of head and face injuries was 17.9% for each region (Table 2).

The occurrence of bone fractures was verified in 67.5% of victims. Fractures in the skull affected 6% of victims, while fractures in the maxilla represented 4.3%. CET affected 24.8% of victims and the occurrence of death was 9.4% (Table 3).

The presence of fracture was associated with the occurrence of multiple lesions (p = 0.005) and the presence of cranial-encephalic trauma (p = 0.036). The bivariate analysis also revealed a statistically significant difference between presence of trauma in the face and the occurrence of CET (p = 0.034).

***Table 1***: *Distribution of victims according to demographic variables and related to road traffic accidents*

| Variables | N | % |
|---|---|---|
| **Gender** | | |
| Male | 87 | 74.4 |
| Female | 30 | 25.6 |
| **Age (Years)** | | |
| 60-69 | 72 | 61.5 |
| 70-79 | 27 | 23.1 |
| > 80 | 18 | 15.4 |
| **Weekend** | | |
| Yes | 37 | 31.6 |
| No | 80 | 68.4 |
| **Time of Occurrence** | | |
| Moorning | 32 | 27.4 |
| Afternoon | 35 | 29.9 |
| Evening | 45 | 38.5 |
| Night | 5 | 4.3 |
| **Type of Road Traffic Accident** | | |
| Pedestrian | 53 | 45.3 |
| Cyclist | 5 | 4.3 |
| Motorcyclist | 39 | 33.3 |
| Vehicle occupant | 20 | 17.1 |

***Table 2***: *Distribution of victims according to the type of injury and the region involved.*

| Variables | N | % |
|---|---|---|
| **Soft Tissue Injuries** | | |
| Yes | 90 | 76.9 |
| No | 27 | 23,1 |
| **Multiple Injury** | | |
| Yes | 46 | 39.3 |
| No | 71 | 60.7 |
| **Head Injury** | | |
| Yes | 21 | 17.9 |
| No | 96 | 82.1 |
| **Face Injury** | | |
| Yes | 21 | 17.9 |
| No | 96 | 82.1 |

***Table 3***: *Distribution of victims according to the presence of bone fracture, regions affected, occurrence of CET and death.*

| Variables | N | % |
|---|---|---|
| **Bone Fracture** | | |
| Yes | 79 | 67.5 |
| No | 38 | 32.5 |
| **Skull Fracture** | | |
| Yes | 7 | 6.0 |
| No | 110 | 94.0 |
| **Maxila Fracture** | | |
| Yes | 5 | 4.3 |
| No | 112 | 95.7 |
| **Mandible Fracture** | | |
| Yes | 1 | 0.9 |
| No | 116 | 99.1 |
| **Occurrence of Cranial-Encephalic Trauma** | | |
| Yes | 29 | 24.8 |
| No | 88 | 75.2 |
| **Death** | | |
| Yes | 11 | 9.4 |
| No | 106 | 90.6 |

# DISCUSSION

Road traffic accidents have a number of consequences, such as individual and family suffering and increased social and economic costs, and are related to high mortality rates [13]. Regarding the distribution according to gender, male individuals were the most affected by road traffic accidents, confirming previous findings.[6,14] This high prevalence of cases may be related to the fact that men are more exposed to traffic, assuming greater risks that compromise well-being.[15]

In the present study, individuals at the age group of 60-69 years were the most involved in road traffic accidents, similar to another study.[16] This population segment newly admitted in the "elderly" category is more susceptible to risks of accidents due to the characteristics of an adult population, such as autonomy and independence. [8]This fact may also explain the progressive reduction in the frequency of involvement in road traffic accidents with advancing age, since old adults are often accompanied by caregivers, thus receiving more attention.[17]

Weekdays recorded the highest number of cases, differing from the findings described by Cavalcanti et al.,[18] in which most accidents occurred on weekends. The divergence of results can be justified by the fact that the study by Cavalcanti et al.[18] was carried out with young individuals, who relate the use of alcohol in their leisure moments, which occur predominantly on weekends,[19] a condition that is not frequently observed in older adults, since 95% of road traffic accidents in this population occur without the effect of alcohol.[20]

Most road traffic accidents occurred at night, similar to other studies.[7,21] The low visibility typical of the nocturnal period probably explains the higher frequency of accidents during this day shift.

Observing the type of road traffic accident, the majority involved pedestrians (45.3%), as reported by Papa et al.,[13] in which about 35% of road traffic accidents registered in Maringá / PR during 5 years involved pedestrians. The fact that older people take longer time to cross highways makes them more susceptible to traffic[22] and, consequently, to the risk of accidents, which possibly justifies the result found. In addition, the frequent need of pedestrians to divide their circulation spaces with cars, as a result of the presence of obstacles or poor conservation of sidewalks increases the risk of this group to road traffic accidents.[21]

The presence of soft tissue lesions affected most victims, as observed by Miguens Jr et al.,[23] These data may be related to the fact that soft tissues, such as skin, lose elasticity and distension over time,[24] thus suffering greater damage when exposed to trauma.

More than one third of victims had multiple lesions, corroborating previous findings.[25] This fact may be related to the greater bone fragility of this population, even when subjected to low magnitude traumas, and less tolerance to lesions, leading to greater number of injuries.[25] It has been reported that it is not uncommon for older adults to suffer multiple lesions when they are involved in accidents, since as described by Pinto et al.,[21]lesions in this population cause greater consequences than in young people.

Lesions in the head and face regions were present in 17.9% of victims, confirming previous findings.[26] Lesions in these regions deserve special attention because they can have

negative consequences for victims in the physical, emotional and functional aspects,[27] and are considered a serious public health problem in developed and developing countries.[28]

In most road traffic accidents, the presence of bone fractures was verified, including bones of the skull and maxilla, corroborating findings obtained in India.[29] These injuries may be related to osteoporosis, common in the elderly, since this disease is a risk factor for fractures.

Cranial-encephalic trauma was present in one quarter of victims, a result similar to that described by Broska Júnior et al..[30] It could be considered that older adults have lower recovery capacity, require longer hospitalization stay and have higher mortality rate when compared to younger victims.[9]

People over 60 years of age have a double chance of dying from road traffic accidents when compared to individuals less than 60 years of age due to the age-related physiological processes.[6] In this study, 9.4% of road traffic accidents were fatal; therefore, knowing that older people are more susceptible to deaths that could be easily tolerated by younger victims,[9] the need for care in preventing this type of accident is reinforced.

The results should be interpreted with caution, considering the retrospective and cross-sectional nature of the study, the fact data come from a single reference center and incomplete or missing data, which may be considered limitations of the study.

Therefore, the characteristics of hospital admissions due to road accidents allows to infer that public health measures should be adopted to the elderly because they represent a specific population that is commonly affected by transitory and permanent dysfunctions after involved in traffic accidents,[20] It is important to ensure preventive actions to reduce the prevalence of traffic accidents among this age group; this includes applying resources to maintain road safety and adequate structure.[6] Some measures to achieve this are using speed reducers6, warning signs, road stabilizers[26] and improving lighting and road structure. In addition, there is a shortage of studies in literature on road traffic accidents involving this population, and it is important to develop new studies related to this subject, as a way of providing greater knowledge of related risk factors.

## CONCLUSION

Thus, road traffic accidents affect male pedestrians in the age range of 60-69 years, at night and cause multiple lesions. Victims present injuries in the regions of head and face, with high occurrence of bone fracture. There was a statistically significant association between presence of trauma on the face and occurrence of traumatic brain injury.

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## REFERENCES

1. BRASIL. Ministério da Saúde. Estatuto do Idoso. Brasília, 2009.
2. BRASIL. Instituto Brasileiro de Geografia e Estatística – IBGE. Síntese de Indicadores Sociais: uma análise das condições de vida da população brasileira, 2016. Rio de Janeiro, 2016.
3. Miranda GMD, Mendes ACG, Silva ALA. Population aging in Brazil: current and future social challenges and consequences. Rev Bras Geriatr Gerontol. 2016 mai/jun;19(3):507-19. doi: 10.1590/1809-98232016019.150140.
4. Ando T, Sakai H, Uchiyama Y. Association of physical activity and appetite with visual function related to driving competence in older adults. BMC Geriatrics. 2017 abr;17(96):1-8. doi: 10.1186/s12877-017-0484-6.
5. Luz TCB, Malta DC, Sá NNB, Silva MMA, Lima-Costa MF. Violências e acidentes entre adultos mais velhos em comparação aos mais jovens: evidências do Sistema de Vigilância de Violências e Acidentes (VIVA), Brasil. Cad Saúde Pública. 2011 nov; 27(11):2135-42. doi: 10.1590/S0102-311X2011001100007.
6. Cardona AMS, Arango DC, Fernández DYB, Martínez AA. Mortality in traffic acidentes with older adults in Colombia. Rev Saúde Pública. 2017 mar;51(21):1-7. doi: 10.1590/S1518-8787.2017051006405.
7. D'avila S, Campos AC, Cavalcante GMS, Silva CJP, Nóbrega LM, Ferreira EF. Characterization of victims of aggression and transportation accidents treated at the Forensic Medicine and Dentistry Institute – Campina Grande, Paraíba, Brazil – 2010. Ciênc Saúde Colet. 2015 mar;20(3):887-94. doi: 10.1590/1413-81232015203.12922014.
8. Grden CRB, Sousa JAV, Lenardt MH, Pesck RM, Seima MD, Borges PKO. Caracterização de idosos vítimas de acidentes por causas externas. Cogitare Enferm. 2014 jul/set;19(3):506-13. doi: 10.5380/ce.v19i3.37972.
9. Lima RS, Campos MLP. Perfil do idoso vítima de trauma atendido em uma Unidade de Urgência e Emergência. Rev Esc Enferm USP. 2011 jun;45(3):659-64. doi: 10.1590/S0080-62342011000300016.
10. Scolari GAS, Derhun FM, Rossoni DF, Mathias TAF, Fernandes CAM, Carreira L. Trendy in mortality of elderly by land transport accidents in Brazil. Cogitare Enferm. 2017 jul;22(3):1-9. doi: 10.5380/ce.v22i3.50170.
11. Souto CC, Reis FKW, Bertolini RPT, Lins RSMA, Souza SLB. Profile of work-related road traffic accident victims recorded by sentinel health units in Pernambuco, Brazil, 2012-2014. Epidemiol Serv Saúde. 2016 abr/jun;25(2):351-61. doi: 10.5123/S1679-49742016000200014.
12. BRASIL. Conselho Nacional de Saúde. Resolução 466/12. 2012. Disponível em: <http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf>. Acesso em 25 de maio de 2018.
13. Papa MAF, Wisnieswski D, Inoue KC, Molena-Fernandes CA, Évora YDM, Matsuda LM. Mortality from land transport accidents: a comparative analysis. Cogitare Enferm. 2014 jan/mar;19(1):49-56. doi: 10.5380/ce.v19i1.35934.
14. Andrade SSCA, Jorge MHPM. Estimate of physical sequelae in victims of road traffic accidents hospitalized in the Public Health System. Rev Bras Epidemiol. 2016 jan/mar;19(1):100-11. doi: 10.1590/1980-5497201600010009.
15. Cabral APS, Souza WV, Lima MLC. Mobile Emergency Care Service:

A survey of local land transportation accidents. Rev Bras Epidemiol. 2011 mar;14(1):3-14. doi: 10.1590/S1415-790X2011000100001.
16. Freitas MG, Bonolo PF, Moraes EM, Machado CJ. Elderly patients attended in emergency health services in Brazil: a study for victims of falls and traffic accidents. Ciênc Saúde Colet. 2015 mar;20(3):701-12. doi: 10.1590/1413-81232015203.19582014.
17. Gonçalves LTH, Leite MT, Hildebrandt LM, Bisogno SC, Biasuz S, Falcade BL. Living together and family care at the fourth age: quality of life for seniors and their caregivers. Rev Bras Geriatr Gerontol. 2013 16(1):315-25. doi: 10.1590/S1809-98232013000200011.
18. Cavalcanti AFC, Lucena BM, Oliveira TBS, Cavalcanti CL, D'avila S, Cavalcanti AL. Head and Face Injuries in Automobile Accidents and Associated Factors in a city in Northeastern Brazil. Pesq Bras Odontoped Clin Integr. 2017 jul/agos;17(1):1-9. doi: 10.4034/PBOCI.2017.171.30.
19. Abreu AMM, Lima JMB, Matos LN, Pillon SC. Uso de álcool em vítimas de acidentes de trânsito: estudo do nível de alcoolemia. Rev. Latino-Am. Enfermagem. 2010 mai/jun; 18(espec):513-20. doi: 10.1590/S0104-11692010000700005.
20. Santos AMR, Rodrigues RAP, Diniz MA. Trauma por acidente de trânsito no idoso: fatores de risco e consequências. Texto & Contexto Enferm. 2017 jun;26(2):1-10. doi: 10.1590/0104-07072017004220015.
21. Pinto LW, Ribeiro AP, Bahia CA, Freitas MG. Urgent and emergency care for pedestrians injured in Brazilian traffic. Ciênc Saúde Colet. 2016 dez;21(12):3673-82. doi: 10.1590/1413-812320152112.17722016.
22. Nagata T, ABE T, Takamori A, Kimura Y, Hagihara A. Factors associated with the occurrence of injuries requiring hospital transfer among older and working-age pedestrians in Kurume, Japan. BMC Public Health. 2017 jun;17(1):1-9. doi: 10.1186/s12889-017-4456-8.
23. Miguens-Jr SAQ, Borges TS, Dietrich LAB, Oliveira MC, Hernandez PAG, Kramer PF. A Retrospective Study of Oral and Maxillofacial Injuries in an Emergency Hospital in Southern Brazil. Pesq Bras Odontoped Clin Integr. 2016 set;16(1):339-50. doi: 10.4034/PBOCI.2016.161.36.
24. Vieira CL, Araújo DCC, Ribeiro MLS, Laureano-Filho, JR. Soft tissue injury in victims of bucco-maxillo-facial trauma. Rev Cir Traumatol Buco-Maxilo-fac. 2013 jan/mar;13(1):89-96. doi: lil-792150.
25. Yu W, Chen H, Yipeng LV. Comparison of influencing factors on outcomes of single and multiple road traffic injuries: A regional study in Shanghai, China (2011-2014). PLos One. 2017 mai;12(5):1-17. doi: 10.1371/journal.pone.0176907.
26. Brand S, Otte D, Mueller CW, Petri M, Haas P, Stuebig T, et. al. Injury patterns of seniors in traffic accidents: a technical and medical analysis. World J Orthop. 2012 set;3(9):151-55. doi: 10.5312/wjo.v3.i9.151.
27. Sousa RIM, Bernardino IM, Castro RD, Cavalcanti AL, Bento PM, D'ávila S. Maxillofacial Trauma Resulting from Physical Violence against Older Adults: A 4-year Study in a Brazilian Forensic Service. Pesq Bras Odontoped Clin Integr. 2016 agos/set;16(1):313-22. doi: 10.4034/PBOCI.2016.161.33.
28. D'avila S, Barbosa KGN, Bernardino IM, Nóbrega LM, Bento PM, Ferreira EF. Facial trauma among victims of terrestrial transport accidents. Braz J Otorhinolaryngol. 2016 mai/jun;82(3):314-20. doi: 10.1016/j.bjorl.2015.10.004.
29. Singh R, Singh HK, Gupta SC, Kumar Y. Pattern, Severity and Circumtances of Injuries Sustained in Road Traffic Accidents: A Tertiary Care Hospital-Based Study. Indian J Community Med 2014 jan/mar;39(1):30-4. doi: 10.4103/0970-0218.126353.
30. Broska Júnior CA, Folchini AB, Ruediger RR. Comparative study of trauma in the elderly and non-elderly patients in a University Hospital in Curitiba. Rev Col Bras Cir. 2013 40(4):281-86. doi: 10.1590/S0100-69912013000400005.

# DENTAL CARIES IN ADOLESCENTS AND ITS ASSOCIATION WITH THEIR USE OF DENTAL SERVICES

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**Palavras-chave:** Adolescente. Cárie Dentária. Índice CPOD. Assistência Odontológica. Serviços de Saúde Bucal.

**RESUMO**

**Objetivo:** Avaliar a associação entre cárie dentária em adolescentes e a utilização de serviços odontológicos no Brasil. **Métodos:** Estudo transversal, baseado em dados secundários relativos às duas últimas Pesquisas Nacionais de Saúde Bucal (2003 – 2010), considerando a prevalência estimada de cárie dentária e higidez dental em adolescentes (15 a 19 anos) e a assistência odontológica. **Resultados:** Para o Brasil, o índice de cuidados odontológicos (ICO) registra um aumento, na média, de 41,2 (2003) para 50,8 (2010); o índice de mutilação dental (IMD), uma diminuição, na média, de 11,7 (2003) para 7,4 (2010); quanto à média de dentes permanentes hígidos, um aumento de 4,9% para o período analisado. Em 2010, a região Centro-Oeste do Brasil é a única que sofre redução, em relação ao índice de cuidados odontológicos. **Conclusão:** Há melhorias, ao menos quantitativamente, quando se analisa a questão do cuidado odontológico por meio do componente restaurado, e qualitativamente na redução do componente perdido, na saúde bucal de adolescentes brasileiros.

**Keywords:** Adolescent. Dental Caries. DMFT Index. Dental Care. Oral Health Services.

**ABSTRACT**

**Objective:** To assess the association between dental caries in adolescents and the use of dental care services in Brazil. **Method:** Cross-sectional study based on secondary data obtained in the last two National Oral Health Surveys (2003 - 2010), considering the estimated prevalence of dental caries and dental hygiene in adolescents aged 15 to 19 years and dental care services. **Results:** In Brazil, the dental care index (DCI) has increased on average from 41.2 (2003) to 50.8 (2010). The dental mutilation index (DMI) has decreased on average from 11.7 (2003) to 7.4 (2010). The healthy permanent teeth index (HPTI) showed an increase of 4.9% in the above period. In 2010, the Central West was the only region in the country to show a decrease in the dental care index (DCI). **Conclusion:** There have been quantitative improvements in regard to dental restoration (dental care), and qualitative improvements in what concerns to tooth loss in the oral health of Brazilian adolescents.

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## INTRODUCTION

Adolescence is a period between childhood and adulthood, characterized by complex changes in the biopsychosocial process. The World Health Organization (WHO) understands adolescence from 10 to 19 years and considers that youth extends from 15 to 24 years. These concepts allow different understandings, identifying young adolescents (15 to 19 years) and young adults (20 to 24 years). In Brazil, according to the WHO, basic oral health surveys work with the concept of young adolescents between the ages of 15 and 19 years.[1]

The Brazilian National Oral Health Survey 2010, which is the latest population-based survey coordinated by the Ministry of

Health, reveals that 13.6% of the adolescents in the study had never been to the dentist, and that at 12 years of age, 34.8% of the patients had already shown some sort of oral problem or discomfort. Among these problems, the most cited are difficulty-eating, discomfort when brushing teeth, irritation or nervousness due to one's oral condition, and embarrassment to smile. The situation was similar for people aged between 15 and 19 years.[2]

The results of the last two population surveys show that the average DMFT index (decayed, missing and filled teeth index) among Brazilian adolescents aged 15 to 19 years is substantially higher when compared to the index of patients aged 12 years. In 2003, the national estimate for the DMFT Index at 12 years old was 2.8, whereas at 15-19 years old it was 6.2. However, in 2010, even with the decrease observed at both age groups in the average index, there was a significant difference between them: the DMFT index was 2.1 for patients aged 12 years, and 4.2 for patients aged 15-19 years.[2,3] Therefore, dental caries and its consequences are a public health problem in Brazil for showing alarming rates in adolescents.

Several researchers have focused on this critical question: what is the cause of the worsening in the national distribution of dental caries average rates between 12-year olds and 15-19-year olds ?[4-7]

Generally, in this life cycle adolescent patients are expected to show favorable health indicators, which would allow them to advance to adulthood with full vitality.[8] However, the data indicate that individuals are susceptible to increased oral health problems during adolescence. What biological, behavioral, social and institutional reasons could explain the epidemiological profile of oral problems in adolescence? One of the factors concerns to the access to care and effective use of health services, since adolescents are no longer benefited by the care and attention traditionally provided to children, nor by assistance programs, such as those provided to adults, pregnant women and elderly people.[9]

The use of proxy variables such as the "dental care index" - DCI (which is also known as the Walsh index); the "dental mutilation index" - DMI; as well as the healthy permanent teeth index - HPTI, allow us to study the ability of dental services to meet, at least partially, the dental care demands associated with dental diseases. These indices reflect the attention and care provided to oral health through preventive/restorative procedures, absence of tooth loss and dental caries, and consequently indirectly expresses the equality / inequality in access to dental care and the effective use of services.[10,11]

Therefore, the focus of the present study will be to evaluate the association between dental caries in adolescents and the use of dental services in Brazil.

# MATERIAL AND METHODS

## Type of study

The methodology used in this study consists of a quantitative approach in an observational epidemiological study, with a cross-sectional design.

## Ethical aspects

Public secondary data were obtained from the following databases:

a) 2003 National Oral Health Survey[3], submitted to the National Committee for Ethics in Research (CONEP) under registration no. 1,356, approved on July 21, 2000, in accordance with report no. 581/2000;

b) 2010 National Oral Health Survey,[2] submitted to CONEP under registration no. 15,498, approved on January 7, 2010, in accordance with report no. 009/2010.

## Sample

In the last two National Oral Health Surveys in Brazil, 2003 [3] and 2010,[2] samples were collected by conglomerates. In 2003, 108,921 individuals were analyzed, while in 2010, the number of analyzed individuals was 37,519. The main harms to oral health as well as the factors related to socioeconomic status, access to dental services and oral health perception by age group were collected.

## Inclusion and exclusion criteria

The inclusion criterion used in this study was the age of individuals (15 to 19 years). In 2003, the number of individuals analyzed was n=16,833, while in 2010 it was n=5,367. The main dental problem considered in the study was dental caries. The remaining ages and dental problems were excluded.

## Variables studied

The following indicative variables were used in order to study the dental care services provided to adolescents aged 15 to 19 years: a) Walsh index, or DCI,[10,11] given by the ratio between filled teeth (F) and the DMFT Index components; b) Dental Mutilation Index (DMI), given by the ratio between missing teeth (M) and the DMFT Index components, which is an expanded adaptation of the original Walsh Index;[10,11] c) Healthy Permanent Teeth Index (HPTI).

### Data analysis

All variables were analyzed according to their values presented in both National Oral Health Surveys in Brazil, which were carried out in the years 2003 and 2010. As the database involves a complex sampling plan, considering the weight of each primary and secondary sampling unit, data weighting was performed before each analysis through the weighting variable contained in the database, which allowed the extrapolation for any database variable, including the indices created. As for the dependent variables, analysis of variance was applied to two or three criteria, in a full factorial model, since the objective was to assess whether there was a difference in the mean values of the indices according to the polytomous categorical independent variables (Year, Region and Age Group). Also, the Pearson Linear Correlation Coefficient when the two variables presented a continuous scale, assuming values in the field of real numbers. This test describes the association between two variables and was applied in order to describe the influence of the components (decayed, missing and filled teeth), that is, which one had the highest degree of impact on the DMFT Index,[12] considering a significant correlation at the 0.01 significance level. The coefficient of determination was obtained by the square of the Pearson Linear Correlation Coefficient, considering the significant correlation at the same level described above, whose result shows how much of the variation in the dependent variable is explained by the variations in the independent variable.[12] All statistical analysis was performed using IBM STATISTICS SPSS software version 21.0.

## RESULTS

According to the objectives outlined and the methodology employed, the main results of the present research are presented. In Brazil the average DCI increased from 41.2 (2003) to 50.8 (2010). The average DMI decreased from 11.7 (2003) to 7.4 (2010), and the average HPTI increased by 4.9% (23.0 in 2003 to 24.1 in 2010).

The variables "year" and "region" were analyzed, revealing significance <0.05 between years, between regions, and in the interaction between year and region. Therefore, it can be inferred that the behavior of the variable region was not the same from one year to another.

In 2010 the Brazilian Central-West region was the only one to suffer a decrease in the DCI (-2.4%), while the North region showed the highest increase (43.1%), followed by the Northeast (40.7%), South (11.4%) and Southeast (6.9%). There was a decrease in the DMI of 39.6% in the Northeast, 38.5% in the South, 27.5% in the North, and 24.8% in the Central-West region. The Southeast presented a small increase (13.6%) in the DMI, but a substantial increase in the HPTI (6.1%) in that period, followed by the Northeast (5.5%), Central West (3%), South (2%) and North (0.3%) (Table 1).

In the age group 15-19 years, the DMFT Index showed a reduction of 22.7% from 2003 to 2010 in the Brazilian national average and also in the individual analysis of its components: decayed, missing and filled teeth. The variable "decayed permanent teeth" registered a reduction of 32%, while the variable "filled permanent teeth" presented a reduction of 9%, and the variable "missing permanent teeth" had a reduction of 45% (Table 2 ).

The Pearson Correlation Coefficient and the Coefficient of Determination for the years 2003 and 2010 were used, in order to investigate the degree of association and the impact of each component (decayed, missing and filled teeth) to explain the variations in the index, since the correlation was expected to be positive as the components were part of the index itself. There was a positive and regular correlation between decayed teeth, missing teeth and the DMFT Index, which showed a determination coefficient of 29.3% and 22.9%, respectively, for the year 2003, and 30.6% and 19.1% for the year 2010, respectively. However, the component filled teeth, which presented a positive and regular correlation in 2003 and a coefficient of determination of 35.5% had a positive and strong correlation in 2010 with a coefficient of determination of 44.4%, which demonstrates that in this age group the component that had the most impact on the DMFT Index was filled teeth.

***Table 1**: Variation in Dental Care Index, Dental Mutilation Index and Healthy Permanent Teeth for the age group 15 to 19 years, from 2003 to 2010 for each region, in Brazil.*

| Region | DCI (%) | DMI (%) | HPTI (%) |
|---|---|---|---|
| North | +43.1 | -27.5 | +0.31 |
| Northeast | +40.7 | -39.6 | +5.47 |
| Southeast | +6.9 | -13.6 | +6.11 |
| South | +11.4 | -38.5 | +2.05 |
| Central-West | -2.4 | -24.8 | +3.02 |
| Total | +23.2 | -36.8 | +4.94 |

***Table 2**: Descriptive statistics of the DMFT Index by component for the age group 15 to 19 years in Brazil, by years 2003 and 2010*

| DMFT Index component | Year | Average | Standard deviation | N (teeth) | Decrease (2003/2010) |
|---|---|---|---|---|---|
| Decayed teeth component | 2003<br>2010 | 2.2<br>1.5 | 2.97<br>2.53 | 18690173<br>9460218 | 32.00% |
| Missing teeth component | 2003<br>2010 | 0.7<br>0.4 | 1.61<br>1.21 | 18690173<br>9460218 | 45.50% |
| Filled teethcomponent | 2003<br>2010 | 2.4<br>2.2 | 3.37<br>3.06 | 18690173<br>9460218 | 9% |

***Table 3**: Pearson Correlation Coefficient for the age group 15 to 19 years, in Brazil in 2003 and 2010*

| Age group 15 to 19 years, 2003 | | Decayed teeth | Filled teeth | Missing teeth | DMFT* |
|---|---|---|---|---|---|
| Decayed teeth | Pearson Correlation<br>p Value<br>N | 1<br><br>18690073 | -0.24**<br>0.00<br>18690073 | 0.18**<br>0.00<br>18690073 | 0.54**<br>0.00<br>18690073 |
| Filled teeth | Pearson Correlation<br>p Value<br>N | -0.24**<br>0.00<br>18690073 | 1<br><br>18690073 | 0.00**<br>0.00<br>18690073 | 0.60**<br>0.00<br>18690073 |
| Missing teeth | Pearson Correlation<br>p Value<br>N | 0.18**<br>0.00<br>18690073 | 0.00**<br>0.00<br>18690073 | 1<br><br>18690073 | 0.48**<br>0.00<br>18690073 |
| DMFT* | Pearson Correlation<br>p Value<br>N | 0.54**<br>0.00<br>18690073 | 0.60**<br>0.00<br>18690073 | 0.48**<br>0.00<br>18690073 | 1<br><br>18690073 |
| **Age group 15 to 19 years, 2010** | | **Decayed teeth** | **Filled teeth** | **Missing teeth** | **DMFT*** |
| Decayed teeth | Pearson Correlation<br>p Value<br>N | 1<br><br>9460053 | -0.13**<br>0.00<br>9460053 | 0.16**<br>0.00<br>9460053 | 0.55**<br>0.00<br>9460053 |
| Filled teeth | Pearson Correlation<br>p Value<br>N | -0.13**<br>0.00<br>9460053 | 1<br><br>9460053 | 0.08**<br>0.00<br>9460053 | 0.67**<br>0.00<br>9460053 |
| Missing teeth | Pearson Correlation<br>p Value<br>N | 0.16**<br>0.00<br>9460053 | 0.08**<br>0.00<br>9460053 | 1<br><br>9460053 | 0.44**<br>0.00<br>9460053 |
| DMFT* | Pearson Correlation<br>p Value<br>N | 0.55**<br>0.00<br>9460053 | 0.67**<br>0.00<br>9460053 | 0.44**<br>0.00<br>9460053 | 1<br><br>9460053 |

*Note: * Decayed, missed, and filled teeth. ** Statistical significance*

***Table 4**: Coefficient of Determination for the age group 15 to 19 years, Brazil, by years 2003 and 2010*

| Coefficient of determination | Year 2003 | Year 2010 |
|---|---|---|
| Decayed Teeth component | 29.3% | 30.6% |
| Missing Teeth component | 22.9% | 19.1% |
| Filled Teeth component | 35.5% | 44.4% |

## DISCUSSION

Nadanovsky and Sheiham[13] point out that the decline of dental caries in the 1970s and 1980s in developed countries among schoolchildren was explained as 65% due to the improvement in socioeconomic conditions, whereas only 3% was attributed to the provision of dental services. Celeste et al.[14] state that 14% is attributable to socioeconomic variables and 11% to the variables of dental services. However, one should take into account the different age groups and methodological differences between the analyzed studies when making comparisons. Data concerning to the last two National Oral Health Surveys (2003-2010)[2,3] were analyzed in terms of the dental care received by the adolescents. The DCI and HPTI registered an increase in their average, while the DMI decreased, demonstrating an improvement in the dental care services provided to this population in the last decade in Brazil.

By analyzing the regions, one may observe that in 2010 the North and Northeast showed the greatest increase in dental care, demonstrated by the DCI, while the Brazilian Central-West region was the only one to suffer a decrease. It must be emphasized that these regions have presented worse health indicators (including oral health) and greater inequalities than other regions over time. Therefore, the largest DCI increase in the North and Northeast region may have occurred because in 2003 these regions presented higher levels of untreated caries than the South and Southeast regions.[2,3]Since then these regions have received substantial contributions of investments and services, based on the principle of equity. That is, a "positive discrimination" to strengthen primary and specialized care, with the implementation of oral health teams and equipment of the *Brasil Sorridente* program (Family Health Strategy, Dentistry Centers, among others).[15-17]

Given the above assumptions, the DCI in these regions may have improved because they already presented greater needs for treatment, with subsequent fulfillment of these needs. The Central-West was the only region to present an increase in the need for more complex treatment of dental caries from 2003 to 2010, including restorations of two or more surfaces, which could explain the drop in the DCI in this region. Is there any influence due to more extensive restorations that demand a longer clinical time of primary care ? [2,3] Is it due to the ineffectiveness of the existing services? Further studies may address such issues.

There was a decrease in the DMI, with greater amplitude in the Northeast and South regions. This decrease might be due to the change in the number of adolescents that had never been to the dentist in the Northeast, which also decreased, suggesting more access to care. To ratify, the DCI showed an increase, demonstrating the growth in the access and use of restorative services. The number of adolescents with no caries also increased, both in the Northeast and in the South. It might represent an improvement in the quantity and also quality of the services, with a focus on health promotion and prevention.[2,3]

The concept of "access" has been widely discussed and authors have used several definitions. By considering public health policies as a social right, an implicit concept is assumed that institutions ensure access to a set of benefits (actions and services) to the largest number of people, according to the needs, priorities and vulnerabilities of social groups.[18] Assuming that the concept of "care" means having access to the necessary treatment imposed by reality, the Northeast stands out. The access to services may result in fewer missing teeth due to the greater possibility of receiving a dental filling procedure. This factor needs special attention in a region that has shown so many social inequities throughout history. Missing teeth could cause fewer work opportunities for the individual, low self-esteem, and also difficulties of personal and professional relations, which makes it more difficult for them to be included in society.[19]

In addition, assuming that the concept of preventive care in oral health is to present a higher average of healthy teeth (with no problems or clinical interventions), the HPTI showed the highest increase in the Southeast and Northeast regions.

These three results add more elements to the debate on the impact of the National Oral Health Policy, since between 2002 and 2008 the number of oral health teams rocketed from 4,261 to 17,349. Oral health teams were present in 4,857 of the 5,564 Brazilian cities and federal expenditures on oral health investments rose from 56.5 million in 2003 to 600 million in 2008. Approximately R$ 2.4 billion were invested in that period.[16] The Northeast received a large improvement with the implementation of the Federal program *Brasil Sorridente*, which included oral health teams acting in the Family Health Strategy; however, there was a controversial influence on epidemiological outcomes.[15-17,20] The Northeast region showed the greatest increase in the population coverage of oral health teams in Brazil (13% to 52%), according to the Department of Basic Care.[21]

Silva and Gottems[22] showed that the degree of coverage of oral health teams in the Family Health Strategy, besides the implementation of primary health care in a structured way and the access to secondary health care are factors that influence the integrality of oral health care. Soares, Chaves and Cangussu[23] also identified that there is a profile of inequality in the use of oral health services, and

those users who belonged to a poor service organization used less secondary attention, indicating that access to use of services is dependent on the organization of care by the local government. This same study verified a trend towards justice in care, corroborating with the advances made by SUS in the offer of services. Otherwise, Ely et. al.[24] suggested that the improvement in access with the presence of oral health in the Family Health Strategy did not culminate with the improvement in the oral health of the users in the studied regions.

According to Celeste et al.[14] and Ekstrand et al.,[25] cities committed to the sustained practice of preventionat individual and collective levels presented improvements in the DMFT Index or decreased chances of untreated caries. Dental services focused on prevention were considered an important factor in the goal of reducing the prevalence of oral diseases, especially dental caries.[14,25-27]

Another point is that cities with instability related to labor, patient coverage or service funding were associated with negative changes in the caries experience, reinforcing the need for sustainable quality dental services, with sufficient and stable workforce, focused on health promotion and prevention in order to provide early diagnosis and minimal intervention.[25,28]

The DMFT Index was analyzed considering its components: decayed, missing and filled teeth. The variables showed a reduction between 2003 and 2010. The data showed a positive and regular correlation between decayed and missing teeth in the DMFT Index. However, the component filled teeth, which had a positive and regular correlation in 2003, presented a positive and strong correlation in 2010, thus being the component that had the most impact on the DMFT Index in this age group. These results demonstrate a quantitative improvement in the component filled teeth and a qualitative improvement in the component missing teeth.

It can be assumed that the drop in the coefficient of determination for missing teeth represents an increase in the quality of dental care, as when fewer teeth are extracted from adolescents they preserve both their functional and aesthetic aspects. According to Davoglio et al.,[29] the increase in the provision of dental services does not necessarily decrease oral health inequities. The authors verified that by improving the access to dental services tooth loss is decreased, as decayed teeth can be treated on a timely basis. Barbato and Peres[30] report that 92.7% of the tooth loss cases in their study were due to untreated dental caries.

In order to properly analyze the results presented in this study, one should take into account the limitation in the use of secondary data, the design of the studies (which may not properly address causality), and the chronological period of the investigations, since updates are required for certain information. In addition, the limitation of statistical models, through quantitative data, to explain the complexity of the attention models of the country and their contextual, qualitative and subjective nuances should also be taken into account. However, it must be emphasized that even with these limitations, the availability of these data and their use as instruments by researchers, managers and decision makers on national and regional oral health policies are of great relevance.

The larger population coverage by oral health teams seems to become more and more relevant, as this coincides with a temporal increase in the DCI. However, the cross-sectional design of this study does not allow inferring cause/effect relationships. Therefore, longitudinal design studies are needed in order to test this hypothesis. Finally, it is important to highlight the relevance of well-collected and robust epidemiological data that meet a rigorous design, with adequate standardization and methodology for its use. Tools that allow researchers to verify trends in the epidemiological profile and contribute to the planning, monitoring and assessment of oral health services are also highly relevant.

The results evidence a reformulation in dental care services provided to adolescents in Brazil, with an increase in the Dental Care Index and Healthy Permanent Teeth Index in most regions and a decrease in the Dental Mutilation Index. This demonstrates an improvement in dental care, at least quantitatively in what concerns to the component filled teeth, and a qualitative improvement in regard to the components missing teeth and healthy permanent teeth.

## REFERENCES

1. Biazevic MGH, Frias AC. Levantamentos em saúde bucal – métodos básicos. 5ª ed. Faculdade de Odontologia da Universidade de São Paulo (FOUSP). 2017.
2. Brasil. Ministério da Saúde. Pesquisa Nacional de Saúde Bucal 2010. Brasília, Ministério da Saúde, 2012.
3. Brasil. Ministério da Saúde. Condições de Saúde Bucal da População Brasileira 2002-2003. Brasília, Ministério da Saúde, 2004.
4. Reifur KD, De Oliveira Piorunneck CM, Moyses SJ. Dental Caries and Treatment Needs in Adolescents Aged 15 to 19 Years Old and their Relationship with Dental Services: A Systematic Review. Dent Health Curr Res. 2017 3:2 doi: 10.4172/2470-0886.1000129.
5. Vazquez F de L, Cortellazzi KL, Kaieda AK, Bulgareli JV, Mialhe FL, Ambrosano GM, et. al. Individual and contextual factors related to dental caries in underprivileged Brazilian adolescents. BMC Oral Health. 2015 Jan; 20; 15:6. doi: 10.1186/1472-6831-15-6.
6. Paula JS, JND Cruz, Ramires TG, Ortega EMM, Mialhe FL. Longitudinal impact of clinical and socioenvironmental variables on oral health-related quality of life in adolescents. Braz Oral Res. 2017 Ago; 31:70. doi: 10.1590 / 1807-3107BOR-2017.vol31.0070.
7. Östberg AL, Kjellström AN , Petzold M. The influence of social deprivation on dental caries in Swedish children and adolescents, as measured by an index for primary health care: The Care Need Index.

Comunidade Dent Oral Epidemiol. 2017 Jun; 45 (3): 233-241. doi: 10.1111 / cdoe.12281.

8. Palazzo LS, Bérla JU, Tomasi E. Adolescentes que utilizan servicios de atención primaria: Cómo viven? Por qué buscan ayuda y cómo se expresan? Cad. Saúde Pública. 2003; 19 (6):1.655-1665. doi:http:// dx.doi.org/10. 1590/S0102-311X2003000600010.

9. WHO, World Health Organization. Nutrition in adolescence: issues and challenges for the health sector: issues in adolescent health and development. 2005, Geneva: WHO.

10. Walsh J. International patterns of oral health care—the example of New Zealand. Harv Dent Alumni Bull. 1968; 10 (17).

11. Antunes JLF, Peres MA, Frazão P, Souza MLR. Cárie dentária. In: Antunes JLF, Peres MA (Org.). Epidemiologia da saúde bucal. 2ª ed. São Paulo: Santos; 2013. p. 71-96.

12. Callegari-Jacques SM. Bioestatística: Princípios e aplicações. Porto Alegre: Artmed; 2011.

13. Nadanovsky P, Sheiham A. Relative contribution of dental services to the changes in caries levels of 12-year-old children in 18 industrialized countries in the 1970s and early 1980s. Community Dent Oral Epidemiol. 1995; 23:331–339. doi:https://doi.org/10.1111/j.1600-0528.1995.tb00258.x.

14. Celeste RK, Nadanovsky P, Leon AP de. Associação entre procedimentos preventivos no serviço público de odontologia e a prevalência de cárie dentária. Rev Saude Publica. 2007; 41:830–838. doi: 10.1590/S0034-89102007000500018.

15. Scherer CI, Scherer MDA. Avanços e desafios da saúde bucal após uma década de Programa Brasil Sorridente. Rev Saúde Pública. 2015; 49:1-12. doi: 10.1590/S0034-8910.2015049005961.

16. Antunes JLF, Narvai PC. Políticas de saúde bucal no Brasil e seu impacto sobre as desigualdades em saúde. Rev Saúde Pública. 2010; 44 (2): 360-365. doi: http://dx.doi.org/10.1590/S0034-89102010005000002.

17. Pereira CR dos S, Roncalli AG, Cangussu MCT, Noro LRA, Patrício AAR,Lima KC. Impacto da Estratégia Saúde da Família sobre indicadores de saúde bucal: análise em municípios do Nordeste brasileiro com mais de 100 mil habitantes. Cad Saúde Pública. 2012; 28 (3): 449-462. doi:http://dx.doi.org/10.1590/S0102-311X2012000300005.

18. Fleury S, Ouverney AM. Política de saúde: uma política social. In: Giovanella L, Escorel S, Lobato LV, Noronha JC, Carvalho AI (Org.). Políticas e sistemas de saúde no Brasil. 2ª ed. Rio de Janeiro: Editora Fiocruz; 2008. P.23-64.

19. Moreira TP, Nations MK, Alves SCF. Dentes da desigualdade: marcas bucais da experiência vivida na pobreza pela comunidade do Dendê. Cad Saúde Pública. 2007; 23 (6): 1383-1392. doi: 10.1590/S0102-311X2007000600013.

20. Scarparo A, Zermiani TC, Ditterich RG, Pinto MHB. Impact of the Brazilian Oral Health Policy – Programa Brasil Sorridente – on the provision of public dental services in the State of Rio de Janeiro. Cad. Saúde Colet. 2015; 23 (4): 409-415. doi: 10.1590/1414-462X201500040153.

21. Brasil. Ministério da Saúde. Portal do departamento da atenção básica (DAB). Brasília, Ministério da Saúde, 2016.

22. Silva HEC, Gottems LBD. The interface between primary and secondary care in dentistry in the Unified Health System (SUS): an integrative systematic review. Ciênc. Saúde Coletiva 2017; 22(8):2645-2657. doi: 10.1590/1413-81232017228.22432015.

23. Soares FF, Chaves SCL, Cangussu MCT. Governo local e serviços odontológicos: análise da desigualdade na utilização. Cad. Saúde Pública. 2015 Mar; 31(3):586-596. http://dx.doi.org/10.1590/0102-311X00077214.

24. Ely HC, Abegg C, Celeste RK, Pattussi MP. Impacto das equipes de saúde bucal da Estratégia da Saúde da Família na saúde bucal de adolescentes do sul do Brasil. Ciênc. Saúde Coletiva. 2016; 21(5):1607-1616. doi: 10.1590/1413-81232015215.07822015.

25. Ekstrand KR, Christiansen MEC, Qvist V, Ismail A. Factors associated with inter-municipality differences in dental caries experience among Danish adolescents. An ecological study. Community Dent Oral Epidemiol. 2010; 38:29–42. doi: 10.1111/j.1600-0528.2009.00505.x.

26. Lu H-X, Wong MCM, Lo ECM, McGrath C. Risk indicators of oral health status among young adults aged 18 years analyzed by negative binomial regression. BMC Oral Health. 2013; 13:40. doi: 10.1186/1472-6831-13-40.

27. Moreira KMS. Oral health in the family health strategy: how to proceed? Rev. Bras. Odontol. 2015 jan./jun; 72(1/2):114-7.

28. Mattos GCM, Ferreira EF, Leite ICG, Greco RM. A inclusão da equipe de saúde bucal na Estratégia Saúde da Família: entraves, avanços e desafios. Ciênc. Saúde Coletiva. 2014; 19(2):373-382. doi: 10.1590/1413-81232014192.21652012.

29. Davoglio RS, Aerts DRG de C, Abegg C, Freddo SL, Monteiro L. Fatores associados a hábitos de saúde bucal e utilização de serviços odontológicos entre adolescentes. Cad Saude Publica. 2009; 25:655–667. doi: 10.1590/S0102-311X2009000300020.

30. Barbato PR, Peres MA. Perdas dentárias em adolescentes brasileiros e fatores associados: estudo de base populacional. Rev Saúde Pública. 2009; 43:13–25. doi: 10.1590/S0034-89102009000100003.

# EFFECT OF GRAPE SEED EXTRACT ON BOND STRENGTH OF RESTORATIVE MATERIAL TO BLEACHED ENAMEL

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**Palavras-chave**: Adesão. Clareamento Dental. Extrato de Semente de Uva.

**RESUMO**

**Objetivo:** Este trabalho teve por objetivo avaliar *in vitro* o efeito de um antioxidante natural (extrato de semente de uva) em diferentes concentrações, na resistência de união do material restaurador ao esmalte clareado. **Métodos:** Quarenta fragmentos de incisivos bovinos hígidos, foram divididos aleatoriamente em quatro grupos (n=10): Grupo I: sem clareamento; Grupo II: clareado com peróxido de hidrogênio 35% (PH) e sem pós-tratamento; GIII: clareado PH 35% + extrato de semente de uva 5%; e Grupo IV: clareado com PH 35% + extrato de semente de uva 10%. A resistência de união da interface esmalte/material restaurador foi avaliada por meio do teste de cisalhamento (MPa). Os dados foram analisados pela análise de variância (ANOVA) e testes de Tukey (α=0,05%). Os tipos de fratura também foram analisados e classificados em: adesiva, coesiva ou mista. **Resultados:** Apenas o Grupo III (clareado + extrato de semente de uva 5%) apresentou aumento estatisticamente significante (p<0,001). dos valores de resistência de união comparado ao Grupo II (clareado e sem pós-tratamento). Todos os grupos mostraram um predomínio do tipo de fratura adesiva. **Conclusão:** O clareamento dental diminui significativamente a força de adesão ao esmalte dental clareado, e o extrato de semente de uva 5% aplicado após o clareamento dental melhora a resistência de união entre o material restaurador e o esmalte clareado.

**Keywords**: Adhesion. Tooth Whitening. Grape Seed Extract

**ABSTRACT**

**Objective**: The aim of this study was to evaluate the effect of different concentrations of a natural antioxidant (grape seed extract) on the bond strength of the restorative material to the bleached enamel. **Methods:** Forty fragments of healthy bovine incisors were randomly divided into four groups (n = 10): Group I: no bleaching; Group II: Bleaching with 35% hydrogen peroxide (HP) and without post-treatment; Group III: Bleaching with 35% HP + 5% grape seed extract; and Group IV: Bleaching with 35% HP + 10% grape seed extract. The bond strength at the adhesive interface was evaluated using the shear test (MPa). The data were analyzed by the analysis of variance (ANOVA) and Tukey test (α=0.05%). The fracture types were also analyzed and classified into: adhesive, cohesive or mixed. **Results:** Only Group III (bleached + 5% grape seed extract) had a significant increase (p<0.001) in bond strength values when compared to Group II bleached, without post-treatment). All groups showed a predominance of the adhesive type of fracture. **Conclusion:** It could be concluded that tooth bleaching decreases the bond strength to bleached enamel and 5% grape seed extract applied after dental bleaching improves the bond strength between the restorative material and the bleached enamel.

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# INTRODUCTION

Dental esthetics is a concern constantly expressed by patients in dental offices, and there is a great demand for whitening darkened teeth. The main agents used for bleaching vital teeth are carbamide peroxide and hydrogen peroxide. When products derived from peroxides come into contact with the tooth structure, they release oxygen and hydrogen free radicals capable of diffusion through dental tissues, causing degradation of the molecules of pigments into increasingly smaller molecules of a lighter color, promoting bleaching.[1]

Although bleaching agents have been shown to be effective treatment as regards color change, the residual oxygen remained on tooth after treatment has adverse effects on the bond strength.[2,3] Changes caused on the enamel surface may alter microhardness, surface roughness and morphology of the enamel,[4] loss of calcium and phosphate,[5,6] and lead to changes in the bond strength, when teeth are restored in the same session that bleaching is performed.[2,3]

The literature has suggested that the professional should wait from 7[7,8] to 14[9] days after concluding the bleaching procedure to perform restorations. This delay will allow the release of residual oxygen that could compromise the bond strength of restorations.

Taking this into consideration, the ideal would be to use methods for minimizing the effects on the tooth structure caused by residual oxygen, so that the tooth could be restored in the same clinical session. Studies have demonstrated that the use of different antioxidant agents immediately after bleaching could neutralize the oxygen molecules and improve the bond strength of the restorative material to bleached enamel,[10-14] among them are some natural extracts.

After bleaching treatment, the use of plant extract has shown positive results in substitution to chemical agents.[11,13] The grape seed extract is composed of oligomeric proanthocyanidins that present activities of eliminating free radicals, and also has antimicrobial and anti-inflammatory properties and has no mutagenic effect.[15] The application of grape seed extract after bleaching aims to increase the bond strength of the restorative material with the dental structure.[13] Thus, the aim of the present *in vitro* study was to evaluate the effect of applying different concentrations of grape seed extract on the bond strength of the restorative material to bleached enamel.

# MATERIALS AND METHODS

## Experimental Design

The study was conducted in a randomized manner, and the sample was composed of 40 bovine tooth fragments (n=10). The experimental groups were divided as follows: GI: no bleaching; GII: Bleaching with 35% hydrogen peroxide (HP) and without post-treatment; GIII: Bleaching with 35% HP + 5% grape seed extract; and GIV: Bleaching with 35% HP + 10% grape seed extract. The quantitative response variable was the bond strength at the enamel/restorative material interface, by means of the shear bond strength test (MPa). In addition, qualitative analysis of the fracture patterns (adhesive, cohesive or mixed) was performed.

## Sample obtainment

Forty (40) healthy bovine teeth were selected. The teeth had no cracks, fractures or hypoplastic stains. The teeth were cleaned with periodontal curettes, pumice stone and water paste, and Robson brushes. After cleaning, the teeth were section with a diamond coated cutting disc mounted in a cutting machine (Isomet 1000, Model 11-2180), under water cooling, to obtain enamel fragments measuring 5x5x3mm.

The tooth fragments were embedded in transparent acrylic resin (VIPI, Pirassununga-SP, Brazil) and PVC rings, so that the enamel surface remained facing towards the outside medium, to allow flattening with abrasive discs #600 and #1200.

Afterwards, the samples were randomly divided into 4 groups according to the surface treatment.

## Surface bleaching

The 35% hydrogen peroxide-based bleaching gel (Whiteness HP; FGM, Joinville, SC, Brazil) had two stages: peroxide (Stage 1) and thickener (Stage 2). The Whiteness HP bleach stages were mixed in the ratio of 3 drops of peroxide to one drop of thickener, and the bleaching agent was applied to the enamel specimen. The bleaching gel application protocol was 3 applications each lasting 15 minutes, per session, in accordance with the manufacturer's recommendations. Between applications, the gel was removed by means of aspiration (endodontic cannula) before re-applying the product. After the bleaching procedure, the specimens were washed with distilled water for 30 seconds and dried with absorbent paper.

The group that did not receive bleaching treatment was stored in relative humidity throughout the procedure.

## Post-bleaching surface treatment

Immediately after the bleaching procedure, the specimens of Group GIII and GIV received post-bleaching treatment with grape seed extract. The extracts were used in gel form, in the concentrations of 5% (pH 3.9) and 10% (pH 4.1), which were prepared by a compounding pharmacy (Homeopatia Ouro Preto, Pirassununga, SP, Brazil).

The grape seed extract was applied by a single

operator, for 10 minutes, with constant agitation, by using a disposable applicator.

After applying the grape seed extract, the specimens were washed with distilled water for 30 seconds and dried with absorbent paper. The restorations were performed immediately after the application of the grape seed extract.

### Restorative Procedure

After the treatment stage, the specimens of all groups received restorative material. Initially, the surface was etched with 37% phosphoric acid (Condac, FGM, Joinville, SC, Brazil) for 30 seconds on the enamel surface, followed by washing with distilled water for 30 seconds and drying with jets of air. After, the adhesive system (Adper Single Bond; 3M, ESPE St. Paul, MN, USA) was applied on the etched enamel using a disposable applicator, in two consecutive coats, and light polymerized for 10 seconds (SDI-Radical, Ribeirão Preto, SP, Brazil).

Previously flattened enamel surfaces were restored using a split Teflon matrix (3 mm internal diameter, 4 mm height). The center of enamel surfaces were restored with resin composite (Filtek Z250; 3M ESPE, St. Paul, MN, USA), inserted in three increments, and each increment was light polymerized for 20 seconds, at a distance of 10 cm (SDI-Radical, Ribeirão Preto, SP, Brazil). The specimens were stored in relative humidity, at 37°C and after 24h the shear bond strength test was performed.

### Bond Strength Test

The specimens were placed on the Universal Test Machine (Model DL 2000, São José dos Pinhais, PR, Brazil, EMIC – Equipamentos e Sistemas de Ensaios LTDA) with a load cell of 50Kg/f, allowing force to be applied at an angle of 45°, without coming into contact with the base of the test specimen. Shear force was applied by means of a rectangular stainless steel tip at a constant speed until the restoration was displaced. The (MPa) values were noted, and later tabulated and sent for statistical analysis.

### Fracture Pattern Analysis

After rupture of the specimen, the surfaces were evaluated by means of a clinical microscope (Model ALL 03 - EL) Aliance Comercial de São Carlos Ltda. - ME, São Carlos, SP, Brazil), to identify the type of fracture. The specimens were evaluated at 16X magnification. The failures were classified as:

1.Adhesive (fracture at the substrate/ restorative material interface); 2. Cohesive in enamel (fracture in enamel); 3. Cohesive in resin (fracture in the restorative material); 4. Mixed (Combined adhesive and cohesive fracture).

### Statistical analysis

The mean values of bond strength for each group were considered for statistical analysis. Statistical analyses were performed with the SPSS 19.0 program for Windows (SPSS Inc., Chicago, IL, USA). First, the normality of the data was evaluated using the Kolmogorov-Smirnov test, followed by the Analysis of Variance (ANOVA) and the Tukey test ($\alpha$= 0.05).

## RESULTS

The Analysis of variance (ANOVA) revealed significant difference among the groups ($p<0.001$). The Tukey test showed that the groups in which the grape extract was used in the concentrations of 5% (Group III) and 10% (Group IV) had higher bond strength values than in those in which bleaching was performed and had no post-treatment (Group II).

However, only Group III had a significant increase in bond strength values, when compared with Group II. Group I, which was not bleached (positive control), showed higher bond strength values than those of the other groups (Table 1).

The fracture patterns were analyzed according to the following classifications: adhesive, cohesive and mixed. In Figure 1, the percentage values of fracture patterns are represented, according to the different experimental groups. Predominance of adhesive failures was observed in all groups, however, in Groups II and IV these types of failures were observed in the total number of their specimens. Group I (control) had the highest number of cohesive failures, followed by Group III. All the cohesive failures in above-mentioned groups were cohesive failures in enamel.

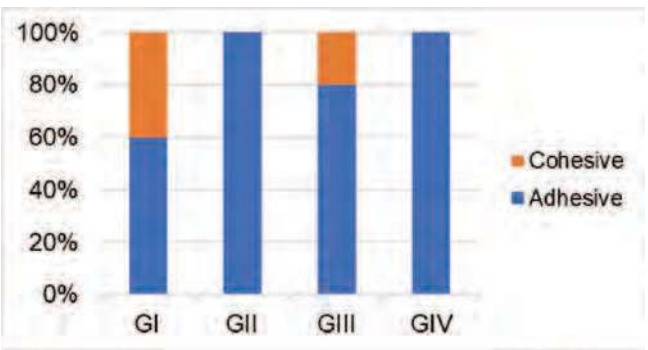


***Figure 1***: *Percentage of fracture patterns for each studied group*

***Table 1**: Mean (standard deviation) of bond strength values (MPa) observed in the four groups studied (n=10)*

| Experimental groups | Mean (±SD) |
|---|---|
| GI - without bleaching | 20.87 (±3.47) a |
| GII - Bleaching with 35% hydrogen peroxide (HP) | 10.72 (±2.71) c |
| GIII - Bleaching with 35% HP + 5% grape seed extract | 16.00 (±2.31) b |
| GIV - Bleaching with 35% HP + 10% grape seed extract | 14.10 (±3.80) bc |

*Note: Equal letters indicate statistical similarity*

# DISCUSSION

There has been a growing demand for esthetic procedures in dental offices, among these, tooth whitening is considered a fast, efficient, accessible and conservative treatment.[16] However, when patients need to replace resin composite restorations, the bond strength of the restorative material to the bleached tooth structure may be compromised if the restorative treatment is performed immediately after bleaching. This is due to the presence of residual oxygen in the tooth structure.[7-9,17]

Antioxidants are chemical substances that inhibit the oxidation process,[18] thus the improvement in bond strength occurs due to the fact that the antioxidant agents donate their electrons to the free radicals, thereby interrupting the chain reaction, and thus impeding the formation of these radicals.[19] The grape seed extract is composed of oligomeric proanthocyanidins, in which there are molecules that form part of a specific group of polyphenolic compounds such as the flavonoids. The proanthocyanidins are found in natural sources, such as for example in plants[20] and are considered effective for eliminating free radicals[21] and they have antioxidant action.[22,23] Proanthocyanidins are also considered an atoxic and safe antioxidant,[24,25] that can be well indicated for application during clinical sessions.

This study evaluated the effect of grape seed extract, a natural antioxidant product, on increasing the bond strength. The results obtained showed that the unbleached Group (GI) had the highest bond strength values when compared with the other groups (GII, GIII and GIV). These results were justified by the presence of residual oxygen in the dental structure of the groups that received bleaching treatment, because bleaching agents act mainly by oxidation of organic compounds that release free radicals (particularly nascent oxygen). Due to its low molecular weight, oxygen is capable of penetrating into enamel and dentin, acting on the organic portion, and attaining the dark pigments, thereby promoting bleaching.[26] The oxygen molecule in the tooth structure inhibits polymerization of the adhesive system and resin composite, and therefore, reduced the bonding capacity of the restorative material.[27]

The group that was bleached and treated with 5% grape seed extract (GIII) had the highest bond strength values when compared with the group that was bleached and not treated (GII), in agreement with the results observed in other studies,[10-13] showing a probable reduction in residual oxygen on the enamel surface treated with 5% grape seed extract. On these concern, Manoharam et al. (2016)[12] evaluated the effect of antioxidant agents in the bond strength of resin to bleached enamel (with 15% carbamide peroxide for 8 hours *per* day during 5 days) and the 5% grape seed extract was the most effective.

In the present study, 35% hydrogen peroxide gel was used in 3 applications lasting 15 minutes each, simulating bleaching by the in-office technique using gels with higher concentrations, as were used in previous studies.[10,11,13] The 5% grape seed extract used after bleaching as antioxidant agent was able to reduce the deleterious effects of bleaching, and significantly increased the bond strength of the restorative material to the enamel bleached[10,11,13], which would be clinically beneficial because it allows a decrease in the waiting time after the bleaching sessions to perform the restorative procedure.

The bleaching gel concentration and time of application may influence the changes caused in tooth enamel, such as morphological changes [28] and the bond strength of restorative materials.[29] However, we noted that even when using different times, concentrations and bleaching gels, the 5% grape seed extract increased the bond strength in all previous studies of literature when compared with the untreated groups.[10,11,12,13]

Sharafeddin & Farshad (2015)[30] also used grape seed extract in the concentration of 10% and verified no significant increase in the bond strength values when compared with the control group, corroborating our results. This fact may be associated with the difference in pH of the extracts studied (5% - pH 3.9 and 10% - pH 4.1). At 5%, the gel was more acid than the concentration of 10%. The interaction of acids on the tooth surface may have act in a better manner with the tooth structure.

The fracture test showed predominance of adhesive failures in all groups. However, some cases of cohesive

fracture was observed in the group treated with 5% grape seed extract (GIII), and in the unbleached group (GI), which corroborated the results of the bond strength tests, showed higher bond strength values in these groups when compared with the other groups. Probably there was a higher presence of residual oxygen in the specimens of groups 2 and 4. This fact compromised the bond strength between enamel and restorative material, favoring the high rate of cohesive fractures.

Overall, the results of this study demonstrated that tooth whitening performed with hydrogen peroxide gel at high concentrations negatively affected the bond strength of restorative materials to enamel. The 5% grape seed extract may have promising results in the removal of residual xygen from bleached surface. Further studies are necessary to evaluate whether different application protocols could improve the results achieved for bond strength to bleached enamel.

## CONCLUSIONS

Within the limitations of this *in vitro* study, it could be concluded that:

1- Bleaching with 35% hydrogen peroxide significantly reduced the bond strength of restorative material to bleached tooth enamel.

2- The 5% grape seed extract increased the bond strength of restorative material to tooth enamel in restorations performed immediately after bleaching.

## REFERENCES

1. Joiner A. The bleaching of teeth: a review of the literature. Journal of Dentistry. 2006 Aug; 34(7):412-419. doi: 10.1016/j.jdent.2006.02.002.
2. Dudek M, Roubickova A, Comba L, Housova D, Bradna P. Effect of postoperative peroxide bleaching on the stability of composite to enamel and dentin bonds. Operative Dentistry. 2013 Jul-Aug; 38(4):394-407. doi: 10.2341/11-429-L.
3. Shinohara MS, Peris AR, Pimenta LAF, Ambrosano GMB. Shear bond strength evaluation of composite resin on enamel and dentin after nonvital bleaching. Journal of Esthetic and Restorative Dentistry. 2005; 17(1):22-29.
4. Pinto CF, Oliveira RD, Cavalli V, Giannini M. Peroxide bleaching agent effects on enamel surface microhardness, roughness and morphology. Brazilian Oral Research. 2004 Oct-Dec; 18(4):306-311.
5. Tezel H, Atalayin C, Erturk O, Karasulu E. Susceptibility of enamel treated with bleaching agents to mineral loss after cariogenic challenge. International Journal of Dentistry. 2011 Aug. doi: 10.1155/2011/953835.
6. Venkatesan SM., Narayan GS, Ramachandran AK, Indira R. The effect of two bleaching agents on the phosphate concentration of the enamel evaluated by Raman spectroscopy: An ex vivo study. Contemporary Clinical Dentistry. 2012 Sep; 3(Suppl 2):172-176. doi: 10.4103/0976-237X.101081.
7. Alencar MS, Bombonatti JFS, Maenosono RM, Soares AF, Wang L, Mondelli RFL. Effect of two antioxidants agents on microtensile bond strength to bleached enamel. Brazilian Dental Journal. 2016 Sep-Oct; 27(5):532-536. doi: 10.1590/0103-6440201600757.
8. Lago ADN, Garone-Netto N. Microtensile bond strength of enamel after bleaching. Indian Journal of Dental Research. 2013 Jan-Feb; 24(1):104-109. doi: 10.4103/0970-9290.114955.
9. CanKarabulut DC, Karabulut B. Influence of activated bleaching on various adhesive restorative systems. Journal of Esthetic and Restorative Dentistry. 2011 Dec; 23(6):399-408. doi: 10.1111/j.1708-8240.2011. 00413.x.
10. Abraham S, Ghonmode WN, Saujanya KP, Jaju N, Tambe VH, Yawalikar. Effect of grape seed extracts on bond strength of bleached enamel using fifth and seventh generation bonding agents. Journal of International Oral Health. 2013 Dec; 5(6):101-107.
11. Khamverdi Z, Khadem P, Soltanian A, Azizi M. In-vitro evaluation of the effect of herbal antioxidants on shear bond strength of composite resin to bleached enamel. Journal of Dentistry (Tehran). 2016 Aug; 13(4):244-251.
12. Manoharan M, Shashibhushan KK, Poornima P, Naik SN, Patil D, Shruthi, AS. Effect of newer antioxidants on the bond strength of composite on bleached enamel. Journal of Indian Society of Pedodontics and Preventive Dentistry. 2016 Oct-Dec; 34(4):391-396. doi: 10.4103/0970-4388.191430.
13. Vidhya S, Srinivasulu S, Sujatha M, Mahalaxmi S. Effect of grape seed extract on the bond strength of bleached enamel. Operative dentistry. 2011 Jul-Aug 36; 4: 433-438. doi: 10.2341/10-228-L.
14. Gogia H, Taneja S, Kumar M, Soi S. Effect of different antioxidants on reversing compromised resin bond strength after enamel bleaching: An in vitro study. Journal of Conservative Dentistry. 2018 Jan-Feb; 21(1):100-104. doi: 10.4103/JCD.JCD_325_16.
15. Perumalla, AVS, Hettiarachchy, NS. Green tea and grape seed extracts - Potential applications in food safety and quality. Food Research International. 2011 May; 44(4):827-839. doi: 10.1016/j.foodres.2011.01.022.
16. Thosre D, Mulay S. Smile enhancement the conservative way: Tooth whitening procedures. Journal of Conservative Dentistry. 2009 Oct; 12(4):164-168. doi: 10.4103/0972-0707.58342.
17. Bittencourt BF, Domínguez JA, Gomes, OMM, Scholz N. Post-whitening adhesion and time intervals: a topic review. Revista Facultad de Odontología Universidad de Antioquia. 2013; 24(2):336-346.
18. Olga S, Camargo MMA, Batistuzzo JAO. Fundamentos de toxicologia. 3ª ed. São Paulo: Atheneu Editora. 2008.
19. Vasconcelos TB, Cardoso ARNR, Josino JB, Macena RHM, Bastos, VPD. Radicais Livres e Antioxidantes: Proteção ou Perigo? UNOPAR Cientifica. Ciencias Biologicas e da Saúde. 2014; 16(3):213-219.
20. Caetano MHN. Propriedades medicinais das proantocianidinas [dissertação]. Instituto Superior de Ciências da Saúde Egas Moniz; 2013.
21. Bagchi D, Bagchi M, Stohs SJ, Das DK., Ray SD, Kuszynski CA, Pruess HG. Free radicals and grape seed proanthocyanidin extract: importance in human health and disease prevention. Toxicology. 2000 Aug; 148(2-3):187-197.
22. Yilmaz Y, Toledo RT. Major flavonoids in grape seeds and skins: antioxidant capacity of catechin, epicatechin, and gallic acid. Journal of Agricultural and Food Chemistry. 2004 Jan; 52(2):255-260. doi: 10.1021/jf030117h.
23. Fine AM. Oligomeric proanthocyanidin complexes: history, structure, and phytopharmaceutical applications. Alternative Medicine Review: a Journal of Clinical Therapeutic. 2000 Apr; 5(2):144-151.

24. Yamakoshi J, Saito M, Kataoka S, Kikuchi M. Safety evaluation of proanthocyanidin-rich extract from grape seeds. Food and Chemical Toxicology. 2002 May; 40(5):599-607.
25. Xie Q, Bedran-Russo AK, Wu CD. In vitro remineralization effects of grape seed extract on artificial root caries. Journal of Dentistry. 2008 Nov; 36(11):900-906. doi: 10.1016/j.jdent.2008.07.011.
26. Seghi RR, Denry I. Effects of external bleaching on indentation and abrasion characteristics of human enamel in vitro. Journal of Dental Research. 1992 Jun; 71 (6):1340-1344. doi: 10.1177/00220345920710061201.
27. Sasaki RT, Flório FM, Basting RT. Effect of 10% sodium ascorbate and 10% α-tocopherol in different formulations on the shear bond strength of enamel and dentin submitted to a home-use bleaching treatment. Operative Dentistry. 2009 Nov-Dec; 34(6):746-752.
28. Bistey T, Nagy IP, Simo A, Hegedqs C. In vitro FT-IR study of the effects of hydrogen peroxide on superficial tooth enamel. Journal of Dentistry. 2007 Apr; 35(4):325-330. doi 10.1016/j.jdent.2006.10.004.
29. Barcellos DC, Benetti P, Fernandes VVB, Valera MC. Effect of carbamide peroxide bleaching gel concentration on the bond strength of dental substrates and resin composite. Operative Dentistry. 2010 JulAug; 35(4):463-469. doi 10.2341/09-242-L.
30. Sharafeddin F, Farshad F. The effect of aloe vera, pomegranate peel, grape seed extract, green tea, and sodium ascorbate as antioxidants on the shear bond strength of composite resin to home-bleached enamel. Journal of Dentistry. 2015 Dec; 16(4):296-301.

# AESTHETIC PERCEPTION OF THE SMILE RELATED TO THE VERTICAL POSITION OF THE LOWER ANTERIOR TEETH BY AFRO-DESCENDENT LAYPEOPLE

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**Palavras-chave:** Tratamento Ortodôntico. Sorriso. Estética.

**RESUMO**

**Introdução:** Avaliar a influência da posição vertical dos dentes anteriores inferiores na percepção estética do sorriso de leigos afrodescendentes de diferentes faixas etárias. **Materiais e Métodos:** Um sorriso padrão foi construído a partir de fotografias intraorais de um indivíduo afro-descendente. A posição vertical dos dentes anteriores inferiores foi gradualmente alterada, movendo os dentes para cima e para baixo dentro da moldura do lábio em incrementos de 0,5 mm variando de -1,5 mm a 2,0 mm, em relação ao ponto zero. Utilizando uma escala analógica visual, 150 indivíduos leigos afrodescendentes brasileiros de três diferentes faixas etárias (15-19, 35-44 e 65-74) classificaram a atratividade em relação a 8 sorrisos com exposição gengival alterada. **Resultados:** Não houve diferenças significativas ($p > 0,05$) entre os avaliadores masculino e feminino para os três grupos. Todos os grupos etários atribuíram pontuações mais altas para os sorrisos com cobertura de 0,5 mm do lábio inferior nos incisivos centrais inferiores. No entanto, para os sorrisos menos atraentes, houve diferenças nas opiniões dos grupos etários ($p < 0,05$). **Conclusão:** os grupos etários compartilhavam preferências semelhantes quanto ao sorriso mais agradável em relação às posições verticais dos dentes anteriores inferiores.

**Keywords**: Orthodontic Treatment. Smile. Esthetics.

**ABSTRACT**

**Introduction:** To evaluate the influence of the vertical position of the lower anterior teeth in the aesthetic perception of the smile of Afro-descendent laypeople from different age groups. **Materials and Methods:** A standard smile was constructed from intraoral photographs of an afro-descendent individual. The vertical position of the lower anterior teeth was gradually changed by moving the teeth up and down within the lip frame in 0.5 mm increments ranging from -1.5 mm to 2.0 mm, regarding point zero. Using a visual analog scale, 150 Afro-descendent Brazilian lay individuals from three different age groups (15-19, 35-44 and 65-74) rated the attractiveness in relation to 8 smiles with altered gingival exposure. **Results:** There were no significant differences ($p > 0.05$) between male and female raters for the three groups. All the age groups assigned higher scores for the smiles with 0.5 mm coverage of the lower lip on the lower central incisors. However, for the less attractive smiles, there were differences in the opinions of the age groups ($p < 0,05$). **Conclusions:** the age groups shared similar preferences regarding the most pleasant smile regarding the vertical positions of the lower anterior teeth.

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# INTRODUCTION

One of the facial expressions that arises more interest in people and composes the beauty of it is the smile.[1-3] Therefore, studies have been conducted in order to reach a desired set of common characteristics for an optimal aesthetic smile. This goal is without successful perspective, since culture and ethnicity, values on what is beautiful and ugly or right and wrong vary on different continents, being illusory the idea of reaching a common denominator on this aspect.[4]

It is noticed that the influence of the lower lip and lower anterior teeth on the aesthetics of the smile is little studied compared with the upper lip and the vertical position of the maxillary incisors and canines. However, upper and lower lip work together in order to position the lip frame, as well as the upper and lower front teeth to create an aesthetic smile. Thus, for a smile to be considered aesthetic, it is necessary to observe the interaction between the various components of the smile.[5]

Teeth and gum exposure are important factors regarding the assessment of the aesthetic smile, and their perception varies in different societies.[1] According to Peck and Peck (1972),[6] when aging the upper teeth exposure decreases with consequently an increased exposure of the lower teeth. Despite such evidence, little is known about the impact of reduced upper teeth exposure and higher exposure of the lower teeth in the perception of people in different age groups, and much less in Afro-descendent individuals of different age groups.

Following this line of reasoning this study aimed to assess the degree of perception of aesthetic variations in gingival exposure of lower anterior teeth by African descendent laypeople, from different age groups.

# MATERIALS AND METHODS

This study was conducted in order to Comply CNS 466/2012 resolution, covering any area of research involving human beings. The research protocol was approved by the Ethics Committee in Research of the State University of Southwest Bahia under CAAE number: 17333113.1.0000.0055.

## Sample size

The sample size calculation was performed using nQueryAdviser (version 6.01, statistical Solutions, Cork, Ireland). According to the pilot study, the effect size was estimated to be 0.975. Based on the alpha significance level of 0.05, the sample size was calculated to be able to achieve 80%. The sample size calculation showed that the sample should be between 45 to 90 individuals. For this reason, we used 50 subjects per group.

## Construction of a series of images

A standard smile was constructed from intra–oral photographs of a female individual, 25 years of age, of Afro-descendent ethnicity. This standard smile had the following characteristics: ideally aligned teeth, exposing up to the first molar; lips smiling in an aesthetic way, and harmonization of the curvature of the lower lip relative to the curvature of the incisal edges of maxillary incisors and canines. When the lower lip was positioned in the lower gingival margin of the lower central incisors the level was defined as point zero (0 mm). The vertical position of the lower anterior teeth was gradually changed by moving the teeth upward and downward within the lip frame in increments of 0.5 mm from -1.5 mm to 2.0 mm, relative to point zero. These image modifications were performed using software for image manipulation (Adobe Photoshop CS4, San Jose, CA, USA). A positive value was assigned when a continuous strip of gum was revealed. A negative value was assigned when the lower lip inferior covered the mandibular central incisors.

The evaluation was performed in two stages, in the first stage all images were presented in groups to the evaluators (Figure 1). It was requested to select the image they liked most and their least favorite. In a second sheet the same images had their orders changed randomly and the same inquiries were made (Figure 2). This second evaluation aimed to assess the reliability of the answers given in the first image (Figure 1). In the second phase of the questionnaire, the images were presented individually in random order, in this stage it was requested from the evaluators to punctuate the images from 0-100 points; where 0 represented not very attractive, 50 attractive and 100 very attractive, with the aid of a 100 mm long visual analog scale (VAS).

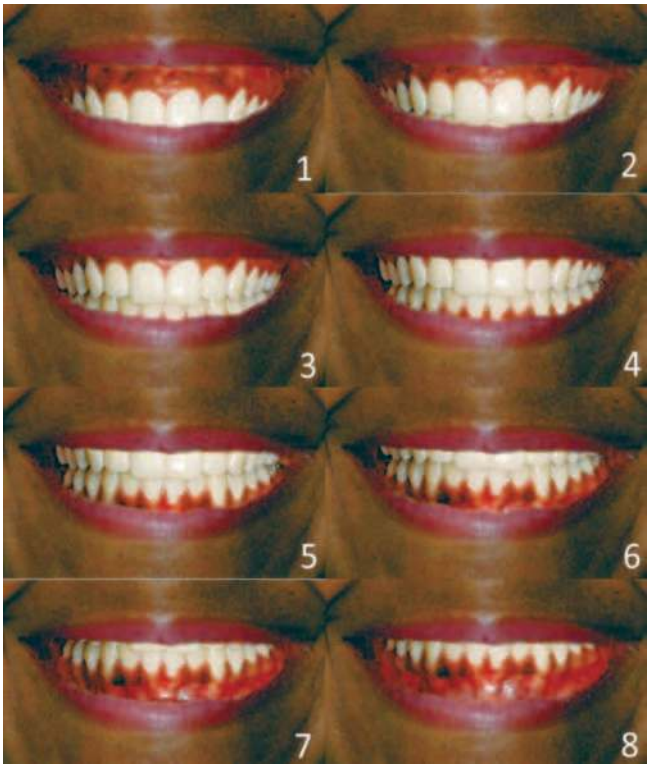


***Figure 1***: *Series of 8 generated images illustrating the range of vertical positions of the anterior teeth: 1; -1.5 mm (1.5 mm coverage of the lower lip on the lower central incisors) 2; -1.0 mm; 3; -0.5 mm, 4; 0mm (standard smile: the lower lip touches the gingival margin of the mandibular central incisors), 5; 0.5 mm (0.5 mm gingival exposure below the lower central incisors), 6; 1.0 mm; 7; 1, 5mm, 8; 2mm.*

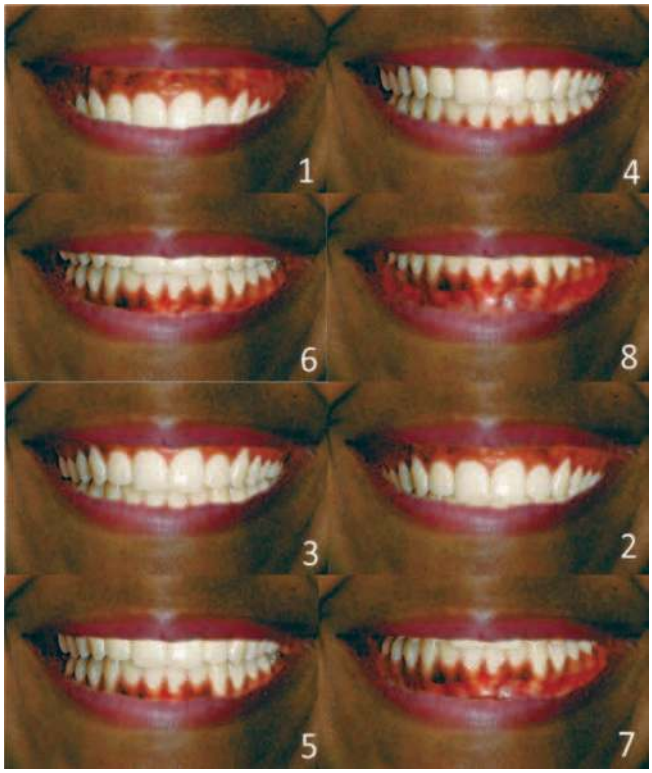


***Figure 2***: *Series of 8 randomized generated images illustrating the range of vertical positions of the anterior teeth: 1; -1.5 mm (1.5 mm coverage of the lower lip on the lower central incisors); 4; 0mm (standard smile: lower lip touches the gingival margin of the mandibular central incisors), 6; 1.0 mm; 8; 2mm, 3; -0.5 mm; 2; -1.0 mm; 5; 0.5 mm (0.5 mm of gingival exposure below the lower central incisors), 7; 1.5 mm.*

### Evaluators

The assessors were Afro-descendent laypeople of three age groups: 15-19, 35-44 and 65-74, of both genders.

### Statistical analysis of data

To compare the distribution of the median scores between male and female evaluators, the Mann-Whitney test was used. The significance level was set at 5 % ($\alpha = 0.05$).

Visual analogue scales are commonly used in research to assess pain and usually a minimal difference on the scale, ranging from 9% to 13%, is adopted as clinically significant.[7,8] In orthodontic research a more conservative criterion has been used, and a 15% difference in the visual analog scale was used by other authors as clinically significant for differentiating the smile's aesthetics.[9,10] In this study, a 15% difference in the visual analog scale was adopted to determine the clinical significance of aesthetic scores. Data were tabulated and analyzed with SPSS Statistics for Windows (IBM SPSS. 21.0, 2012, Armonk, NY: IBM Corp.).

## RESULTS

There was no significant difference ($p>0.05$) between male (n=73) and female (n=77) evaluators in assessing the effect of the vertical positions of the lower anterior teeth on the attractiveness of the smile. Therefore, data from male and female evaluators were pooled for the following analyzes. Median values and ranges of the aesthetic scores for each vertical position of the anterior teeth, according to the evaluation of the three age groups are shown in Figure 3.

The younger age groups (15-19 and 35-44) assigned similar scores in relation to aesthetics of the smile. These scores increased gradually as labial movement occurred in relation to the lower anterior teeth, from -1.5 mm (image 1) to -0.5 mm (Image3). The same groups reduced the scores progressively when the lower lip moved down, revealing growing parts of gingival display, from 0mm (image 4) to +2 mm (Image 8). 0mm was considered as the standard smile (lower lip touches the cervical border of the lower anterior teeth) and positive aesthetic scores (0.5, 1.0, 1.5 and 2.0 mm) when the gums were exposed by lip retraction.

The 65-74 age group shared the same opinion than the previous groups regarding the most attractive smiles. However, for the less attractive smiles, clinically significant decline in their score attribution was observed only from +0.5 mm (Image 5) of mandibular gingival exposure.

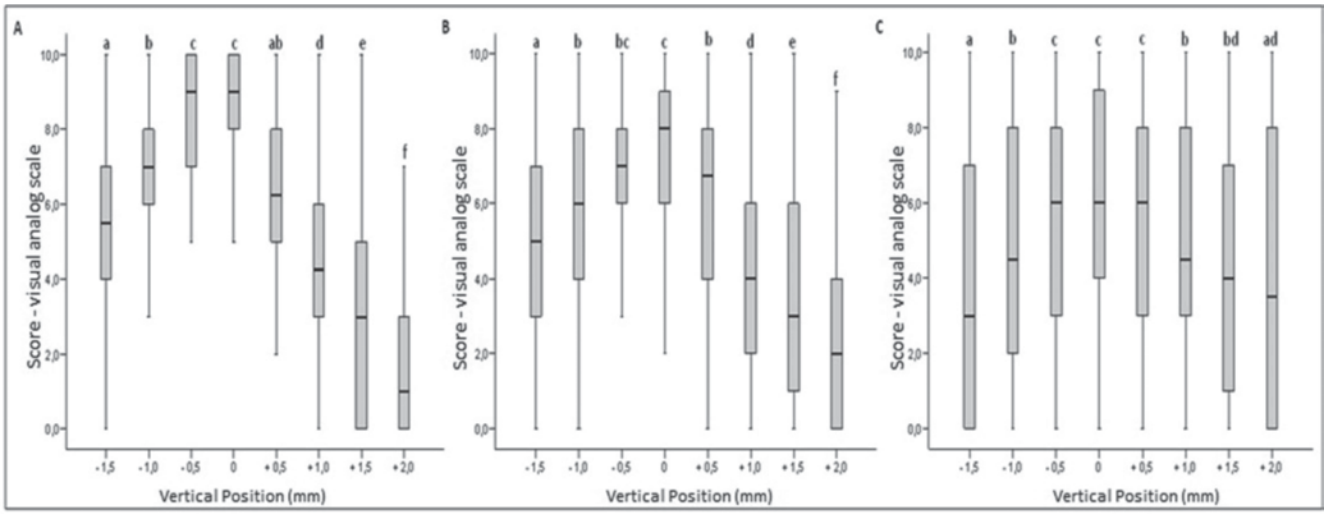


***Figure 3***: *Median values and ranges of the aesthetic scores for each vertical position of the lower anterior teeth. A; evaluators of the 15-19 age group; B; evaluators of the 35-44 age group; C; evaluators of the 65-74 age group. a, b, c, d, e, f Different letters indicate clinically significant diference.*

## DISCUSSION

Obtaining an aesthetic smile that gives satisfaction to the patient is one of the major goals of dental treatment. However, beauty is a concept loaded with subjectivity, thus is it indispensable that there should be tools for the study of society, in order to decrease the existing disparities when classifying the appearance of something as pleasant.

Several studies are found in literature dealing with the determination of an aesthetic smile, with emphasis on the perception of individuals about the influence of superior gingival exposure in this process.[9-11] However, there are few studies on the perception of an aesthetic smile with variations in exposure of the lower incisors. Based on this premise, the aim of the authors of the present study was to evaluate the perception of individuals about the aesthetic smile, when it suffered variations in lower incisor exposure.

Gingival exhibitions, mostly, are not accepted as attractive in a smile. Studies show that the limit of acceptability for aesthetic smiles may vary, finding values as 0 mm, or ranges of acceptability, 0 mm to 1 mm 2,11 or 0 mm to 2mm[10, 11] of gingival exposure for the maxilla and 0mm for the mandíbula.[9] In the present study, young and old lay individuals showed preference to those smiles without gingival exposure or with a small strip of 0.5 mm of mandibular gingival exposure. It can be said that the limit of acceptability for an aesthetic smile, based on the analysis of the mandibular arch in the smile's composition, can range between 0 mm and 0.5 mm of exposure; which is still considered attractive.

An important factor that influences the perception of individuals about the aesthetics of the smile is the ethnic one. This study evaluated the perception of smile aesthetics of a group, Afro-descendents, by laypeople of the same ethnicity. The results of the survey revealed that the groups preferred smiles that showed no lower gingival exposure as mentioned previously: Ahmad (1998)[12] reports in his study that black individuals tend to exhibit less their upper teeth and gums, probably because of the shape and volume of their labial muscles. This fact justifies the data found in this study. In their study, Owens and collaborators (2002)[13] evaluated six clinical variables, including gingival exposure, in 253 patients, which included six different ethnic groups, among which black people showed greater gingival exposure. Differing perceptions appear in literature about the range of gingival exposure related to black people; one of the reasons may be the mixing of races, because an individual considered as a black person can display characteristics of other ethnic groups, thus varying the ranges of exposure of teeth and gum while talking or smiling. Given the premise, to achieve an esthetic and functional occlusion it will be necessary to consider the individual characteristics of each person besides their ethnicity.

Another influential factor in height and aesthetics of the smile is age. Older people tend to have a low smile, while younger people's smiles are generally high, and, with age, medium to low. A gingival smile autocorrects itself with age, except for low smiles.[14] The exposure of teeth undergoes changes during talking and smiling. Thus, compared to older individuals, young people expose more teeth when performing those actions; insofar the lip coverage on the teeth may suffer an increase of 4mm.[15, 16]

The greater compliance for lower smile expressed by the older individuals in the present study confirms that this

trend influences their aesthetic perception, showing greater attractiveness for smiles that cover the lip on the maxillary anterior teeth and lower teeth exposure till exhibiting a small gingival strip. It also evinces the tendency of the young subjects, who consider high smiles more attractive – those exposing the entire crown of the upper anterior teeth - and partly the crown of the lower anterior teeth. Thus, age is a crucial factor to be noted in orthodontic planning.

This study evaluated perception of smile esthetics by individuals of three age groups, 15-19, 35-44 and 65-74, revealing results that demonstrated similarities between their perceptions of the aesthetics of the smile and physiological factors favored by age. In general, all age groups considered smiles with lower lip coverage from 0.5 mm to 1.5 mm on the lower anterior teeth more attractive. They differed minimally solely on strips of gingival exposure which were less attractive. Younger age groups showed less tolerance to lower gingival smile than the older age group. The 15-19 and 35-44 groups considered smiles with 0mm coverage of the lower lip over the lower teeth till 2mm lower gingival exposure less attractive while the scores of the 65-74 group began to decline from 0.5mm of lower gingival exposure.

In recent years, there has been an increase of older patients seeking orthodontic treatment. As it is a recent event, information about the aesthetic preference of individuals from this age group are still scarce,[16] thus justifying this study.

An attractive smile is a key element for patient satisfaction and its analysis is very important for orthodontic diagnosis and treatment planning.[17,18] This study suggests that professionals should recognize the ethnic and age differences in preference and perceptions of patients regarding an aesthetic smile, with more or less lip coverage on the lower anterior teeth, in order to trace, with effectiveness, the orthodontic treatment's goals.

## CONCLUSION

It can be concluded with the completion of this study that:

- The age groups shared similar preferences regarding the most pleasant smile;

- The younger age groups show less preference for smiles with lower gingival exposure, revealing less attractiveness to those with ranges 0mm to 2mm of gingival exposure;

- The 65-74 age group has less preference for smiles with 0.5 mm to 2 mm of gingival exposure on the lower anterior teeth.

## REFERENCES

1. Souza RA, Alves GN, Mattos JM, Coqueiro RDS, Pithon MM, Paiva JB. Perception of attractiveness of missing maxillary lateral incisors replaced by canines. Dental Press J Orthod 2018;23(5):65-74 10.1590/2177-6709.23.5.065-074.oar.

2. Carneiro EN, Pithon MM, Machado AW, Braga E. Perception of facial profile attractiveness of a brown subject displaying different degrees of lip projection or retrusion, in the city of Salvador/Bahia. Dental Press J Orthod 2018;23(2):62-67 10.1590/2177-6709.23.2.062-067.oar.

3. Oliveira PLE, Motta A, Pithon M, Mucha J. Details of pleasing smiles. Int J Esthet Dent 2018;13(4):494-514

4. Ioi H, Kang S, Shimomura T, Kim SS, Park SB, Son WS, et al. Effects of vertical positions of anterior teeth on smile esthetics in Japanese and korean orthodontists and orthodontic patients. J Esthet Restor Dent 2013;25(4):274-82 10.1111/jerd.12032.

5. Ioi H, Nakata S, Counts AL. Influence of gingival display on smile aesthetics in Japanese. Eur J Orthod 2010;32(6):633-7 10.1093/ejo/cjq013.

6. Peck H, Peck S. Esthetics and the aging face: an orthodontic myth. J Mass Dent Soc 1972;21(2):76-82

7. Powell CV, Kelly AM, Williams A. Determining the minimum clinically significant difference in visual analog pain score for children. Ann Emerg Med 2001;37(1):28-31 10.1067/mem.2001.111517.

8. Todd KH, Funk KG, Funk JP, Bonacci R. Clinical significance of reported changes in pain severity. Ann Emerg Med 1996;27(4):485-9

9. Geron S, Atalia W. Influence of sex on the perception of oral and smile esthetics with different gingival display and incisal plane inclination. Angle Orthod 2005;75(5):778-84 10.1043/0003-3219(2005)75[778:IOSOTP]2.0.CO;2.

10. Abu Alhaija ES, Al-Shamsi NO, Al-Khateeb S. Perceptions of Jordanian laypersons and dental professionals to altered smile aesthetics. Eur J Orthod 2011;33(4):450-6 10.1093/ejo/cjq100.

11. Guo J, Gong H, Tian W, Tang W, Bai D. Alteration of gingival exposure and its aesthetic effect. J Craniofac Surg 2011;22(3):909-13 10.1097/SCS.0b013e31820f7f7a.

12. Ahmad I. Geometric considerations in anterior dental aesthetics: restorative principles. Pract Periodontics Aesthet Dent 1998;10(7):813-22; quiz 24

13. Owens EG, Goodacre CJ, Loh PL, Hanke G, Okamura M, Jo KH, et al. A multicenter interracial study of facial appearance. Part 1: A comparison of extraoral parameters. Int J Prosthodont 2002;15(3):273-82

14. Camara CA. Estética em Ortodontia: seis linhas horizontais do sorriso. Dental Press J Orthod 2010;15:118-31

15. Desai S, Upadhyay M, Nanda R. Dynamic smile analysis: changes with age. Am J Orthod Dentofacial Orthop 2009;136(3):310 e1-10; discussion 10-1 10.1016/j.ajodo.2009.01.021.

16. Pabari S, Moles DR, Cunningham SJ. Assessment of motivation and psychological characteristics of adult orthodontic patients. Am J Orthod Dentofacial Orthop 2011;140(6):e263-72 10.1016/j.ajodo.2011.06.022.

17. Wang C, Hu WJ, Liang LZ, Zhang YL, Chung KH. Esthetics and smile-related characteristics assessed by laypersons. J Esthet Restor Dent 2018;30(2):136-45 10.1111/jerd.12356.

18. Lajnert V, Kovacevic Pavicic D, Pavlic A, Pokrajac-Bulian A, Spalj S. Smile Aesthetics Satisfaction Scale: development and validation of a new brief five-item measure of satisfaction with smile aesthetics in adults and the elderly. Int Dent J 2018;68(3):162-70 10.1111/idj.12362.

# MALOCCLUSION TRAITS AND SUCKING HABITS IN PRESCHOOL CHILDREN: A CROSS-SECTIONAL STUDY

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**Palavras-chave**: Má Oclusão. Chupetas. Pré-escolar. Comportamento de Sucção. Estudos Transversais.

**RESUMO**

**Objetivo**: O objetivo foi estimar a prevalência de maloclusões avaliadas em conjunto e separadamente em mordida aberta anterior, sobressaliência acentuada e mordida cruzada posterior, e a possível associação entre elas e os hábitos de sucção e amamentação. **Métodos**: Estudo transversal foi realizado com 472 pré-escolares de 24 a 60 meses e seus pais (taxa de resposta de 86,6%). Três dentistas treinados (Kappa > 0,70) examinaram as crianças para mordida aberta anterior, sobressaliência acentuada e mordida cruzada posterior e os pais responderam a um questionário indicando a presença de amamentação, uso de mamadeira, uso de chupeta, sucção de dedo e tempo de hábito. **Resultados**: A prevalência de maloclusões foi de 38,8%. A sobressaliência acentuada foi o mais prevalente (30,3%), seguido da mordida cruzada posterior (8,9%) e da mordida aberta anterior (7,4%). A regressão de Poisson não ajustada mostrou que as crianças que não foram amamentadas apresentaram 63,0% maior prevalência de maloclusão quando comparadas com aquelas que foram amamentadas (RP 1,63, IC95% 1,06-2,50). A duração do uso de chupeta em meses foi o único hábito que permaneceu no modelo ajustado associado à mordida aberta anterior (RP 1,10, IC 95% 1,05-1,14, p < 0,000) e sobressaliência acentuada (RP 1,03, IC 95% 1,01-1,05, p = 0,004). Para mordida cruzada posterior nenhum hábito mostrou associação no modelo ajustado. Todos os modelos foram ajustados por idade e sexo. **Conclusão**: A sobressaliência acentuada é a maloclusão mais prevalente. O tempo do uso de chupeta está associado à presença de maloclusão, mordida aberta anterior e sobressaliência acentuada. Nenhum dos hábitos investigados está associado à mordida cruzada posterior.

**Keywords**: Malocclusion. Pacifiers. Preschool. Sucking Behavior. Cross-Sectional Studies

**ABSTRACT**

**Objective**: The aim was to evaluate the prevalence of malocclusion traits altogether and separate in anterior open bite, accentuated overjet and posterior cross-bite, and the possible association between them and sucking habits and breastfeeding. **Methods**: A preschool-based cross-sectional study was conducted with 472 children aged 24-60 months and their parents (response rate 86.6%). Three trained dentists (Kappa > 0.70) examine children for anterior open bite, accentuated overjet and posterior cross-bite and parents answered a questionnaire indicating the presence of breastfeeding, bottle usage, pacifier usage, finger sucking and the length of usage of all these habits. **Results**: The prevalence of malocclusion traits was 38.8%, Accentuated overjet was the most prevalent (30.3%) followed by posterior cross-bite (8.9%) and anterior open bite (7.4%). The unadjusted Poisson regression showed that children who were not breastfed had 63.0% more prevalent malocclusion traits when compared with those who were breastfed (RP 1.63, 95%CI 1.06-2.50). Length of pacifier usage in months was the only habit remained in the adjusted model associated with anterior open bite (RP 1.10, 95%CI 1.05-1.14, p < 0.000) and accentuated overjet (RP 1.03, 95%CI 1.01-1.05, p = 0.004). For posterior cross-bite none habit showed association in the adjusted model. All models were adjusted for age and sex. **Conclusion**: Accentuated overjet is the most prevalent malocclusion trait. Length of pacifier usage is associated with the presence of malocclusion traits, anterior open bite and accentuated overjet. None of the investigated habits is associated with posterior cross-bite.

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# INTRODUCTION

Malocclusion development depends on the interactions of factors such as genetics and environmental.[1] It is not new that sucking habits like pacifier usage and finger sucking may influence on the growth imbalance and change what would be a normal occlusion.[2] Attempts were made to diminish this interference like pacifier and bottle nozzle shape, conventional versus orthodontic, although it is still not possible to affirm that the orthodontic shape would protect stomatognathic system.[3]

Conversely it has been proposed that the usage of pacifier may be encouraged due to its beneficial effects on reducing the risk of sudden infant death syndrome[4] even though no randomized controlled trail could confirm this assumption.[5] Nevertheless the prevalence of anterior open bite (AOB) among 24-36 months old children pacifier users ranges from 17 to 96% and the prevalence of posterior cross-bite (PCB) 27 to 88%.[6] And in contrast, among those who were not pacifier users, the malocclusion prevalence reaches only 3%.[7]

There is still controversy related to pacifier usage and breastfeeding. Breastfeeding could be even difficult due to the usage of pacifier[8] or its usage could have no impact on prevalence or duration of breastfeeding at six months of age.[9] In fact, two meta-analyses had suggested that breastfeeding offers protection against malocclusion in children[10] decreasing its risk in primary dentition.[11]

Though sucking habits are still controversial and published recommendations on its usage are contradictory.[12] It has been proposed that malocclusion associated with sucking habits are subjected to its frequency, duration and intensity of usage.[13] Therefore, the objective of the study was to investigate the possible associations of malocclusion and sucking habits and breastfeeding. Also to verify the prevalence of malocclusion traits combined and evaluated separately in AOB, accentuated overjet (AO) and PCB. The study hypothesis was that it would be a direct relation among malocclusion and sucking habits so that children with sucking habit would present more malocclusion traits. It was also hypothesized that children who were breastfeed would have less malocclusion traits.

# MATERIALS AND METHODS

The project was submitted to Plataforma Brasil and the Ethics Committee at The Federal University of Santa Catarina approved it under the number 343.658. All the subjects, children and parents, signed the Informed Consent previously the data collection. The research is reported following the Strobe Guidelines.[14]

## *Sample selection and calculation*

A school-based cross-sectional study was designed to estimate the prevalence of malocclusion traits and to test the association of sucking habits with malocclusion traits in children aged 24-60 months enrolled in public preschools at Florianópolis, Brazil and their parents. The human development index in the city is 0.847 and there were 72 public preschools in 2014, when data were collected (March-September).[15] The estimated population in this age range in the city is considered to be 6349 children.[15]

The sample size calculation was based on a previous study[7] using the comparison of two proportions: 27.8% prevalence of children with posterior cross-bite and using pacifier and 14.6% prevalence of children with increased overjet and no pacifier usage. The calculus was made with the aid of the G*Power 3 analysis (version 3.1, University Dusseldorf, Germany). The considered test power was 90.0% with a standard error 0.3 reaching 454 participants. To compensate for possible losses 20% was added so that the stipulated sample was 545 pairs of child/parent.

All public preschools in the municipality could participate in the study. So children in each classroom were randomly selected. Attempts were made to have the same proportion on each age range in the study.

The inclusion criteria were children enrolled in public preschool and presenting primary teeth. Children were excluded if the behavior during the examination was not collaborative, if they had erupted permanent teeth and/or if they have had previous orthodontic treatment.

## *Training exercise and pilot study*

Three trained dentists performed the oral exams. Coefficient of Kappa was used reaching value >0.7 (inter and intra-examiner). The training was developed in two phases: first theoretic and after 15 days, practical; and a specialist in pediatric dentistry was considered the gold standard. The pilot study was carried out in a preschool near the University with 27 children to test the methodology. Those who participated in the pilot study were not included in the final sample. The pilot study consisted also in testing the questionnaire specially designed for this research. Parents from children participating in the pilot study received and answered the questionnaire, which was deemed appropriate, and no changes were made.

## *Data collection and analysis*

Data were collected using clinical examination and questionnaires send to parents. Three trained dentists examined children in the preschool ambient with the aid of a flashlight and appropriate protective sterilized equipment.

Children remained sited in front of the examiner in a knee-to-knee position allowing good mouth visualization. All malocclusion traits were evaluated with children in maximum habitual intercuspation (MHI). The anterior open bite (AOB) was measured with a millimeter probe perpendicular to the occlusal plane using the distance between the incisal edges of the upper and lower central incisors and was evaluated in present (≥3 mm) and absent (AOB <3 mm, presence of overbite or anterior end-to-end bite).[16] Overjet was measured using a millimeter probe positioned parallel to the occlusal plane and was classified in class III (when negative), end-to-end bite, <3 mm and ≥3 mm. For the analysis purpose, class III was grouped with ≥3 mm so that it was evaluated as accentuated overjet (AO) ≥3 mm and absent (overjet <3 mm and end-to-end bite).[17] This decision was made because only seven children presented class III. Posterior cross-bite (PCB) was classified as absent, when normal transverse relationship between maxillary and mandibular posterior teeth was observed, or present (uni or bilateral), when at least two of the maxillary molars occluded in lingual relation to the lower molars.[18] Each malocclusion trait was analyzed individually and as malocclusion present (AOB, AO and/or PCB present) and absent and then compared.

Questionnaires send to parents had questions concerning breastfeeding, bottle usage, pacifier usage and finger sucking habit. Also, parents responded the length of usage of all these habits in months.

Data were analyzed descriptively and with unadjusted and adjusted Poisson regression with Statistical Package for Social Sciences (SPSS version 21.0; SPSS Inc, Chicago, IL, USA). Confidence intervals (95%CI) and prevalence ratios (PR) were calculated. The significance level was set at 5%. The model was adjusted for age and sex. All the variables presenting p value < 0.05 in the bivariate analysis remained in the adjusted model. Continuous variables were analyzed as such and as categorical variables.

## RESULTS

From the 72 preschools invited to participate (all public preschools in the city) 46 accepted. Those schools that did not accept to participate explained that they had already a nutrition research group working with children. Parents received the invitation with the Informed Consent and after the signing children and parents took part on the research. The response rate was 86.6%, from the 545 pairs of child/parent invited, 472 returned the consent and questionnaires and were examined. Though the needed sample was maintained. The reasons of the losses were children absent in the day the dentists performed the examinations, children who had forgotten to bring the questionnaires and blanked answers in the questionnaires. Table 1 brings the descriptive characteristics of the sample. Most of children were breastfed, although only almost a quarter were exclusively breastfeed, almost three quarters were bottle-fed and almost half of them used pacifier. The prevalence of malocclusion traits was 38.8% being accentuated overjet the most prevalent (30.3%). In the unadjusted analysis only finger sucking was not associated with all types of malocclusion traits as could be seeing in Table 2. The longest children were breastfed were 50 months. Length of pacifier usage and length of finger sucking remained associated with all types of malocclusion traits in the adjusted model (RP 1.03, 95%CI 1.01-1.05 and RP 1.02, 95%CI 1.01-1.04, p=0.001 respectively). Each month using pacifier increased the prevalence of malocclusion traits in 3.0% and each month of finger sucking increased malocclusion traits in 2.0% adjusted for age, sex, breastfeeding, length of breastfeeding, bottle usage, length of bottle usage, pacifier usage and length of finger sucking usage. Analyzing the different types of malocclusion traits, most of the independent variables were associated with AOB and AO in the unadjusted models. For PCB only pacifier usage and length of pacifier usage were associated in the unadjusted model as could be seeing in Table 3, though they lost the significance in the adjusted model. Length of pacifier usage in months was the only habit remained in the adjusted model associated with AOB (RP 1.10, 95%CI 1.05-1.14, p < 0.000) and AO (RP 1.03, 95%CI 1.01-1.05, p = 0.004). There were children still using pacifier in the moment of the data collection, which means 60 months.

## DISCUSSION

The study results suggest that length of pacifier usage is associated with malocclusion traits irrespective of the presence and length of breastfeeding. Confirming one of the study hypothesis and refuting the other one. It is important to highlight that most of children presented more than one sucking habit simultaneously and only few were exclusively breastfeed and this in turn could influence the outcomes.

Data on the prevalence of malocclusion traits in this study (38.8%) diverges from a national Brazilian survey were 63.3% of children aged 60 months presented malocclusion. In that study, among cities, the higher the prevalence of breastfeeding at 12 months of age the lower the prevalence of malocclusion at 60 months.[19] Maybe those differences are due to participant age. In the present study there were children younger than 60 months. Although studies had found breastfeeding could protect children from developing

***Table 1***: *Descriptive characteristics of malocclusion and sucking habits (n=472).*

| Variables | n | % |
|---|---|---|
| **Sex** | | |
| Male | 249 | 52.8 |
| Female | 223 | 47.2 |
| **Age** | | |
| 2-3 | 203 | 43.0 |
| 4-5 | 269 | 57.0 |
| **Breastfeeding** | | |
| Yes | 432 | 91.5 |
| No | 40 | 8.5 |
| **Bottle use** | | |
| No | 125 | 26.5 |
| Yes | 347 | 73.5 |
| **Pacifier use** | | |
| No | 242 | 51.3 |
| Yes | 230 | 48.7 |
| **Finger sucking** | | |
| No | 443 | 93.9 |
| Yes | 29 | 6.1 |
| **Malocclusion** | | |
| Absent | 289 | 61.2 |
| Present | 183 | 38.8 |
| **Anterior open bite** | | |
| < 3 mm | 437 | 92.5 |
| ≥ 3 mm | 35 | 7.5 |
| **Accentuated overjet** | | |
| < 3 mm | 329 | 69.7 |
| ≥ 3 mm | 143 | 30.3 |
| **Posterior crossbite** | | |
| Absent | 430 | 91.1 |
| Uni/bilateral | 42 | 8.9 |
| **Associated habits** | | |
| Breastfeeding only | 103 | 21.8 |
| Breastfeeding+ Bottle use | 113 | 23.9 |
| Breastfeeding+ Bottle use+ Pacifier use | 176 | 37.2 |
| Breastfeeding+ Bottle use+ Pacifier use+ Finger sucking | 6 | 1.2 |
| Breastfeeding+ Bottle use+ Finger sucking | 14 | 2.9 |
| Breastfeeding +Pacifier use | 17 | 3.6 |
| Breastfeeding+ Pacifier use+ Finger sucking | 1 | 0.2 |
| Breastfeeding+ Finger sucking | 2 | 0.4 |
| Bottle use+ Pacifier use | 27 | 5.7 |
| Bottle use+ Finger sucking | 4 | 0.8 |
| Bottle use+ Pacifier use+ Finger sucking | 2 | 0.4 |
| Bottle use only | 5 | 1.0 |
| Pacifier use only | 1 | 0.2 |
| None | 1 | 0.2 |
| **Length of habit** | **Mean (months)** | **SD** |
| Breastfeeding | 14.5 | 12.1 |
| Bottle use | 22.3 | 16.6 |
| Pacifier use | 13.9 | 16.3 |
| Finger sucking | 1.6 | 7.4 |
| **Habit** | **Malocclusion** | |
| | **Absent (n= 289; 61.2%)** | **Present (n= 183; 38.8%)** |
| Breastfeeding | | |
| Yes | 273 (63.2) | 159 (36.8) |
| No | 16 (40.0) | 24 (60.0) |
| Bottle use | | |
| Yes | 196 (56.5) | 151 (43.5) |
| No | 93 (74.4) | 32 (25.6) |
| Pacifier use | | |
| Yes | 104 (45.2) | 126 (54.8) |
| No | 185 (76.4) | 57 (23.6) |
| Finger sucking | | |
| Yes | 12 (41.4) | 17 (58.6) |
| No | 277 (62.5) | 166 (37.5) |

*Note: SD - Standard deviation.*

malocclusion traits,[11] in this research this association lost significance in the adjusted model.

Generally finger sucking brings worst outcome in the development of malocclusion traits in children when compared to pacifier usage[20] considering that it is easier to loose the pacifier habit. In this study finger sucking was neither associated with malocclusion traits combined nor when they were evaluated separately maybe because of the small number of children presenting the habit. Although it is important to observe that the sample size calculation was based on the pacifier habit and maybe the small number found of children with finger sucking habit in due to this fact. Besides that, only length of finger sucking was associated with malocclusion. Also, it was observed that none of the sucking habits were associated with PCB perhaps because the length of the habits combined with children's growth patterns were not enough to contribute to the development of this kind of malocclusion. Although is not possible to affirm this since facial growth patterns were not assessed, which could be considered a limitation of the study.

The most important result of the study is the association of length of pacifier usage with malocclusion traits combined, with AOB and AO corroborating with previous study.[7,11,18] It is important to address that class III malocclusion was grouped with overjet e ≥ 3 mm in the present study because of the small number of observed children with this malocclusion type and this could have influenced the result increasing the percentage of AO. A recent systematic

***Table 2***: *Unadjusted and adjusted Poisson regression models for independent variables associated with all malocclusion types combined. Florianopolis/SC*

| Variables | Malocclusion | | | |
|---|---|---|---|---|
| | Unadjusted | | Adjusted | |
| | PR (IC95%) | P value | PR (IC95%) | P value |
| **Age (years)** | | | | |
| 1-3 | 1 | 0.72 | 1 | 0.51 |
| 4-5 | 1.05 (0.78-1.40) | | 1.10 (0.81-1.48) | |
| **Sex** | | | | |
| Male | 1 | 0.79 | 1 | 0.94 |
| Female | 1.03 (0.77-1.39) | | 0.99 (0.73-1.33) | |
| **Breastfeeding** | | | | |
| Yes | 1 | 0.026* | 1 | 0.40 |
| No | 1.63 (1.06-2.50) | | 0.81 (0.50-1.31) | |
| **Length of breastfeeding** | 0.98 (0.96-0.99) | 0.004* | 1.00 (0.99-1.02) | 0.46 |
| | | | | |
| No | 1 | 0.006* | 1 | 0.31 |
| Yes | 1.70 (1.16-2.48) | | 0.72 (0.38-1.36) | |
| **Length of bottle usage** | 1.01 (1.00-1.01) | 0.030* | 0.99 (0.97-1.00) | 0.35 |
| | | | | |
| No | 1 | <0.000* | 1 | 0.94 |
| Yes | 2.32 (1.70-3.18) | | 1.02 (0.54-1.93) | |
| **Length of pacifier usage** | 1.02 (1.01-1.03) | <0.000* | 1.03 (1.01-1.05) | 0.001 |
| | | | | |
| No | 1 | 0.079 | | |
| Yes | 1.56 (0.95-2.57) | | | 0.001 |
| **Length of finger sucking** | 1.01 (1.00-1.03) | 0.030* | 1.02 (1.01-1.04) | |

*Note: Adjusted for age and sex. All length measured in months. *p value < 0.05 indicates statistical significance.*

***Table 3***: *Unadjusted and adjusted Poisson regression models for independent variables associated with different types of malocclusion separately. Florianopolis/SC*

| Variables | Anterior open bite (AOB) | | | | Accentuated overjet (AO) | | | | Posterior crossbite(PC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Unadjusted | | Adjusted | | Unadjusted | | Adjusted | | Unadjusted | | Adjusted | |
| | PR (IC95%) | P value | PR (IC95%) | P value | PR (IC95%) | P value | PR (IC95%) | P value | PR (IC95%) | P value | PR (IC95%) | P value |
| **Age (years)** | | | | | | | | | | | | |
| 1-3 | 1 | 0.50 | 1 | 0.21 | 1 | 0.80 | 1 | 0.95 | 1 | 0.52 | 1 | 0.42 |
| 4-5 | 0.79 (0.41-1.55) | | 1.52 (0.77-2.99) | | 0.95 (0.68-1.33) | | 1.01 (0.72-1.41) | | 1.22 (0.65-2.28) | | 1.29 (0.68-2.410 | |
| **Sex** | | | | | | | | | | | | |
| Male | 1 | 0.24 | 1 | 0.24 | 1 | 0.92 | 1 | 0.57 | 1 | 0.33 | 1 | 0.33 |
| Female | 1.48 (0.76-2-90) | | 0.65 (0.31-1.34) | | 0.98 (0.70-1.36) | | 0.90 (0.64-1.27) | | 1.35 (0.73-2.48) | | 1.35 (0.73-2.48) | |
| **Breastfeeding** | | | | | | | | | | | | |
| Yes | 1 | 0.073 | | | 1 | 0.041* | 1 | 0.44 | 1 | 0.800 | | |
| No | 2.23 (0.92-5.38) | | | | 1.65 (1.02-2.68) | | 0.81 (1.47-1.38) | | 1.13 (0.40-3.18) | | | |
| **Length of breastfeeding** | 0.93 (0.89-0.97) | 0.001* | 0.99 (0.94-1.03) | 0.65 | 0.98 (0.97-0.99) | 0.015* | 1.00 (0.98-1.02) | 0.61 | 0.97 (0.95-1.00) | 0.114 | | |
| **Bottle usage** | | | | | | | | | | | | |
| No | 1 | 0.014* | 1 | 0.44 | 1 | 0.016* | 1 | 0.43 | 1 | 0.278 | | |
| Yes | 5.94 (1.42-24.77) | | 0.48 (0.07-3-11) | | 1.70 (1.10-2.61) | | 0.74 (0.36-1.55) | | 1.53 (0.70-3.30) | | | |
| **Length of bottle usage** | 1.02 (1.00-1.05) | 0.008* | 0.98 (0.95-1.01) | 0.38 | 1.01 (1.00-1.02) | 0.034* | 0.99 (0.98-1.01) | 0.69 | 1.00 (0.98-1.02) | 0.880 | | |
| **Pacifier usage** | | | | | | | 1 | 0.56 | | | | |
| No | 1 | <0.000* | 1 | 0.57 | 1 | <0.000* | 1.24 (0.59-2.60) | | 1 | <0.000* | 1 | 0.37 |
| Yes | 17.36 (4.16-72.34) | | 1.82 (0.21-15.15) | | 1.95 (1.38-2.76) | | | | 3.85 (1.84-8.06) | | 0.56 (0.15-2.00) | |
| **Length of pacifier usage** | 1.08 (1.06-1.11) | <0.000* | 1.10 (1.05-1.14) | <0.000* | 1.02 (1.01-1.03) | <0.000* | 1.03 (1.01-1.05) | 0.004* | 1.03 (1.02-1.05) | <0.000* | 1.02 (0.99-1.06) | 0.11 |
| **Finger sucking** | | | | | | | | | | | | |
| No | 1 | 0.552 | | | 1 | 0.033* | 1 | 0.79 | 1 | 0.329 | | |
| Yes | 1.43 (0.43-4.67) | | | | 1.79 (1.04-2.05) | | 0.85 (0.25-2.85) | | 0.37 (0.05-2.70) | | | |
| **Length of finger sucking** | 1.01 (0.98-1.05) | 0.392 | | | 1.01 (1.00-1.03) | 0.018* | 1.02 (0.98-1.06) | 0.21 | 0.98 (0.92-1.03) | 0.501 | | |

*Note: Adjusted for age and sex. All length measured in months. *p value < 0.05 indicates statistical significance.*

review observed that irrespective of the pacifier shape, children that had the habit of sucking pacifier experienced higher prevalence of malocclusion traits when compared to those that did not had the habit.[21] Auto correction of AOB is reported to occur if the habit is abandoned up to 4-6 years of age,[22] although the American Academy of Pediatric Dentistry recommends children stopping sucking habits up to 36 months old or younger.[23] Nevertheless it is important to address that breastfeeding could reduce the risk of developing maloclusion,[11] although in the present study this association was not found.

Although it was not the scope of this study, literature suggests that in order to minimize the consequences of pacifier usage on the children's occlusion, it is important to limit hours of usage to a maximum of 4-6 a day.[13]

The study has limitations that restrict generalizations. All those related to the cross-sectional design that does not allow cause-effect conclusions since evaluate cause and outcome in the same moment. Besides, only public preschools participated in the sampling so it does not represent all children in the city. Population socioeconomic characteristics were not investigated, although it is known that the city has a good human development index, it is not enough to affirm that it represents all socioeconomic strata with all its implication considering that Brazil has significant social differences. Another important limitation is that only duration of the habits were investigated and it is known that the frequency and intensity have influence on malocclusion development. Plus, facial growth patterns, genetics, timing and sequence of primary teeth eruption were not evaluated. Finally, another limitation was that parents could have had difficulty remembering details of their children sucking habits.

The study also has strengths, the adequate sample size calculation and sampling method, pilot study and trained examiners with an adequate diagnostic method. Longitudinal studies evaluating duration, frequency and intensity of the sucking habits are still needed to better determine in what extend they may influence in malocclusion traits.

Health professionals in charge of children generally guide advice to parents on breastfeeding and sucking behaviors so the better their knowledge on the subject the better information they will be able to pass. In this sense the study reinforce the importance of breastfeeding[11] and the rational usage of pacifier.[23] When its usage could not be avoided, it is essential to limit the usage only when children are going to sleep, keeping it in mouth for the maximum of 6 hours a day[22] and encourage the abandonment up to 36 months of age,[23] when it is still possible to recover the normal occlusion.

# CONCLUSION

AO is the most prevalent malocclusion trait. Length of pacifier usage is associated with the presence of malocclusion traits, AOB and AO. None of the investigated habits is associated with PCB.

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# REFERENCES

1.Moss ML, Salentijn L. The primary role of functional matrices in facial growth. Am J Orthod Dentofacial Orthop. 1969;55(6):566-577.
2.da Silva Filho OG, Gomes Gloncalves RJ, Maia FA. Sucking habits: clinical management in dentistry. J Clin Pediatr Dent. 1991;15(3):137-156.
3.Correa Cde C, Bueno Mda R, Lauris JR, Berretin-Felix G. Interference of conventional and orthodontic nipples in system stomatognatic: systematic review. CoDAS. 2016;28(2):182-189.
4.Alm B, Wennergren G, Mollborg P, Lagercrantz H. Breastfeeding and dummy use have a protective effect on sudden infant death syndrome. Acta Paediatr. 2016;105(1):31-38.
5.Psaila K, Foster JP, Pulbrook N, Jeffery HE. Infant pacifiers for reduction in risk of sudden infant death syndrome. The Cochrane database of systematic reviews. 2017;4:Cd011147.
6.Lima AA, Alves CM, Ribeiro CC, Pereira AL, da Silva AA, Silva LF, et al. Effects of conventional and orthodontic pacifiers on the dental occlusion of children aged 24-36 months old. Int J Clin Pediatr Dent. 2017;27(2):108-119.
7.Nihi VS, Maciel SM, Jarrus ME, Nihi FM, Salles CL, Pascotto RC, et al. Pacifier-sucking habit duration and frequency on occlusal and myofunctional alterations in preschool children. Braz Oral Res. 2015;29:1-7.
8.Kramer MS, Barr RG, Dagenais S, Yang H, Jones P, Ciofani L, et al. Pacifier use, early weaning, and cry/fuss behavior: a randomized controlled trial. Jama. 2001;286(3):322-326.
9.Collins CT, Ryan P, Crowther CA, McPhee AJ, Paterson S, Hiller JE. Effect of bottles, cups, and dummies on breast feeding in preterm infants: a randomised controlled trial. BMJ. 2004;329(7459):193-198.
10 Victora CG, Bahl R, Barros AJ, Franca GV, Horton S,
Krasevec J, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. Lancet. 2016;387(10017):475-490.
11.Peres KG, Cascaes AM, Nascimento GG, Victora CG. Effect of breastfeeding on malocclusions: a systematic review and meta-analysis. Acta Paediatr. 2015;104(467):54-61.
12.Nelson AM. A comprehensive review of evidence and current recommendations related to pacifier usage. J Pediatr Nurs. 2012;27(6):690-699.
13.Warren JJ, Levy SM, Nowak AJ, Tang S. Non-nutritive sucking behaviors in preschool children: a longitudinal study. Pediatr Dent. 2000;22(3):187-191.
14.Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. PLoS medicine. 2007;4(10):e296.

15.Brazilian Institute of Geography and Statistics | cities | Santa Catarina | Florianopolis | School-enrollment, Teachers and School Network. Cited April 2018. Available from: https://cidades.ibge.gov.br/brasil/sc/florianopolis/pesquisa/13/5902.
16.Thilander B, Pena L, Infante C, Parada SS, de Mayorga C. Prevalence of malocclusion and orthodontic treatment need in children and adolescents in Bogota, Colombia. An epidemiological study related to different stages of dental development. Eur J Orthod. 2001;23(2):153-167.
17.Aldrigui JM, Abanto J, Carvalho TS, Mendes FM, Wanderley MT, Bonecker M, et al. Impact of traumatic dental injuries and malocclusions on quality of life of young children. Health Qual Life Outcomes. 2011;9:78.
18.Mendes ACR, VAlençA AMG, de Lima CC. Associação entre aleitamento, hábitos de sucção não-nutritivos e maloclusões em crianças de 3 a 5 anos. Braz Dent Sci. 2010;11(1).
19.Correa-Faria P, de Abreu M, Jordao LMR, Freire M, Costa LR. Association of breastfeeding and malocclusion in 5-year-old children: Multilevel approach. Int J Clin Pediatr Dent. 2018;28(6):602-607. doi: 10.1111/ipd.12417. [Epub 2018 Aug 8].
20.Tomita NE, Sheiham A, Bijella VT, Franco LJ. Relação entre determinantes socioeconômicos e hábitos bucais de risco para más-oclusões em pré-escolares. Pesqui Odontol Bras. 2000;14:169-175.
21.Medeiros R, Ximenes M, Massignan C, Flores-Mir C, Vieira R, Porporatti AL, et al. Malocclusion prevention through the usage of an orthodontic pacifier compared to a conventional pacifier: a systematic review. Eur Arch Paediatr Dent. 2018 Oct;19(5):287-295. doi: 10.1007/s40368-018-0359-3. [Epub 2018 Jul 27].
22.Heimer MV, Tornisiello Katz CR, Rosenblatt A. Non-nutritive sucking habits, dental malocclusions, and facial morphology in Brazilian children: a longitudinal study. Eur J Orthod. 2008;30(6):580-585.
23.Guideline on Management of the Developing Dentition and Occlusion in Pediatric Dentistry. Pediatr Dent. 2016;38(6):289-301.

# GARRÉ'S OSTEOMYELITIS: A CASE REPORT WITH A 6-MONTH FOLLOW-UP

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**Palavras-chave:** Osteomielite de Garrè. Tomografia Computadorizada. Antibioticoterapia. Remodelação óssea.

**RESUMO**

**Introdução:** A osteomielite de Garrè é um tipo raro e crônico de infecção óssea associado a periostite proliferativa que induz neoformação óssea reacional. **Objetivo:** relatar o caso clínico de osteomielite de Garrè em uma paciente jovem tratada com sucesso. **Relato de caso**: Paciente do gênero feminino, 11 anos compareceu ao serviço odontológico com queixa de aumento de volume em borda de mandíbula acompanhada de dor e assimetria facial. A tomografia computadorizada revelou extensa destruição dentária associada a lesão periapical e a presença de várias laminações ósseas radiopacas paralelas ao cortical da mandibula, sugerindo o diagnóstico de osteomielite de Garrè. O caso foi tratado com a remoção do elemento dentário associado a antibioticoterapia, o que resolveu completamente a infecção e diminuiu a assimetria facial conforme constatado após 6 meses de proservação. **Conclusão:** Uma vez estabelecido o diagnóstico de osteomielite de Garrè, e a infecção adequadamente tratada, o prognóstico tende a ser extremamente favorável e a remodelação óssea deve ocorrer continuamente até que a superfície retorne à sua anatomia normal.

**Keywords:** Garrè's osteomyelitis. Computed Tomography. Antibiotic Therapy. Bone Remodeling.

**ABSTRACT**

**Introduction:** Garrè's osteomyelitis is a rare, chronic infection associated with proliferative periostitis that induces reactional bone neoformation. **Objective:** To report the clinical case of successful treatment of Garre's osteomyelitis in a young patient. **Case report:** An 11-year-old girl visited a dental clinic with complaints of volume increase in the mandibular border accompanied by pain and facial asymmetry. Computed tomography revealed extensive tooth destruction, a periapical lesion, and several radiopaque bone laminations parallel to the mandible cortex, all findings suggestive of Garrè's osteomyelitis. The patient was treated by tooth removal and antibiotic therapy, and the condition was completely resolved, with decreased facial asymmetry at the 6-month follow up. **Conclusion:** Once the diagnosis of Garrè's osteomyelitis is established and proper treatment is provided, the prognosis tends to be extremely favorable and bone remodeling should be considered until the affected surface returns to its normal anatomy.

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## INTRODUCTION

Garré's osteomyelitis is a chronic osteal infection, also known as ossifying periostitis. This condition is also referred to as osteomyelitis with proliferative periostitis, ossificating periostitis, non-suppurative ossifying periostitis, Garrè's periostitis, and peri-mandibular ossification; its etiology or pathophysiology are still under speculation.[1-3]

Garrè's osteomyelitis presents as an infection with periosteal reaction that induces new bone formation. It affects children and young adults, with an average onset age of 13 years. It mostly occurs in the region of the mandibular premolars and molars, but it can also affect the maxilla and metaphysis of long bones such as the tibia and femur.[1,4-6] The majority of

cases originate from periapical inflammatory disorders associated with dental cavities, but other possible causes include periodontal infections, fractures, vestibular bifurcation cysts, and non-odontogenic infections.[5,7] Clinically, patients usually present asymptomatic facial asymmetry caused by a localized swelling over the mandibular margin, with normal or slightly erythematous skin. It can be associated with pain, regional lymphadenopathy, trismus, and fever. The condition is predominantly unilateral, although reports of multiple quadrants affected are present in the literature. Typically, the oral mucosa remains unaltered.[1,5,8,9]

Clinical and radiographic examinations are fundamental for the diagnosis of Garrè's osteomyelitis. Occlusal and panoramic radiographs, as well as computed tomography (CT) can be successfully used for diagnosis. Radiological findings include new bone formation that shows a pattern of parallel radiopaque bone laminations along the underlying cortical bone, in a shape that resembles onion peels.[5,10] Bone sequestration or osteolysis may present as radiolucent areas within the neoformed bone. Because of the pattern of periosteal bone neoformation, other diseases should be considered in the differential diagnosis, such as Ewing's sarcoma, fibrous dysplasia, osteogenic sarcoma, osteoma, metastatic neuroblastoma, infantile cortical hyperostosis, congenital syphilis Langerhans cells histiocytosis and Caffey disease.[1,11,12]

Garrè's ostiomyelitis is typically treated by eliminating the odontogenic cause of the infection by extraction or endodontic treatment of the evolved tooth. To accelerate and improve infection resolution, the use of antibiotic therapy with pathogen identification, drainage, removal of osseous tissue, and debridement may also be used.[1,13] After the infection is resolved, bone layers are expected to consolidate within 6-12 weeks with the aid of the surrounding musculature, which will contribute to the bone remodeling. The prognosis is often favorable when the cause is completely removed and antibiotic therapy is administered.[5]

## CASE REPORT

A 11-year-old black female patient was brought to the stomatology service of the Federal University of Rio de Janeiro, with complaints of toothache and facial asymmetry. The patient presented a large cavity in her permanent lower first molar, and extra-oral examination revealed increased volume on the left side of the mandible with firm consistency and slight skin color alteration (Figure 1); however, no cervical lymph node was detected. On intraoral examination, the patient showed an extensive cavity on the left mandibular first molar, extensive destruction of the dental crown that reached root furcation, and slight bulging of the vestibular



***Figure 1***: *Frontal view of the patient showing well-delimited swelling in left side of the jaw (arrow).*




***Figure 2***: *Panoramic reconstruction of cone beam CT showing an extensive radiolucent image associated with the first mandibular molar, with bone rarefaction and radiopaque bone laminations on the cortical surface resembling "onion peels."*

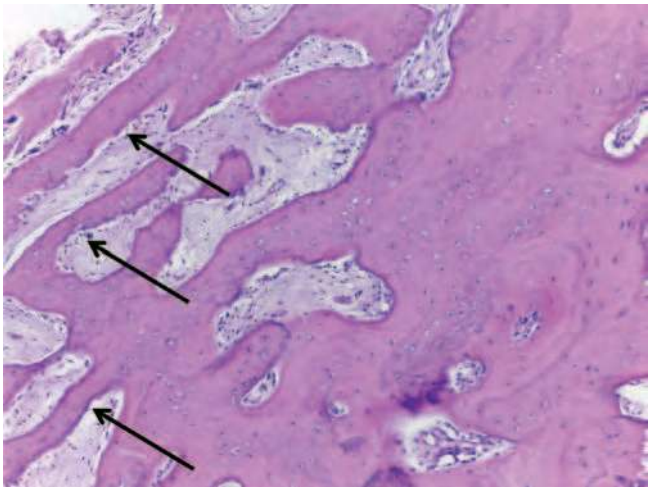

***Figure 3***: *Histopathological analysis shows parallel rows of richly cellularized reactive trabecular bone extending from the cortical surface (thin arrows).*




***Figure 4***: *(A) Frontal view of the patient at the 6-month follow-up showing no facial asymmetry. (B) Panoramic radiographic image evidencing significant bone remodeling in the mandible ridge (arrow).*

alveolar ridge. CT revealed an extensive periapical lesion evidenced by a well-delimited radiolucent area involving the apex of the compromised tooth, as well as new bone formation among the cortical border presented as radiopaque laminations that resembled onion peels. The findings were suggestive of Garrè's osteomyelitis (Figure 2).

Treatment involved the removal of the left first mandibular molar, followed by extensive curettage of the adjacent alveolar bone and antibiotic therapy with amoxicillin 1.5 g/day for 10 days. The collected material was sent for histopathological analysis, which showed parallel rows of highly cellular and reactive trabecular bone (Figure 3), confirming the diagnosis of Garrè's osteomyelitis. After treatment, the signs and symptoms of the infection were completely resolved and the process of bone neoformation had initiated. Follow-up was conducted at 6 months and the decrease in facial asymmetry and bone structure remodeling was evidenced by radiographic and imaging records (Figure 4).

The patient's legal guardian was duly advised and agreed to the terms of permission to publish her case according to free and informed consent.

## DISCUSSION

Garrè's osteomyelitis is a rare pathological condition that mostly affects young patients with a mean age of 13 years. Several hypotheses have been made to explain the high prevalence of the condition in children and adolescents. Some hypothesis postulate that the high periosteum activity in young individuals can react strongly against low virulence infections or that an imbalance between the osteoblastic and osteoclastic activities may enable the predominance of osteoblastic activity.[1-6,14]

In most cases, Garrè's osteomyelitis originates from lesions of mandibular permanent molars, as reported in the present study. The extent of the lesion as well as its clinical symptoms depend on microbiological factors such as the degree of virulence of the microorganism, and on the immunological state of the host.[1,6,14] Some studies suggest that because the mandibular first molars are the first permanent teeth to erupt, they become more susceptible to cariogenic agents, and therefore are more frequently involved in the disease.[1] Nevertheless, a few cases of Garré's osteomyelitis caused by impacted third molars that can lead to a very low-grade infection or inflammation able to trigger new periosteal bone formation have also been reported in pre-teen patients.[15]

The case of Garrè's osteomyelitis presented here was focal and unilateral, which is the most usual presentation of this condition. However, a multiple quadrant situation may be also be observed in a small percentage of cases, according to a previous study.[16]

Radiographic examinations are essential to reach the diagnosis of Garrè's osteomyelitis. Among the available methods, CT has many advantages and is an effective tool for assessing the extent and contour of lesions, as well as the involvement of surrounding structures. In fact, the existence of a communication channel between an infected tooth and bone expansion observed on CT can be used as additional criteria to diagnose Garrè's osteomyelitis caused by endodontic infection.[17] In the present case, the initial CT revealed areas of radiopaque bone lamellae parallel to each other and to the surface of the cortical bone of the mandible. This pattern is often described by the literature as "onion peels," and is one of the most consistent radiographic characteristic of Garrè's osteomyelitis. These laminations

may range from 1 to 12 lamellae, and are often separated by radiolucent areas.[5] Although the diagnosis can be established by clinical and radiographic examination alone, in this case, the authors decided to send any collected material for histopathological analysis, and that allowed a definitive diagnosis.

Histopathological descriptions of Garrè's osteomyelitis present in the literature are quite similar to the microscopic features observed in this case. The literature describes the histological aspect of Garrè's osteomyelitis as parallel rows of highly cellular reactive trabecular bone surrounded by osteoblasts. The rows are often parallel to each other and perpendicular to the cortical surface, with relatively non-inflamed fibrous connective tissue between them. The literature also states that when bone sequestration is present, typical histological features of bone necrosis can be observed.[1,5]

The treatment of Garrè's osteomyelitis typically involves eliminating the infection either by tooth removal or an endodontic approach.[1,5] In this case report, tooth removal associated with antibiotic therapy was selected due to the high destruction of the dental structure and severity of the infection dissemination. The 6-month follow-up included panoramic radiography at different moments, allowing the evaluation of alveolar bone neoformation, as well as the remodeling of the lower mandibular border.

Garrè osteomyelitis has predilection for young patients and, if untreated, can lead to facial asymmetry and discomfort for the patient. Diagnosis can be achieved through clinical and radiographic examination alone, although in this case, we proved the usefulness of confirmation by histopathological analysis. The authors chose to perform histological evaluation because it is very important in cases where the classic presence of pulp necrosis with a periapical lesion and well-defined bone neoformation forming layers on the cortical surface is not evident. Thus, histological analysis helps exclude all other differential diagnoses. Finally, this case report confirms previous findings that when treatment is correctly performed, prognosis can be favorable and bone remodeling should be considered until the bone surface returns to its normal anatomy.

## REFERENCES

1- Silva, MM, Castro, AL, Castro, EVFL, Coclete, GA. Garré's osteomyelitis. An update and report of two new cases. Rev. bras. odontol. 2009 Jan/Jun; 66 (1): 8-11.
2- Jacobson, HLJ, Baumgartner, JC, Marshall, JG, et al. Proliferative periodontitis of Garré: Report of a case. Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod. 2002Jul; 94 (1): 111-114.
3- Moares, FB, Motta TMV, A Severin AA, et al. Garré's sclerosing osteomyelitis: case report. Rev Bras Ortop. 2014; 49 (4): 401-404.
4- Zand, V, Lotfi, M, Vosoughhosseini, S. Proliferative Periostitis: A Case Report. J Endod. 2008; 34: 481-483.
5- Neville BW, Damm OD, Allen CM, Bouquot JE. Oral and maxillofacial pathology. 2ª ed. Philadelphia: Saunders, 2009.
6- Kannan, SK, Sandhya, G, Selva-rant, R. Periostitis ossificans (Garre's osteomyelitis) radiographic study and two cases. Int. J. Pediatric. Dent., 2006 Jan; 16 (1): 59-64.
7- Sugaya, NN, Pedote, CM, Birman, EG. General considerations on the "osteomyelitis" of Garrè: report of a case. Rev. Fac. Odontol. F. Z. L. 1991 Jul / Dec; 3 (2): 99-105.
8- Castro, FPSS, Guaré, RO Mathias, RS. Garré Osteomyelitis: general considerations and clinical case report. Ver. ABO Nac. 2001 Aug / Sep; 9 (4): 247-250.
9- Kadom N, Egloff A, Obeid G, Bandarkar A, Vezina G. Juvenile mandibular chronic osteomyelitis: multimodality imaging findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011; 111 (3): 38-43.
10- Nortjé, CJ, Wood, RE, Grotepass, F. Periostitis ossificans versus Garrè's osteomyelitis. Part II: Radiologic analysis of 93 cases in the jaws. Oral Surg Oral Med Oral Pathol. 1988 Aug; 66 (2): 249-260.
11- Belli, E, Matteini, C, Andreano, T. Sclerosing osteomyelitis of Garré periostitis ossificans. J. Craniofac. Surg. 2002 Nov; 13 (6): 765-768.
12 - Akgül HM, Çağlayan F, Günen Yilmaz S, Derindağ G. Garre's Osteomyelitis of the Mandible Caused by Infected Tooth. Case Rep Dent. 2018 Jul; 8;(18):1-4
13- Hudson, JW. Osteomyelitis of the jaws: a 50-year perspective. J. Oral Maxillofac. Surg. 1993 Dec; 51 (12): 1294-1301.
14- Suei Y, Taguchi A, Tanimoto K. Diagnosis and classification of mandibular osteomyelitis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005; 100: 207-14.
15- Park J, Myoung H. Chronic suppurative osteomyelitis with proliferative periostitis related to a fully impacted third molar germ: a report of two cases. J Korean Assoc Oral Maxillofac Surg. 2016 Aug;42(4):215-20.
16- Eisenbud, L, Miller, J, Roberts, IL. Garré's proliferative periostitis occurring simultaneously in four quadrants of the jaws. Oral Surg Oral Med Oral Pathol. 1981 Feb; 51 (2): 172-178
17- Brazão-Silva, MT & Pinheiro TN.The So-called Garrè's Osteomyelitis of Jaws and the Pivotal Utility of Computed Tomography Scan.Contemp Clin Dent. 2017 Oct-Dec; 8(4): 645–646.

# Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal) | Instructions to authors

The Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal), a periodical published quarterly aiming at divulging and promoting scientific production and interchange of information between the Brazilian and International community in the different areas of Dentistry and other fields of Health Care. The entire content of the Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal) is available on the following web site http://revcientifica.cro-rj.org.br, to which there is free access. All the articles published in the Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal) have a publication license CC BY-NC-ND (http://creativecommons.org/licenses/by-nc-nd).

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**Peer Review Process**

All the content published by the Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal) goes through the process of review by specialists. Articles submitted for appreciation are sent to the CRO-RJ librarian, who, under the supervision of the Editors-in Chief, initially assesses them with regard to the minimum standards demanded relative to form of presentation in the Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal), with a view to complying with all the guidelines required for sending original articles. Once approved at this stage, the original is submitted for appreciation by the Editorial Board, to assess the merit of the work and decide about the convenience of publishing it, with or without changes. After this, the article is sent to undergo a process of evaluation carried out in the review system, by peers selected from a register of reviewers. The reviewers are always professionals from institutions different from that of the origin of the article; they are blind to the identity of the authors and place of origin of the work. After receiving both reports, the Editorial Council evaluates them, and decides about acceptance of the article without changes, rejection, or return to the authors with the suggestions about changes. The Editorial Board is responsible for returning the article to the authors for explanations, as many times as necessary, and at any time, the Editors may decide to reject the document. Each version is always analyzed by the Editorial Board that has the power of making the final decision.

**Types of Articles Published**

The Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal) accepts the spontaneous submission of original articles, clinical case reports, reviews, letter sot the editor and editorials/review comments, and letters to the editor.

**Original articles** include randomized and controlled studies; studies of diagnostic tests and triage; observational cohort, case control and cross-sectional studies; other descriptive and experimental studies, as well as those of basic research with laboratory animals. The text must have a maximum of 3.000 words, excluding tables and references; the number of references must not exceed 30. Articles that report clinical trials with therapeutic interventions must be registered in one of the Registers of Clinical Trials
listed by the World Health Organization. In the absence of a Latin American Register, the Revista do CRO-RJ (Rio de Janeiro Dental Journal) suggest that the authors use the following register www.clinicaltrials.gov, of the National Institute of Health (NIH). The Identification Number must be presented in the body of the manuscript. The submission of clinical trials must adhere to CONSORT checklist (http://www.consort-statement.org/). In cases of submission of observational studies, for preparation of the manuscript, adhesion to the STROBE guidelines is requested (https://www.strobe- statement.org/index.php?id=strobe-home).

**Clinical Case Reports** must not exceed 2000 words, including the abstract, brief introduction, description of the case, discussion, acknowledgments (if there are any). The figures may be organized in the form of a panel. Each panel will be considered a figure. The abstract must not exceed 250 words. Case report articles must be accompanied by the term of free and informed consent signed by the participant and/or his/her legal guardian. For preparation of the manuscript, authors must adhere to the guidelines suggested in CARE (http://www.care-statement.org).

**Reviews** are critical and orderly assessments of the literature relative to topics of clinical importance, with emphasis on factors such as the causes and prevention of diseases, their diagnosis, treatment and prognosis. Systematic reviews and meta-analyses are included in this category. In the body of the manuscript of the latter two types of reviews, authors must include the Registration Number of the Review protocol in PROSPERO (http://www.crd.york.ac.uk/PROSPERO/). For preparation of the manuscript, authors must follow the guidelines proposed by PRISMA (http://www.prisma-statement.org/). Authors may also submit a proposal of a review article, with a script, to the Editorial Board. If this is approved the author may develop the script and submit it for publication. Review articles must be limited to 6.000 words, excluding references and tables.

**Letters to the editor** must contain comments with a constructive critical content about subject matter previously published in the Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal). These must be submitted directly to the Editorial Board. The maximum size is 1000 words, including a maximum of 10 bibliographic references. Whenever possible, a reply to the authors will be published together with the letter.

**Editorials and comments** are commissioned from authorities in specific areas. The Editorial Board may also analyze proposals of spontaneously submitted comments.

**General Guidelines**

The manuscript must be written using 12-point Arial font, on A4 size pages, with 1.5 line spacing, and a 3 cm margin on each side of the page, including the bibliographic references and titles/legends of tables and illustrations. The file must be presented in digital format, extension “doc” or “docx”. Each section must start on a new page, in the following order; title page, abstract in Portuguese, Abstract in English, text, acknowledgments, bibliographic references, tables (each complete table, with title and footnotes, on a separate page), figures (each complete figure, with titles and footnotes, on a separate page) and figure legends.

The following are the main guidelines about each section, according to the type of manuscript:

**Title Page**

The title page must contain all of the following items of information:

a) Title of the article, concise and informative, avoiding the use of superfluous terms and abbreviations; also avoid indicating the place and city where the study was conducted;

b) Abbreviated title (short title) to be stated at the top of all the pages with a maximum of 60 characters, counting the spaces;

c) The full name of each of the authors (first name and other surnames, with the last surname typed in bold-face font.

d) Department to which the authors are affiliated and/or definition of the institution or official service to which the study is tied;

e) Specific contribution of each author to the study;

f) Declaration of conflict of interest (write “nothing to declare” or a clear revelation of any interest of an economic or other nature that may cause embarrassment if it becomes known after publication of the article);

g) Name, address, telephone, fax and e-mail address of the corresponding author;

h) Source of financing or supplier of equipment and materials, if this were the case;

**ABSTRACT**

The abstracts (Portuguese and English) must contain a maximum of 250 words, avoiding the use of abbreviations. No words that identify the institution or city where the article was written must be put into the abstract, to facilitate blind reviewing. All the information that appears in the abstract must also appear in the article. The abstract must be structured according to the following description:

**Abstract of Original Article**

Introduction (optional): introduce the reader to the topic to be addressed in the article.

Aim: inform the initial hypotheses, if there are any. Define the main aim and inform only the most relevant secondary aims.

**Methods:** Inform the type of study design, contextual or local, the patients or participants (define the eligibility criteria, sample number, sample distribution criteria among groups, etc.), the interventions/ exposures (describe characteristics, including methods of application, variables analyzed, duration, etc.), and the criteria for measuring the outcome, including the statistical analysis.

**Results:** Inform the main data, confidence intervals and significance, the statistics of the findings.

**Conclusions:** Present only those supported by the data of the study, and that contemplate the aims, as well as their practical application with equal emphasis on the positive and negative findings that have similar scientific merits.

**Abstract of Case Reports**

**Introduction** (optional): inform the reader about the topic to be addressed.

**Aim**: briefly state the aims of the report.

**Case Report**: report the case itself.

**Results:** Inform the main data related to resolution of the case.

**Conclusions:** Present only those supported by the data of the study, and that contemplate the aims and their application.

**Abstract of Reviews**

Introduction (optional): briefly report the central topic of the review, and justify why it was conducted.

**Aim:** Inform the aim of the review, indicating whether it especially emphasizes some factor, risk, prevention, diagnosis, treatment or prognosis.

**Sources of data:** Describe the sources of the research, defining the databases and years researched. Briefly inform the eligibility criteria of articles and methods of extraction and evaluation of the quality of information (in cases of Systematic Reviews).

**Summary of data:** Inform the main results of the research, whether they are quantitative or qualitative.

**Conclusions:** Present the conclusions and their clinical application.

After the summary of the original articles, case reports or reviews, include three to six key-words that will be used for indexing. Use terms of Medical Subject Headings (MeSH), available in http:// www.nlm.nih.gov/mesh/ meshhome.html. When adequate descriptors are not available, it is possible to use free terms.

**ABBREVIATIONS**

These must be avoided, because they hamper comfortable reading of the text. When used, they must be defined when they are used for the first time. They must never appear in the title and abstracts.

**TEXTS**

The text of **original articles** must contain the following sections, each with its respective sub-title:

**Introduction:** Clear, objective, succinct, citing only references strictly related to the topic, and seeking to justify why the study was conducted. At the end of the introduction, the aims of the study must be clearly described.

**Materials and Methods:** Describe the population studies, sample and eligibility criteria; clearly define the variables and detail the statistical analysis; if necessary, include references about the methods used during the course of this section. Procedures, products and items of equipment used must be described in sufficient detail to allow reproduction of the study. Furthermore, they must contain details of the brand and place of manufacture. In case of studies with human beings and/or animals, it is mandatory to include a declaration that all the procedures were approved by the research ethics committee of the institution to which the authors belong. In the absence of this, approval must be obtained from another research ethics committee indicated by the National Commission of Research Ethics of the Ministry of Health.

**Results:** These must be presented clearly, objectively and in a logical sequence. The information contained in tables or figures must not be repeated in the text. The option to use graphs instead of tables with a large number of data depends on the authors and Editorial Board, which may suggest changes and adjustments with the purpose of making them better suited to the guidelines and specificities of the Revista de Odontologia do CRO-RJ (Rio de Janeiro Dental Journal).

**Discussion:** This must interpret the results and compare them with data previously described in the literature, emphasizing the new and important aspects of the study. Discuss the implications of the findings and their limitations, as well as the need for additional researches. Avoid repetition of the results and/or superimposition between results and discussion. The conclusions must be presented at the end of the discussion, and must respond to the aims of the study, by avoiding information if inferences were not supported by the findings. The authors must place equal emphasis on favorable and unfavorable findings that have similar scientific merits. Include recommendations, when these are pertinent.

The text of **case reports** must contain the following sections, each with its respective sub-title:

**Introduction**: Clear, objective, succinct, citing only references strictly related to the topic, and seeking to justify why the study was conducted. Describe the aims at the end of the introduction.

**Case Report**: must present details of the case and procedures for performing them. Describe the follow-up data and prognosis of the case, when pertinent. CRO suggests that cases without due conclusion should be avoided. Mention the Term of Free and Informed Consent.

**Discussion:** Discuss the diagnostic, therapeutic and technical criteria used, among other details about the case. Discuss the clinical implications of the findings and their limitations. The conclusions must be presented at the end of the discussion, and must respond to the aims of the study, by avoiding information if inferences were not supported by the findings. The authors must place equal emphasis on favorable and unfavorable findings that have similar scientific merits. Include recommendations, when these are pertinent.

The text of **review articles** must contain the following topics: - In case of **narrative reviews**, the following are suggested:

**Introduction:** clear and objective, in which the authors explain the importance of the review to clinical practice, in the light of dental literature. The introduction must conclude with the aims of the review.

**Materials and Methods/Data Source:** It is necessary to describe the methods of data selection and extraction, followed by Data Synthesis.

**Data Synthesis:** This data synthesis (result/discussion) must present all the pertinent information in rich detail.

**Conclusion:** The conclusion section must correlate the main ideas of the review with the possible clinical applications, limiting generalization to the domains of the review.

**-** In cases of **systematic reviews, with or without meta-analyses**, the authors must follow the PRISMA statement (http://www.prisma-statement.org/). These reviews must contain: **Introduction**: that demonstrates the pertinence of the subject and the existent controversy with respect to the topic. At the end of the introduction, the authors should raise the focal question of the review. **Materials and Methods**: must present the search strategy; eligibility criteria of the studies; risk of bias analysis of the included studies; data extraction, and when pertinent, the strategy used for quantitative data synthesis.

**Result**: must respond in an orderly manner to the data searched according to the methodological design with respect to the qualitative and quantitative synthesis of the primary studies included.

**Discussion**: must consider interpreting the results, emphasizing resolution of the controversies related to the topic, with this being directed towards answering the focal question of the review, showing whether or not there is need for further research. The limitations of the study must also be pointed out and envisage the external validity of the study (power of generalization of the data).

**Conclusion:** The conclusion section must correlate the main ideas of the review with the possible clinical applications.

**Acknowledgments**

These must be brief and objective; they should only mention the person or institutions that made a significant contribution to the study, butthat had not fulfilled the criteria of authorship.

**References**

The references must be formatted in the Vancouver style, also known as the Uniform Requirements style.

The bibliographic references must be numbered and ordered according to the order in which they appear in the text, in which they must be identified by the respective superscript Arabic numbers. To list the references, do not use the Word resource of end notes or footnotes.

Articles accepted for publication, but not yet published, may be cited provided that the name of the journal is indicated and that it is "in press". Unpublished observations and personal communications may not be cited as references. If it were imperative to include information of this type in the article, it must be followed by the observation "unpublished data" or "personal communication" in parentheses in the body of the article.

The titles of periodicals must be abbreviated as recommended in the Medicus Index; a list with their respective abbreviations may be obtained by means of the publication NLM "List of Serials Indexed for Online Users", available at the address http:// www.nlm.nih.gov/tsd/serials/lsiou.html.

As follows, we present some examples of the model adopted by the Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal):

**Articles in periodicals:**

*1.* Up to six authors:

Vieira AR, Bayram M, Seymen F, Sencak RC, Lippert F, Modesto A. In Vitro Acid-Mediated Initial Dental Enamel Loss Is Associated with Genetic Variants Previously Linked to Caries Experience. Front Physiol. 2017 Feb 22;8:104. doi: 10.3389/fphys.2017.00104.

*2.* More than six authors:

da Silva Bastos Vde A, Freitas-Fernandes LB, Fidalgo TK, Martins C, Mattos CT, de Souza IP, et. al. Mother-to-child transmission of Streptococcus mutans: a systematic review and meta-analysis. J Dent. 2015 Feb;43(2):181-91. doi: 10.1016/j.jdent.2014.12.001.

*3.* Organization as author:

American Academy of Pediatrics. Clinical practice guideline. Diagnosis and management of childhood obstructive sleep apnea syndrome. Pediatrics 2012;130 (3):576-684.

*4.* Articles with electronic publication, not yet with printed publication:

Tavares Silva C, Calabrio IR, Serra-Negra JM, Fonseca- Gonçalves A, Maia LC. Knowledge of parents/guardians about nocturnal bruxism in children and adolescents. Cranio. 2016; Jun 24:1-5. [Epub ahead of print]

**Books:**

Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth. 4ª ed. Copenhagen: Mosby. 2007.

Chapters of Books:

Pagel JF, Pegram GV. The role for the primary care physician in sleep medicine. In: Pagel JF, Pandi-Perumal SR, editors. Primary care sleep medicine. 2nd ed. New York: Springer; 2014.

Academic Studies:

BorkowskiMM. Infant sleep and feeding: a telephone survey of Hispanic Americans [dissertation]. MountPleasant(MI): Central Michigan University; 2002.

**CD-ROM:**

Soils. Geographica on CD ROM. [CD ROM]. Melbourne, Australia: Random House. 1999.

**Homepage/website:**

Integrative Medicine Center[Internet]. Houston: University of Texas, M. D. Anderson Cancer Center; c2017 [cited 2017 Mar 25]. Available from: https://www.mdanderson.org/patients- family/diagnosis-treatment/care-centers-clinics/integrative- medicine-center.html.

Ministry of Health Documents/Decrees and Laws:

1. Brazil. Decree 6.170, of July 25, 2007. States provisions about the rules relative to Transfers of resources from the Union by means of transfer agreements and contracts and makes other provisions. Diário Oficial, Brasília, 26 jul. 2007.

2. Brazil. Ministry of Health Health Care Secretary Department of Primary Care Política Nacional de Atenção Básica / Ministério da Saúde. Health Care Secretary Department of Primary Care Brasília, Ministério da Saúde, 2012. (Série E. Legislação em Saúde)

Presentation of Paper/Study?

Pierro VSS, Maia LC, Silva EM. Effect of pediatric syrups on roughness and erosion of enamel (abstract). 82nd. IADR General Session & Exhibition; 2004 Mar 10-13, Honolulu, Hawaii. J Dent Res 2004, 83 (Special Issue A): 896.

**Tables**

Each table must be presented on a separate page, numbered with a Arabic numeral (1, 2, 3, etc.), in the order of appearance in the text; with single spacing between lines, and contain a summarized but explanatory title. All the explanations must be presented in footnotes and not in the title, identified with superscript letters in alphabetical order. Do not underline or draw lines within the tables and do not use spaces to separate the columns. Do not use space on either side of the symbol ± or any other symbol.

**Figures (photographs, drawings, graphs, etc.)**

All the figures must be numbered with Arabic numerals (1, 2, 3, etc.), in order of appearance in the text. The title must be clear and objective, and must appear at the base of the Figure. All the explanations must be presented in the legends, including those about the abbreviations used. Figures reproduced from other previously published sources must indicate this condition in the legend, in addition to being accompanied by a letter of permission from the copyright holder. Photographs must not allow identification of the patient; masking the patient's eye region in the photograph may not provide sufficient protection. Should there be possibility of identification, it is mandatory to include a written term of free and informed consent to publication. Microphotographs must present internal scales and arrows in contrast with the background.

Illustrations in color are accepted for publication online, without additional cost to the authors. However, all the figures will be transformed to black and white in the printed version. If the authors consider it essential for a certain image to be in color, even in the printed version, the authors are requested to make special contact with the editors. Computer-generated images, such as graphs, must be attached in the form of files in the following formats: .jpg, .gif or .tif, with minimum resolution of 300 dpi. Graphs must preferably be presented in two dimensions. CRO will only accept

drawings, photographs or any illustrations that contain an adequate degree of resolution for the printed version of the journal.

**Figure Legends**

These must be presented on a separate page, duly identified with their respective numbers.

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As part of the submission process, authors are requested to indicate their agreement with the items listed as follows:

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3. The submission file (manuscript) must be sent as a Microsoft Word document.

4. The title page must contain all the information required, as specified in the guidelines to the authors.

5. The abstract and key words must be formatted and submitted in English and Portuguese, following the title page.

6. The entire text must be presented in double line spacing using 12-point Arial font, and using italics instead of underlining to indicate emphasis (except in e-mail addresses. All the tables, figures and legends must be numbered in the order in which they appear in the text; each of these must be placed on a separate page, after the bibliographic references at the end of the article.

7. The text must be in accordance with the demands of style and bibliography described in the publication guidelines.

8. The references must be presented in the so-called Vancouver style, and numbered consecutively in the order in which they appear in the text.

9. Information about approval of the study by a research ethics committee must be clearly presented in the text, in the Methods section, and must be sent as an attachment.

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