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Summary
Contents

Editorial

Endodontic "trends": What does science have to say about them?
Emmanuel J.N.L. Silva 1

Letter to editor

New perspectives for teaching dentistry
Alice Pereira da Costa Santos, Beatriz Salomão Porto-Alegre Rosa, Maria Augusta Visconti 2

Review

The functional architecture of the stomatognathic system and orofacial aesthetic repositioning during the aging process
Marvin do Nascimento, Caroline Grijó e Silva, João Victor França Moura, Bruno dos Santos Fausto, Andrea Damas Tedesco 4

Original article

Antimicrobial activity of antibiotic pastes used in pulp therapy through direct contact with a multispecies biofilm: a pilot study
Mariana Coutinho Sancas, Anne Caroline Lunardi de Souza, Amanda Souza Nunes Monteiro, Andréa Vaz Braga Pintor, Maysa Lannes Duarte, Laura Salignac de Souza Guimarães Primo 17

Evaluation of microbial contamination and efficacy of antimicrobial agents in disinfection of handicapped patients' toothbrushes
Paulo Nelson Filho, Beatriz Medina Coeli Barboza, Raquel Assed Bezerra da Silva, Amanda Silva Bertasso, Fabrício Kitazono de Carvalho, Alexandra Mussolino de Queiroz, Léa Assed Bezerra da Silva 24

Cephalometric profile norms for southeastern African-Brazilian adults according to the legan-burstone analysis: a pilot study
Teresa Cristina Pereira de Oliveira, Flávio de Mendonça Copello, Isabela Maria de Carvalho Crusoé Silva, Lincoln Issamu Nojima, Matilde da Cunha Gonçalves Nojima 29

Mapping of supernumerary elements in patients seeking orthodontic treatment
Bruna Caroline Tomé Barreto, Ingrid Cristina Pinto Da Costa, Margareth Maria Gomes De Souza, Sandra Regina Torres, Ana Maria Bolognese 35

Auriculotherapy for sleep bruxism in children: a series of cases
Bruna Mello de Moraes, Bruna Balthazar Scheffelmeier, Joyce Duarte, Fabian Calixto Fraiz, Juliana Feltrin de Souza 42

Case report

Without mini-plates, mini-implants and surgery: treatment of severe anterior open bite in an adult patient - A case report
Leonard Euler Nascimento 49

Management of an unerupted tooth and odontoma after trauma in predecessor
Thais Rodrigues Campos Soares, Thais Pinto Alves, Leonardo Pinto Monteiro, David Nascimento Braga, Rogério Gleiser, Gloria Fernanda Barbosa de Araujo Castro 58

Surgical treatment of ankyloglossia using an ophthalmic topical anesthetic and a tentacannula for tongue elevation: a case report
Leógenes Maia Santiago, Eduardo Sérgio Donato Duarte Filho, João Carlos Amorim Lopes, Fernanda Maria Barros Guerra, Carlos Frederico de Moraes Sarmento, Dellano Fernandes da Silva Santos 64

Periodontal management of a patient with chronic kidney disease: a case report
D. C. Penoni, F. Sader, M. N. Silami, A.T.T. Leão, S. R. Torres 69

Minimally invasive aesthetic treatment of white spots by dental fluorosis in children: case report
João Victor Frazão Câmara, Daniel Otero Amaral Vargas, Isabel Ferreira Barbosa, Julio Cesar Campos Ferreira Filho, Amara Eulália Chagas Santos, Hana Fried, Lucianne Cople Maia, Gisele Damiana da Silveira Pereira 75

Anterior open bite treated with palatine crib: a case report with cephalometric, speech and electromyography analyses
Flávio Mendonça Copello, Flávia Viegas, Larine Ferreira Lira, Isabela Contage Amin, Rodrigo Lopes de Lima, Katia Nemr, Margareth Maria Gomes de Souza 80

Multidisciplinary conservative management of dental fracture in young patient: case report
Aline dos Santos Letieri, Lucas Alves Jural, Paula Moraes Lima, Cinthia, Marques Sperduto, Jeane Batista dos Santos, Lívia Paes Borges, Luiza Seabra Martins Mattos, Thaís Rodrigues Campos Soares, Gisele Damiana da Silveira Pereira, Lucianne Cople Maia 87

ENDODONTIC "TRENDS": WHAT DOES SCIENCE HAVE TO SAY ABOUT THEM?

The Endodontic world is often flooded with new products and protocols, generally with a strong commercial appeal, ensuring improvements in the outcomes of root canal treatment. These new techniques have often been labeled as being less invasive or more biology-reliant and have been indicated to replace scientifically and clinically supported therapies. The most recent and widely discussed examples in the endodontic scenario are the minimally invasive treatments (especially minimally invasive endodontic access cavities), the so-called "natural" disinfection therapies such as ozone therapy, and new "biological miraculous" root canal sealers.

New techniques and materials will always be welcome in Endodontics. The point is that, for these techniques to be implemented in clinical practice, there should be followed process, as in any other medical and dental specialties. In general, this assessment is made before greenlighting any new technique and/or material. It basically consists of two distinct phases: a preclinical phase; and a clinical phase.[1] The preclinical phase involves laboratory investigation regarding the safety and benefits of the new proposal. The clinical phase involves clinical trials that aim to confirm the laboratory findings in humans. If in both preclinical and clinical phase the new proposed treatment does not offer advantages over the traditional model currently used and/or presents major disadvantages, it should not be used clinically. A widely known example of methodological oversight regarding the launch of new drugs is the case of Thalidomide. This drug was launched without adequate proof of its safety for the patient's health. This medication had some teratogenic effects, the main one being phocomelia (retarded limb growth) leading to a long delay in the growth of the long bones of the arms and legs. Approximately 12 thousand children were affected in several countries.[2] Translating this to the Endodontic research, it is essential that any new therapy and/or medication be previously evaluated with extreme attention and thoroughness checking the benefits and risks in order to guarantee the well-being of the individual undergoing this therapy.

At some point, whether in the preclinical or in the clinical phase, research on the three above-mentioned examples, minimally invasive accesses cavities; ozone therapy; and bioceramic root canal sealer, failed to provide scientific evidence to support their use. Regarding minimally invasive accesses cavities, it would appear logical to assume that the fracture resistance of endodontically treated teeth would be better preserved if this access was performed, thus improving long-term prognosis.[3] However, the results so far have failed to point out the real benefits of this new access modality with regard to fracture resistance.[4] In fact, the results demonstrated series of drawbacks related to the location, cleaning, shaping disinfection and filling the root canals.[5-7] Although the research on ozone therapy might have some found promising results in laboratory experimental models, it failed to point out real clinical benefits in *in vivo* studies that would justify it being used as a substitute or as a complementary approach to the gold standard irrigation protocols used in Endodontics (NaOCl associated with EDTA).[8] Some root canal sealers, especially those claimed to have a better biological response have a strong commercial appeal – mainly due to the BIO prefix – however, did not managed to fulfill all the requirements of physico-chemical laboratory tests proposed by ISO or ADA guidelines.[9,10]

While the emergence of new trends warms the Endodontics market from time to time, Endodontic science has an obligation and responsibility to validate or refute new hypotheses and materials. In fact, the impulses of scientific thinking ask for evidence. One major problem is that many of these proposals are widely disseminated or commercialized before any type of strong scientific evidence or even without favorable results. As in general, the new trends are still lacking in scientific evidence, the take home message is clear: take a deep breath and wait for scientific evidence before modifying any clinical protocol that is currently being used with scientifically proven benefits.

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NEW PERSPECTIVES FOR TEACHING DENTISTRY

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Higher education is challenged to think about how to enable people, at any stage of their lives, to take part in stimulating learning experiences. In this context, information and communication technology (ICTs) has been transforming a large part of society and there is little reason to believe that it will not be the definitive transformative innovation for higher education in the 21st century. Technology can help education to meet the expectations of better quality, while saving costs in an era of reduced funding and many political impasses facing educational issues in many countries.[1] In March 2020, the COVID-19 pandemic demanded the immediate closure of face-to-face dental education to comply with social isolation standards, bearing in mind that clinical activity in dentistry occupies a unique place among those with the greatest potential for spreading the infection. Many dental schools faced the challenge of effectively involving students through virtual learning.[2]

Also called web-based learning, online learning, computer-aided instruction, computer-assisted learning and internet-assisted learning, e-learning has the potential to produce a paradigm shift from passive teacher-centered learning to active learner-centered learning. In 2016, a systematic review carried out to provide a synthesis of the effectiveness of e-learning in oral radiology, when compared to the traditional classroom, suggested that e-learning is at least as effective as traditional learning methods and that students have positive attitudes about e-learning.[3]

Asynchronous online learning does not require students and teachers to be online at the same time, offering more flexibility to access and interaction with a specific activity, which may include for example, video lectures and automatically graded online assignments, but also communicative activities such as discussion forums or emails.[4] Asynchronous activities, despite offering greater autonomy to the student, can bring feelings of isolation, hindering collaborative learning.[5] In synchronous online learning, students and teachers meet in real time, in a live environment, such as videoconference or chat, with the meeting being pre-programmed and with a defined time, allowing the student to establish visual and voice communication with the teacher and other course participants, in addition to establishing a collaborative learning environment, resembling the traditional classroom, favoring greater student motivation, as well as creating a sense of community.[6] In this way, both asynchronous and synchronous activities are important, as they have different purposes and can complement each other: "Synchronous e-learning increases excitement and motivation, while asynchronous e-learning increases the ability to process information".[5]

One promising pedagogical approach for combining asynchronous and synchronous online learning is the online flipped classroom model. Inspired by the traditional flipped classroom approach [7], students are encouraged to watch video lectures at home as preparation for joint meetings. However, unlike the original flipped classroom model, students and teachers will not be meeting physically, but online. [4] This model, centered on the student, requires them to be responsible for participating in class with prior knowledge of the students, so that they can collaborate in discussions and activities in class. Content acquisition is individualized and self-guided. Faculty members act as learning facilitators, organizing content, developing interactive experiences, challenging students to think critically and providing feedback all the time.[8] Bergmann and Sams[7] stated that rich and open experiences within the classroom prepare students for success, foster critical cognitive development and promote innovation through collaboration. Chen et al.[9] assessed dentistry students' perceptions of distance learning strategies during the COVID-19 pandemic and their preferences between recorded lectures or other online course formats. Overall, students reported that learning formats such as flipped classrooms and creative uses of technology would be most beneficial for their virtual learning. However, regarding teaching activities in dental school clinics, no e-learning strategies can replace experience with patients, since online simulation with dental training manikins is extremely difficult.[10] In conclusion, the combination of synchronous and asynchronous components of distance education, such as the online flipped classroom, is a promise for future dental courses, in a blended learning format, where all theory content is done online and only clinical practice is performed in a face-to-face stage. The COVID-19 pandemic highlights the need for further research in this area.

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THE FUNCTIONAL ARCHITECTURE OF THE STOMATOGNATHIC SYSTEM AND OROFACIAL AESTHETIC REPOSITIONING DURING THE AGING PROCESS

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Palavras-chave: Envelhecimento. Envelhecimento da Pele. Preenchedores Dérmicos. Sistema Estomatognático.

RESUMO

Introdução: O envelhecimento facial implica em cuidados especiais e um tratamento diferenciado. Desse modo, a nova vertente da Odontologia Neo moderna busca, por meio da Harmonização Orofacial, o equilíbrio funcional e estético entre o aparelho estomatognático e a face. **Objetivo:** Esse artigo busca compreender, por meio de uma revisão de literatura, as consequências estéticas do reposicionamento do aparelho estomatognático e envelhecimento orofacial. **Fonte dos dados:** A presente revisão de literatura consistiu em um viés qualitativo nas plataformas PubMed e Google Acadêmico, nos ultimos 10 anos, sem restrição de idiomas. Os critérios de inclusão consistiram em estudos clínicos, livros, dissertações, teses ou revisões de literatura que abordavam os tópicos de interesse. **Síntese dos dados:** Foram recuperados nas bases de dados 231 artigos. Após a aplicação de um limite de publicação de 10 anos, 111 permaneceram e, com base nos critérios de inclusão e exclusão, 20 artigos foram selecionados e incluídos nesta revisão. **Conclusão:** Com as limitações do presente estudo, pode-se concluir que o processo de envelhecimento é natural e previsível e pode ser mutável e maleável por meio de procedimentos que restauram os nutrientes de suporte perdidos. A estética pode ser alcançada como uma consequência funcional do reposicionamento do sistema estomatognático e do envelhecimento orofacial.

Keywords: Aging. Skin Aging. Dermal Fillers. Stomatognathic System.

ABSTRACT

Introduction: Facial aging implies special care and personalized treatment. Thus, the new strand of Neomodern Dentistry seeks, through Orofacial Harmonization, the functional and aesthetic balance between the stomatognathic system and the facial aspect. **Objective**: This article seeks to disclose, through a literature review, the aesthetical consequences of the stomatognatic system repositioning and orofacial aging. **Data source**: The present literature review consisted in researches up to May 2019 using PubMed and Google Academic electronic databases. A 10-year publication limit was applied in the research. No language restriction was applied. Inclusion criteria were clinical investigations, books, dissertations, thesis or literature reviews that addressed the topics of interest. **Data synthesis**: A total of 231 articles were retrieved from databases. After applying a 10-year publication limit, 111 remained and, based on the inclusion and exclusion criteria, 20 articles were selected and included in this review. **Conclusion**: Considering the limitations of the present study, it can be concluded that the aging process is natural and predictable and can be changeable and malleable through procedures that restore the support nutrients that were lost. The aesthetics can be achieved as a functional consequence of the stomatognathic system repositioning due to orofacial aging.

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INTRODUCTION

Neomodern dentistry is under a new face, surpassing all restored paradigms by restructuring functionally the Stomatognathic System (SS) in facial aging. Thus, the search for functional and aesthetic restoration is directly qualified with the individual's self-estem. Therefore, the procedures or intervals of interaction have as one of their goals, to rehabilitate the functions included in oral motor skills.

The SS is presented as a functional organs and tissues complex of orofacial structures, that with participation of the jaw, defines usual functionalities. The composition of the SS comprises: Temporomandibular Joint (TMJ); facial neuromuscular component; periodontal ligament; dental surfaces and occlusion.[1]

The submission to the aging supply provides in intrinsic and extrinsic ways, important factors that alter the orofacial homeostasis, and therefore, the anatomophysiological modifications from aging significantly affects the structuring of the SS.[2]

Orofacial harmonization has as its purpose the patient's demand, which is established by functional therapies with aesthetic and cosmetic consequences applied to the SS that goes beyond isolated smile components. The biggest acquisition is based on health, functional stability, aesthetics, youthfulness, harmony and well-being.[3] Thinking about this aspect, this article seeks to understand and present the aesthetic consequences of the functional repositioning of the stomatognathic system.

Study design

Electronic searches up to May 2019 were conducted using PubMed and Google Academic electronic databases. The descriptors "aging", "skin aging", "dermal fillers", "stomatognathic system", limited to the title and abstracts fields. A 10-year publication limit was applied in the search. No language restriction was applied. Inclusion criteria were clinical investigations, books, dissertations, theses or literature reviews that addressed the use of orofacial harmonization showing their main indication, techniques used and facial components, skin aging and stomatognathic system. Factors such as age, follow-up time, interventions, trauma and craniofacial deformities, among other variables, were not considered, since the purpose of this review is not to follow up in stages of the aging process in different clinical conditions, but to demonstrate the functional and aesthetic differences of the stomatognathic system and orofacial aging.

SYNTHESIS OF DATA

Initially, 159 and 72 references were retrieved from PubMed and Google Academic, respectively. After the application of a 10-year publication limit, 84 and 27 remained, and based on the inclusion and exclusion criteria, 20 papers were selected and included in this review.

SUMMARY OF THE FINDINGS

Main characteristics of the selected studies regarding the stomatognatic system and orofacial aging (Table 1).

Stomatognathic System Aging Process

The SS is composed of sensory functions that represent the overall oral sensation, and motor functions that are characterized by oral activity with mandibular cooperation.[1]

Motor functions are responsible for oral motor skills, which the main one is the mandibular posture. However, it can be further divided into two groups of dynamic functions: classical (chewing, sucking, swallowing, speech articulation, speech-singing and mouth breathing) and adaptive (yawning, kissing, bite, facies, mimic, vocalization, spitting, blowing, laughing). Sensitive functions deal only with oral sensitivity.[2]

When thinking about the structural constitution, the SS can be divided into: static structures and dynamic structures. Static structures are related to any articular bone structure composed of supporting organs and tissues, represented by the elements: bones (jaw, hyoid, maxilla, cranial base, and cervical spine), TMJ (temporomandibular joint), teeth (occlusal area, periodontium), tendons (aponeuroses and ligaments). The dynamic structures, on the other hand, are composed by: nerves (motor and sensory) and muscles.[2,6]

The aging process affects the stomatognathic system just as linearly as it affects the rest of the body. In the neuromuscular system, there is a progressive decrease in the nerve plexuses that innervate the muscles, increasing the time of muscle response. The aging of the neuromuscular system becomes visible due to decreased activity of the chewing muscles.[1,2,3] As a result, the insufficiency of stomatognathic musculature is directly linked to the formation of static facial wrinkles, since the neuromuscular portion is closely linked to bone, connective tissue and skin.[3] In bone structures, less osteoblastic activity will occur in parallel with the osteoclastic action, leading to bone absorption, with consequent atrophy of specific parts of the maxilla and jaw[3,2] and enlargement of the orbital and piriform cavities.

Facial Squareness

The structural presentation of the face during youth is identified as a triangle, with the base facing upwards, characterizing a thin and defined youthful face, following the proportions of beauty described in the literature (Figure 1).

***Table 1**: Summary of research on stomatognathic system and orofacial aging*

	Muscle and Fat	Bone	Skin	References
Young face	Has a thick layer of submuscular adipose tissue	Presence of bone support and regular osteoblastic and osteoclastic activity	More prominent contours, more marked surface, and more projected curve lines	**Coimbra et al., 2014[7] Gitirana et al., 2013[8]**
	Facial muscles have the specific function of transferring each contractile movement to the adjacent tissue	Cranial-facial growth, increased face height and increased mandibular length	Increased thickness of the epidermis and dermis for better tension of collagen fibers	**Albert et al., 2007[12] Mendelson & Wong, 2012[18] Couto, 2007[29]**
	While facial fat does not exist as a homogeneous object on the face, it is a set of dynamic compartments that can be evaluated, increased and modified	Occurs or continuously expands facial bones, this does not progressively increase certain facial anthropometric measures with age, such as a nasal spine from the nose to an anterior region and a facial width	Cutaneous stiffness due to white subcutaneous tissue paper and a network of collagen fibers	**Fitzgerald & Rubin, 2014[15] Wollina et al., 2017[17]**
	Facial muscles play a great role in imitation and facial expression, important for facial aesthetics and human communication	Cranifacial growth with regular osteocyte activity. Bone tissue acting with good bone base for support and support	A dermis has a structural support of collagen fibers and provides skin resistance and elasticity. This keeps the skin cleaner, more resistant to mechanical changes	**Douglas, 1994[2] Madeira, 2004[30] Guirro and Guirro, 2004[31] Sovinski, 2012[32]**

	Progressive decrease in the muscles tone, displacement of fat portions and the increase of skin causing flaccid aspect	Less osteoblastic activity will occur in parallel with the osteoclastic action, leading to bone absorption	The convex facial features become straighter, increasing facial ptosis	**Manavpreet et al., 2015[9]** **Coleman et al., 2006[10]**
	There is loss of strength and muscle tone due to the decrease in volume, consistency and speed at which muscle tension can be developed and released	Bone formation activity decreases in relation to resorption. Thus, the jaws and jaw undergo atrophy due to disuse	Premature aging due to UV exposure. Degradation and delay in the collagen fibers production	**Fisher et al., 2002[4]** **Freitas Junior et al., 2008[3]** **Shaw et al., 2011[19]**
Old Face	Increased muscle bonus, shorter range of motion, and resting muscle bonus is closer to the maximum hiring bonus. Some superficial fat compartments undergo hypertrophy during aging of	Glabella protrusion, lateral translation of the orbits, expansion of supraorbital, increased depth of the cheeks, increase in the length, width and vertical dimensions of the nose; and increased vertical height in the occlusal region associated with increased chin prominence	Fall of the upper eyelid, appearance of nasolabial lines, lateral lines in the nose, mouth and orbit, reduction of the lip thickness and length of the nose and chin, concealed appearance of the cheeks, protrusion of the nose and ears caused by craniofacial convexity	**Cotofana et al., 2016[14]** **Sadick et al., 2015[16]**
	Limitation of facial expressions, repetitive muscle contractures resulting in a change in fat and, therefore, accentuation of furrows and wrinkles, with a transformation of dynamic facial lines into static facial lines	Craniofacial and alveolar remodeling progresses, increased mandibular length	Decreased skin thickness and tissue repair processes	**Porto, 2008[11]** **Horizonte, 2012[27]**

***Figure 1**: Face during youth represented by a triangle, with the base facing upwards, characterizing a thin and defined young face. Stomatognatic tissues naturally well positioned.*

With the fundamental modification of the established aging process, this triangle is reversed due to loss of volume and definitions of facial angles and gravitational tissue ptosis as previously discussed.[7]

The face is divided into three parts that seek the regularization of homeostasis and facial symmetry, namely:
- Upper third: extends from the hair insertion line (trichium point) to the glabella,
- Middle third: from the glabella to the subnasal point and,
- Lower third: from the subnasal point to the chin.

The most noticeable changes during aging of the upper third of the face are due to chronic sun exposure, facial mimic muscle contracture throughout life and its domains under the epidermis and dermis with loss of tissue elasticity.[7,8] These factors, when associated with the action of gravity and constant periorbital contracture, lead to decreased visual amplitude with advancing age.[9] According to Sadick et al, the appearance of tired eyelid occurs due to excess skin that generates a skin fold as a result of the loss of elasticity associated with advancing age. The appearance of frontal ptosis occurs due to the loss of stability of the upper eyelid and the temporal support of the lateral portion of the eyebrow.[10] The appearance of periorbital wrinkles and the darkened pigmentation of this region occur as a result of infraorbital subcutaneous tissue aging and melanocyte activity in the dermis.[9]

In the middle third of the face, changes in endogenous factors such as decreased production of fibroblasts in the dermis, loss of stiffness, increased flabbiness and osteocytic and chondrocytic changes are observed intensely.[7,8] Aging leads to decreased fat replacement, which results in a smaller volume of fat pads, giving the appearance of empty cheeks.[10] Changes in adipose tissue in the oropharyngofacial region may also dimensionally affect the zygomatic bone region. A nasolabial fold develops due to weakening of the supporting ligaments that hold tissues to the zygomatic bone.[9] The chronological reduction of adipose tissue leads to weakening of the orbital septum, which suggests a protrusion of the lower or upper eyelid, the first located in the middle third, while the second in the upper third. However, there may still be sinking traces of the eyelid region, which indicates depletion of the eyelid hypodermis.[7] The aging of the nose follows the same characteristics as the other parts of the middle third, presenting less muscle and ligament tension. Supporting structures may become inelastic resulting in loss of definition of the back and tip. Nasal cartilage, as well as the ear, increases in volume over time. Associated with the bony opening of the piriform cavity, there is a fall of the nose and, consequently, stretching of the middle facial third. Therefore, in addition to supporting tissues, bone and cartilage elements also have an effect on age, with irregularities of the most visible bone and cartilage portions.[11]

In the lower third, changes occur mainly due to

neuromuscular structures associated with oropharyngofacial facies, such as changes related to connective tissue related to loss of subcutaneous fat and type III collagen fibers. These changes generate a greater appearance of sagging skin, also due to the lack of support due to the remodeling of bone and cartilage structures that occur with aging.[7,8] Repeated contraction of the orbicularis muscle of the lips throughout life, loss of fat in this region and reduction of the dermal components, vertical wrinkles form on the cutaneous portion of the lips, known as barcodes. With aging, from adolescence to old age, the vermilion of the lips is affected by an average narrowing of 3.6mm. The clinical aspect of lip length increases significantly by 1.4mm between 40 and 50 years of age.[12] The anterior portion of the mandible protrudes, becomes thinner and rotates in axial rotation. And yet, there is three-dimensional loss of the entire middle facial third structure due to resorption of the sustaining periodontium.[8,9] As a structural component of the integumentary system, the skin and its appendages present a set of different histological tissues, which are organized harmoniously to adjust the integument in its primary functions.

The skin consists of epidermis that originates from the skin ectoderm, formed by a lining epithelium; and dermis, formed by attached connective tissue, originating from the mesoderm. Just below is the hypodermis, tissue not considered as a constituent structure of the skin by histologists, but a connective tissue whose function is to connect the integument to the adjunct structures. However, pathologists classify the hypodermis as the deepest subcutaneous layer of the skin, which, in anatomical view, will be recognized as superficial fascia.[8]

The composition of the epidermis has different cell types, such as keratinocytes, melanocytes, Langerhans cells, and Merkel cells. Keratinocytes are the main morphological species, constituting approximately 95% of the cellular composition and function linked to keratin production. Histologically, the epidermis is organized into: basal layer, spiny layer, granular layer, lucid layer and corneal layer.[12,13]

The epidermis has variable thickness and can be classified into thin skin when it has high keratinization; and thick skin when little keratinized. This division refers not only to the consistency of the skin, but also to the histological characteristics of the epidermis.[8]

In young skin, epidermal ridges, which are projections of epidermal tissue into the dermis, are responsible for the interactions between these two tissues. In the dermis, these projections are surrounded by loose connective tissue present in the most superficial layer of the dermis called papillary dermis. Epidermal ridges aim to increase nutrient availability by increasing the epidermis-dermis contact area, since the epidermis is an avascular structure and depends on nutrition from the dermis.[8,9]

Among with aging process, this epidermis-dermis interaction becomes weakened by shrinkage of the dermal papillae, which eventually reduces the contact area. As a result, the integument becomes more fragile and susceptible to exposure to injurious trauma. The cutaneous proliferative mitotic activity of the epidermis is conserved. Thus, the keratin corneal layer that structures the epithelial layer remains stabilized. The epidermis has a cellular refresh rate that happens approximately 20 to 30 days. The literature shows that the rate of epidermal renewal drops over time at a rate of 30% from 30 years and 50% at 80 years, changing epithelial thickness, specifically the spinous layer.[9,13]

The composition of the dermis can be classified into: papillary dermis and reticular dermis. The papillary dermis is in direct contact with the epidermis, and is basically composed of loose connective tissue. The reticular dermis consists of dense unmodified connective tissue, consisting primarily of collagen and elastin fibers. Richly composed of glycosaminoglycans (GAGs), the fundamental substance of the dermis, structures formed by linear polymer disaccharide units, which repeat continuously in a long chain structure, basically made up of a hexosamine (N-acetylglycosamine or N-acetylgalactosamine) linked to a uronic acid.[8,14]

Over the course of aging, the skin becomes whitish due to morphofunctional changes. There is less vasculocapillary tone directly influencing the homeostatic thermoregulation, and consequently, a lower tissue oxygenation, which ends up generating a small nutritive contribution and, consequently, the reduction of tissue hydration. There is a lower extracellular matrix (ECM) constitution, and as a result the decrease in collagen fibers productivity due to the lower fibroblastic production that is directly associated with sagging and cutaneous atrophy. There is also a reduction in the synthesis of GAGs that can lead to inconstant levels of deep dehydration.[9,13,14]

A skeletal facial aspect occurs due to the loss of

dimension of the adipose tissue involving the subcutaneous lining of the face, making the facial grooves more evident, which added to the flaccidity of the hypodermis directly affect the contours of the face. The stomatognathic muscle group during youth can affect the grooves and cranial bone projections, together with the composition of subcutaneous and adipose tissue. And they are also responsible for the structuring of harmonically positioned facial segments.[9]

Facial Muscles Action Associated with Submuscular Fat Compartments

At a young age, the face has more prominent contours, more marked surface, and more projected curve lines. This aspect is directly associated with the submuscular adipose layer that acts as an efficient surface contact for the facial muscles sliding. With the aging process, the convex facial features become straighter, the range of muscle action is increased, and the submuscular adipose tissue layer decreases, increasing facial pstosis.[7]

The frontal musculature, in its upper third, has a thick layer of submuscular adipose tissue. However, a centric extended bone deflation with superior and inferior rounding occurs throughout life. This occurs due contractive forces and muscle pressure acting under the functional center region. In the glabellar portion, due to the great depressing action of the corrugator supercilii and procerus, important changes occur, contributing to the disposition of the tiredness and discontent aspect. Therefore, the displacement of fat portions in the eyelid region and the increase of skin causes flaccid aspect to this region.[7,15]

In the ocular area, the muscles around the eyes, the orbicularis, are directly indicated by the aging effect of the face, causing protrusive repositioning of the orbicular fat segments, resulting in the fall of the final portion of the eyebrow and generating eyelid fat fragments, favoring the appearance of periocular rhytids and greater chances of cutaneous ptosis in the eyelid region. The result of repetition of the contraction of the corrugator supercilii muscle segregates deep fat fragments, which ultimately wear suggesting orbital bone.[15,16]

The movements of the major and minor zygomatic muscles disperse the submuscular adipocyte layer of the lower region, generating a jugal sphere deflation. The mimic muscles have repeated and combined contractures in the periorbital and peribucal sections, which in addition to expelling the adipocyte fragments, also generate great pressure on the underlying bone. With this, the appearance of perioral rhytids occurs, along with the volume and lip contour loss.[17]

In the depressor angulli oris muscle, along with the elevation made by the mentalis muscles, fat is expelled from the submuscular layer towards the upper middle cervical region, which eventually increases the excess of skin. With the aging process there is also an increase in the resting tone of the depressor angulli oris muscle, which deeps the labio-mental crease and increase the commissure depression.[7,15]

Facial Bone Remodeling

Facial bone loss interferes in the facial soft tissues. These are chronological changes that produce glabellar protrusion, lateral orbit translation, depth increase, lateral cheek expansion, three-dimensional enlargement of the nose and chin. There is prominence of the medial orbital fat pad, also associated with resorption of the upper edge of the orbital bone.[18]

Severe soft tissue changes associated with the aging process affect the middle zygomatic section. The maxilla is the structure that presents greater reconfiguration in aging, and it can be observed by the emptying of the cheek. The loss of the maxillary projection generates a tissue decrease in the nose and upper lip support, contributing to the increase of the piriform opening, and consequently causing the ptosis of the centrofacial region and stretching of the nose to the upper lip. There is also progression of deformity advancement of tear-trough lines, nasolabial fold, zygomatic fat, and is most often chronologically characteristic due to fat reduction or ptosis.[19]

In the lower facial third, due to aging, the vertical maxillary decrease influences the dental and skeletal structures, decreases the exposure of the superanterior teeth, directly interfering with the smile.[7]

OROFACIAL HARMONIZATION PROCEDURES

In order to promote the balance of the stomatognathic system, symmetry of the face as well as issues associated with system functions such as pain, masticatory dysfunction, also soften aging and improve quality of life, materials have been developed that can be applied both intra oral and extra oral areas (Table 2).[20]

***Table 2**: Main Orofacial Harmonization procedures*

Procedures	Orofacial Indications	References
Botulinum toxin	Produced by the bacterium *Clostridium botulinum*, it has seven serotypes called A-G that will be used to correct cases of bruxism, masseter hypertrophy, sialorrhea, smile asymmetry, accentuated gingival exposure and temporomandibular dysfunctions for safe application on head and neck structures. Aesthetic changes caused by senescence, such as wrinkles, are largely counteracted by treatment with botulinum toxin.	**Martins et al., 2016**[21] **Tamura, 2010**[38] **Tamura, 2010**[39] **Jabbari, 2016**[41]
Wire lift	Wire lift is a modern and minimally invasive approach, effective and durable compared to other materials. They induce collagen formation in the body promoting the treatment of sagging skin, wrinkles, as well as facial lifting. Thus they are indicated for treatments aimed at facial rejuvenation in order to reduce the effects of skin aging.	**Wan et al., 2019**[22] **Tavares et al., 2020**[49] **Obourn et al., 2018**[50] **Suh et al., 2015**[51]
Bichectomy	The surgery to remove part of the buccal fat pad or Bichat's fat pad, called bichectomy surgery, may contribute to orofacial harmonization. Performed for both aesthetic and functional purposes, it is indicated for individuals who present excessive volume of the buccal adipose body and want a better facial contour, besides enabling correction of masticatory defects. On the other hand, older people with an advanced elastosis process and who have a tapered face, this procedure is not indicated.	**Faria et al., 2018**[23] **Moura et al., 2018**[45] **Bernal Rodriguez et al., 2018**[46] **Storrer et al., 2019**[44]
Polycaprolactone	Polycaprolactone is a biomaterial considered bioabsorbable polymer. Extremely versatile, it can be used in applications directly on epidermal, muscle, bone and also cartilage tissues. Its use does not requires the collection of autogenous and allogeneic materials, promotes a shorter clinical treatment time and less formation of inflammatory processes and discomforts. It is degraded by a process that will result in the release of carboxylic acid occurring hydrolysis and cleavage of ester groups.	**Almeida, 2018**[28] **Jeong et al., 2019**[57] **Kwon et al., 2019**[58] **Kim., 2019**[59]

DISCUSSION

The aging process is subjective and depends on some variables. Older people may have more aging traits than younger, and the reverse is also true. According to Douglas,[2] there are two moments for the aging process: anatomophysiological development and its involution. Some factors contribute to this, namely: radiation, smoking, diet and stress. Couto[29] reports that during aging there is a reduction in thickness in the epidermis and a decrease in dermal space, compared to a young or intermediate group. In Freitas Junior[3] studies the aging is a multifactorial phenomenon and can be explained by genetics (chronological aspect of genetic mechanisms) and environment (random limiting factors that reduce adaptive capacity). Fisher[4] believed that the orofacial aging process occurs due to endogenous and exogenous consequences. Endogenous mechanisms are basically characterized by congenital and cumulative factors, that is, changes in natural cellular levels linked to physiological aging, such as the formation of superficial wrinkles and skin atrophy. On the other hand, the cumulative exogenous aging system is assisted by exposure to external environmental, physical and chemical conditions, which gradually accelerate aging. The main agents responsible for exogenous aging are ultraviolet radiation and smoking, which can cause deep wrinkles on the face, decreased dermal hydration, skin staining, and increased stratum corneum. Changes in fibrous elements and fundamental substances also occur with the aging process. The fibrous elements undergo alterations in the collagen system with a lower production of type I and type III collagenous fibers, the main constituent fibers of the dermis. With this, the skin takes on a more wrinkled and slender appearance. In the elastic system, there is less synthesis of elastic fibers leading to a greater aspect of sagging. There is also progressive loss of fundamental substances such as glycosaminoglycans (GAG), the main one being hyaluronic acid, resulting in less dermal hydration.[4,8,29] The visual modification of the face to the detriment of aging occurs through the formation of 3 types of wrinkles.

- Dynamic wrinkles: these are lines of expression that appear during facial mimes and disappear at rest. They are related to facial mimic.

- Static wrinkles: they are formed by the inertia of movements related to muscle fatigue, resulting from facial expressions during the individual's life. Presenting on the skin even at rest.

- Gravitational Wrinkles: these are folds formed by ptosis that occurs in all facial support tissue such as the skin and fatty pads.[30,31,32]

In this way, the effects of the aging process applied to the SS and the orofacial region may have a minimally invasive intervention, the orofacial harmonization procedures, which seek to propose a new tissue repositioning of the structures that were affected by aging, maintaining the functional and having aesthetics consequences. The facial mimic muscles contractions cause depressions in the form of lines or perpendicular pits to the fibers, which eventually turn into wrinkles, also called ridges or folds. The movements repetition during stomatognathic functions causes the appearance of these expression marks (Figure 2).[29,30,33]

In addition, the bone structure of the face has areas of resorption, which has its morphology altered over time. The orbit, for example, has resorption areas in the lower left third of the orbital floor. In this context, there is resorption of this area causing loss of muscle support, decreasing the tone of this muscle. Fillers, such as hyaluronic acid, can be used to reset this volume, and fill spaces caused by the loss of collagen structure. In addition, they can be used for facial contouring by reshaping the damaged structures to return a favorable aesthetic alignment to the face.[34,35] Hyaluronic acid filling is classified as a safe procedure, showing signs of inflammation as mild and moderate severity effects, which usually last for a week. [36,37] Fillers are indicated when it is too late to use botulinum toxin, which is the case with static wrinkles. They will improve the structure, which, as a result of loss of lift, becomes flabby. Grooves that are formed across the face throughout the aging process can be filled with hyaluronic acid to regain the volume of the area. An example is dark circles, which tend to deepen and move lower, giving an air of tiredness. This region forms the nasojugal groove, known as the tear trough, which extends from the medial corner of the orbit. The buccinator muscle region around the lips can be completed to eliminate the so-called "barcode" that comprises the region of the upper lip lines.[34,38,39] Botulinum toxin, on the other hand, can be used preventively in the dynamic wrinkle.[40] It can be applied to correct the horizontal forehead lines, on the upper part of the face, which has the effect of raising the eyebrows. It can also be used to correct the glabellar frown lines between the eyebrows. Not only is it used to correct marionette and periorbital lines.[21,41,42] The marionette groove is caused by congenital and external factors. It is the result of continued use of the mouth angle depressor muscle, which originates from the anterior region of the oblique line of the jaw and fits into the angle of the mouth. Being responsible for pain and suffering expressions, its overuse leads to a scar that causes a depressing appearence to the mouth comissure (Figure 3).[34,43,44]

In addition, the dermis components reduction and disorganization caused by the aging process contribute to

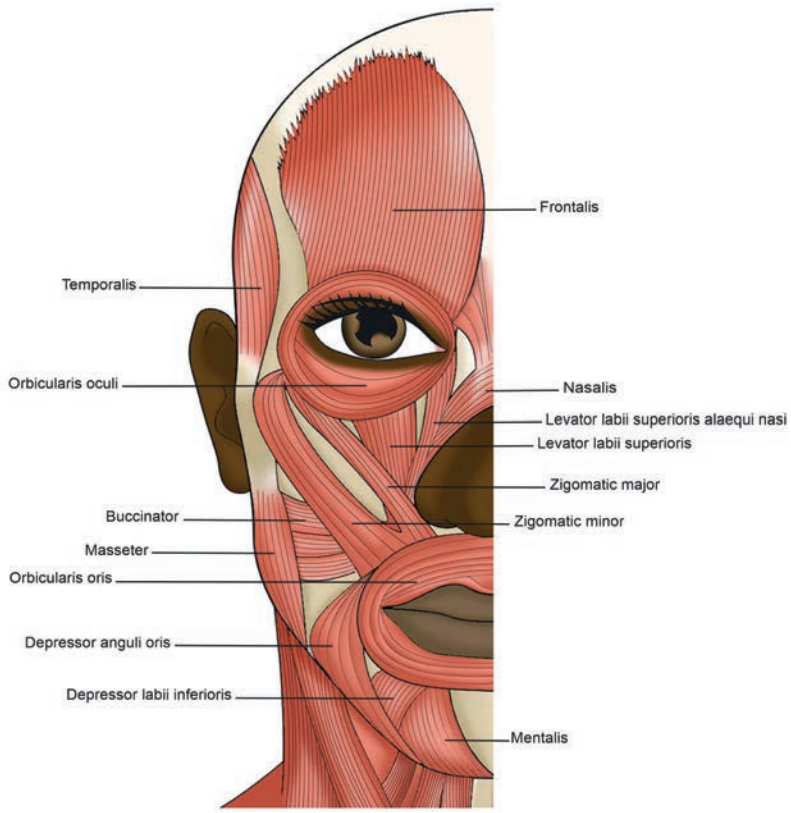

***Figure 2**: The shape of muscle lines in opposite direction of facial wrinkles. The contraction of the orofacial musculature associated to the factors that lead to the aging process, generates these facial grooves, marks and wrinkles. This is associated with bone remodeling, fat loss and skin thickness, which contributes to the facial squaring process.*

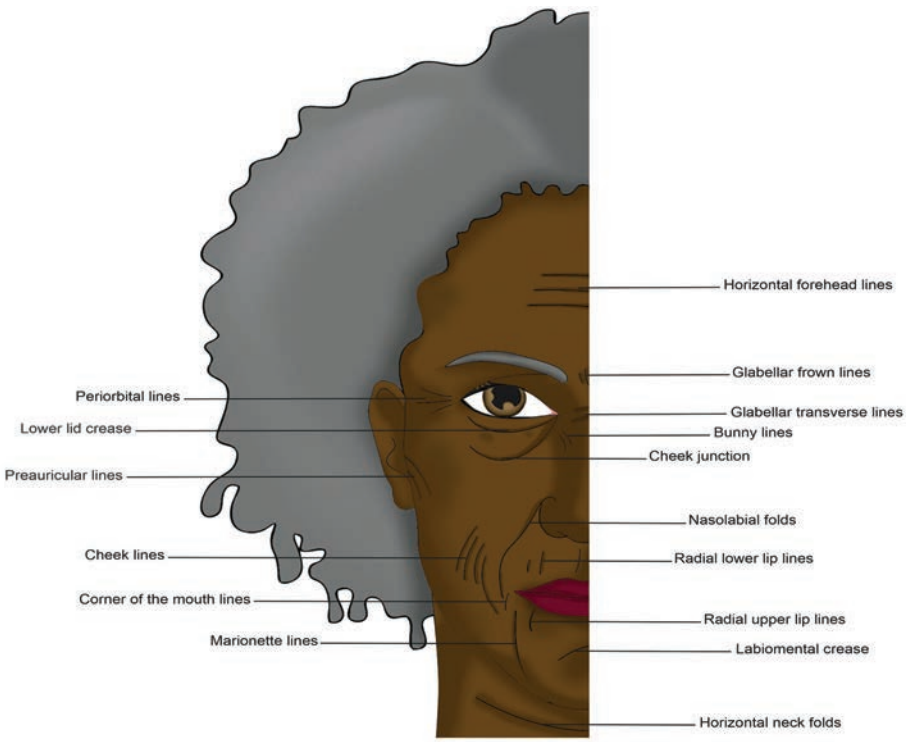

***Figure 3**: Major facial wrinkles caused by the aging process. The aging process is uniquely interpreted by each patient. They can have different representations and aesthetic intervention may not be required. Thus, the procedures have to be outlined as a functional repositioning that has the aesthetic as a consequence.*

the evolution of this deformity. The production of components that are essential for a youthful appearance, such as collagen and elastic fibers, decrease over time. Just as fat and bones are reabsorbing and muscles are losing their support strenght. In this context, injection of botulinum toxin type A into the depressor muscle of the mouth is indicated for this sign treatment. Bae GY[40] conducted a study in Korea of 16 cases in which botulinum toxin type A injections associated with hyaluronic acid were applied to treat marionette groove. In this study, out of the sixteen patients, none were dissatisfied and only four had collateral effects such as speak difficulty, playing instruments and lip herpes.[40] The bichectomy can help to provide a thinner aspect of the face, similar to an inverted triangle and more common in female faces. There are two approaches to achieve this thin aspect: intra oral incisions removing partially or entirely the buccal fat and the ones associated with facial lifting procedures. The first one is considered safer, however, there's no significant differences between both procedures related to complications in literature.[45,46,47] The repositioning of the fallen facial third should take into account the individuals yearnings, who needs to be carefully listened in order to understand what he wants to be restored. The individual's perspective on his own aging and the extent which they accept and wishes to change it is unique and variable. It is up to the professional to seek and identify which elements generate distress to the patient, combining what is spoken with the scientific knowledge about the anatomical structures involved. Cabral et al[48] describe that it is indispensable for the dentist surgeon to be sensitive to understand what really matters to the patient, since the origin of the disharmony can be very personal.

CONCLUSION

Considering the limitations of the present study, it can be concluded that the aging process is natural and predictable and can be changeable and malleable through procedures that restore the support nutrients that are lost. The aesthetics can be achieved as a functional consequence of the stomatognathic system repositioning due to orofacial aging. The art of harmonization is part of this process, making it lighter and more beautiful, and bringing well-being to the individual. A new Neomodern Dentistry philosophy is created, giving a positive perspective to those who pass through the aging process, which should not be feared but manipulated. Orofacial Harmonization becomes not only a hope of recovering what has been lost, but a prevention to keep what is feared to lose. It is, then, a strand that seeks to promote greater facial understanding, highlighting the smile, as one of the most amazing and unforgettable facies of the human being, and bringing life to the face which is part.

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ANTIMICROBIAL ACTIVITY OF ANTIBIOTIC PASTES USED IN PULP THERAPY THROUGH DIRECT CONTACT WITH A MULTISPECIES BIOFILM: A PILOT STUDY

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Palavras-chave: Dente Decíduo. Tratamento de Canal radicular. Combinação do Medicamentos. Antibacterianos. Testes de sensibilidade microbiana.

RESUMO

Objetivo: Avaliar a atividade antimicrobiana de pastas antibióticas utilizadas na técnica *Lesion Sterilization and Tissue Repair* (LSTR), através de nova metodologia de contato direto com membrana contra um biofilme multiespécies e estabelecer diluições adequadas para avaliação. **Métodos**: CTZ (cloranfenicol, tetraciclina, óxido de zinco) e duas formulações de pastas 3Mix (Ciprofloxacina, Metronidazol e Minociclina), 3Mix1 e 3Mix3, foram avaliadas, além dos grupos controle, negativo (solução salina a 0,9%) e positivo (clorexidina 0,2%). Biofilmes de *Candida albicans* e *Enterococcus faecalis* cultivados sobre membranas de celulose (n=10) durante 24 h foram expostos diretamente em contato com quantidades padronizadas de pastas frescas e controles (n = 2) por 24 h. As membranas foram imersas em 900 µL de solução salina e sete diluições seriadas foram obtidas por amostra. O plaqueamento para cada diluição (n = 2) foi realizado em meios de cultura para microrganismos totais e seletivos para *Candida* spp. e *Enterococcus* spp. para contagem de unidades formadoras de colônias (UFC). Para comparação entre grupos, os dados da contagem de UFC foram convertidos em $\log_{10}$ UFC / mL e o teste Mann-Whitney foi aplicado (p<0,05). **Resultados**: Observou-se inibição de UFC para todas as pastas, maior para CTZ no meio seletivo para *Candida* (p<0,001) e 3Mix1 nos demais meios (p<0,004). **Conclusão**: Concluiu-se que as pastas apresentaram atividade antimicrobiana contra o biofilme multiespécies testado e que a nova metodologia de contato direto proposta foi eficiente. Além disso, as diluições utilizadas mostraram-se adequadas para essa metodologia.

Keywords: Tooth Deciduous. Root Canal Therapy. Drug Combinations. Anti-bacterial agents. Microbial sensitivity tests.

ABSTRACT

Objective: To evaluate the antimicrobial activity of antibiotic pastes used in lesion sterilization and tissue repair (LSTR) technique, through a novel membrane direct contact methodology against a multispecies biofilm and to establish appropriate dilutions for this method. **Methods**: CTZ (chloramphenicol, tetracycline, zinc oxide) and two formulations of 3Mix pastes (ciprofloxacin, metronidazole, and minocycline), 3Mix1 and 3Mix3, were evaluated with negative (0.9% saline) and positive (chlorhexidine 0.2%) control groups. *Candida albicans and Enterococcus faecalis* (24-hour) biofilms (n=10) grown on cellulose membranes were directly exposed to standardized amounts of fresh pastes and control solutions (n=2) for 24h. Membranes were immersed in 900 µl of saline solution, and seven serial dilutions were made for each sample. Plating for each dilution (n=2) was performed on culture media for microbial colony-forming unit (CFU) counting of total microorganisms, *Candida* spp. and *Enterococcus* spp. Aiming the comparison between groups, CFU quantification data were transformed into $\log_{10}$ CFU / mL and the Mann-Whitney test was applied (p<0.05). **Results**: Inhibition of CFU was observed for all pastes, with greatest effects for CTZ paste in medium selective for *Candida* spp. (p<0.001) and 3Mix1 in non-selective (p<0.000) and selective for *Enterococcus* spp. (p<0.004). **Conclusion**: The pastes showed antimicrobial activity against the tested multispecies biofilm, and the proposed direct contact methodology was efficient. Moreover, the dilutions used proved to be appropriate for this methodology.

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INTRODUCTION

Instrument-free endodontic therapy, based on the lesion sterilization and tissue repair (LSTR) technique, aims to eliminate bacteria from the root canals of irreversibly infected teeth by the use of bacteriostatic and bactericidal drugs. These disinfect the lesion and promote repair by the host's natural tissue response, thus contributing to the health of the tooth and its supporting tissues until physiological exfoliation.[1,2]

CTZ and 3Mix pastes are examples of antimicrobial drug combinations employed in the LSTR technique. CTZ paste is composed of two broad-spectrum antibiotics, chloramphenicol and tetracycline, and zinc oxide and eugenol, which also exhibit antimicrobial activity.[3] 3Mix paste is composed of three broad-spectrum antibiotics (ciprofloxacin, metronidazole, and minocycline) added to distinct vehicles, such as macrogol and propylene glycol (MP), [4,5] or saline solution.[6]

Several factors may influence the success of antimicrobial drugs, among them the minimum concentration, the type of infection, and the bacterial resistance.[7] *Enterococcus faecalis* and *Candida albicans* have been reported as resistant to antibiotics and are associated with failure of endodontic treatments.[8] Thus, the evaluation of antibiotic combinations against these microorganisms becomes relevant for the pulp therapy of primary teeth. Although there is evidence that the pastes used in the LSTR technique exhibit antimicrobial properties on isolated microorganisms,[9,10,11] to date, the potential antimicrobial activity of distinct formulations of such primary teeth-targeted antibiotic pastes has not been investigated against multispecies biofilms.

Therefore, this pilot study aimed to evaluate the antimicrobial activity of antibiotic pastes, CTZ, and 3Mix in two formulations, through a direct contact antimicrobial assay against a polymicrobial biofilm composed of *C. albicans* and *E. faecalis* and to establish the appropriate dilutions for this assessment in future studies.

MATERIALS AND METHODS

The experiment was performed at the Multidisciplinary Laboratory of the School of Dentistry of the Federal University of Rio de Janeiro. Two membranes (Microlab Scientific, Yueqing City, Zhejiang Province, China) were used per group: CTZ, 3 Mix1, 3 Mix3, positive control (0.2% Chlorhexidine gel [CHX], Perioxidin® Bioadhesive Gel, Gross, Lacer, Rio de Janeiro, Brazil) and negative control (0.9% saline solution, Eurofarma Laboratórios S.A., São Paulo, Brazil). The experiment was performed in duplicate.

Preparation of antibiotic pastes

The enteric coating was removed by scalpel from those drugs obtained commercially in tablet form: Cipro® (Bayer SA, Socorro, Brazil), Flagyl® (Sanofi-Aventis Pharmaceutical Ltda., São Paulo, Brazil), and minocycline hydrochloride (Ranbaxy Laboratories Limited, Dewas, India). The tablets were separately pulverized in mortar and pestle and sieved (Tamis mesh 70 sieve) to standardize the particle size of each antibiotic powder. These were stored individually in opaque colored vials to prevent light exposure.

The antibiotic pastes were prepared as in previous studies:

a) CTZ capsules were prepared by a local pharmacy (Barraderm, Rio de Janeiro, Brazil). Each capsule contained all components in powder form (62.5 mg chloramphenicol, 62.5 mg tetracycline, and 125 mg zinc oxide).[12] Four drops of eugenol (SSWhite Dental Articles Ltd., Rio de Janeiro, Brazil) were added to the content of each capsule at the time of use.

b) 3Mix1 paste, composed of 500 mg ciprofloxacin (Cipro®, Bayer SA, Socorro, Brazil), 400 mg metronidazole (Flagyl®, Sanofi-Aventis Pharmaceutical Ltda., São Paulo, Brazil) and 100 mg minocycline hydrochloride (Ranbaxy Laboratories Limited, Dewas, India) were combined in a 1:1:1 ratio in excipients macrogol and propylene glycol (in a 1:1 ratio) (adapted from Nakornchai et al.[4]).

c) 3Mix3 paste, consisting of 500 mg ciprofloxacin (Cipro®, Bayer SA, Socorro, Brazil), 400 mg metronidazole (Flagyl®, Sanofi-Aventis Pharmaceutical Ltda., São Paulo, Brazil) and 100 mg minocycline hydrochloride (Ranbaxy Laboratories Limited, Dewas, India) were combined in a 1:3:3 ratio with 0.9% saline excipient (adapted from Divya et al.[6]).

All pastes were manipulated on sterile glass plates using a stainless steel spatula immediately prior to the experiment, at room temperature (25° C) using aseptic conditions, to obtain similar ointment consistency.

For the positive control (CHX), 0.2% chlorhexidine gel (Perioxidin® Bioadhesive Gel, Gross, Lacer, Rio de Janeiro, Brazil) was used, while 0.9% saline solution (NaCl, Eurofarma Laboratórios S.A., São Paulo, Brazil) was used for the negative control.

Preparation of inoculum and media

To obtain the mixed inoculum, reference strains of *Enterococcus faecalis* (ATCC 29212) and *Candida albicans* (ATCC 10231) were reactivated from original cultures on BHI

medium (Difco, Sparks, USA) for 48h at 37ºC with 5% CO_2. Bacterial colonies were collected and suspended with the aid of a sterile loop into BHI broth (Difco, Sparks, USA). The inoculum of microorganisms was standardized (in a spectrophotometer at 625 nm) at a concentration of 1×10^7 CFU / mL, corresponding to a 0.1 absorbance for *E. faecalis* and 10 for *C. albicans*. Brain Heart Infusion Agar (BHI) (Difco, Sparks, USA) was used for the selection of total microorganisms, CHROMagar™ Candida (Difco, Sparks, USA) for *Candida* spp. and BBLTM Enterococcosel™ Agar (Difco, Sparks, USA) for *Enterococcus* spp. BHI is a nutrient medium used for the cultivation of various microorganisms such as Streptococcus spp., Enterobacterium, yeast, and fungi. CHROMagar™ Candida (Difco, Sparks, USA) is a selective medium for Candida spp and for presumptive identification of some species in which colonies produce different colors, such as *Candida albicans*, whose colonies appear light green to medium green. BBLTM Enterococcosel™ Agar (Difco, Sparks, USA) is a selective medium used for rapid detection of enterococci.[13]

The media were prepared following the manufacturer's instructions and distributed into sterile Petri dishes (5 mL per plate). After solidification and drying, they were incubated at 37°C for 24 hours.

Evaluation of antimicrobial activity by direct contact of fresh pastes with multispecies biofilms

Two 13-mm diameter cellulose membrane discs (Microlab Scientific, Yueqing City, Zhejiang Province, China) distributed into 5 groups (n=10) were placed on BHI agar. A standard mixed microbial suspension (20 L) was pipetted over the discs for mixed biofilm formation. The plates were incubated under microaerophilic conditions for 24 hours at 37°C, after which, biofilm growth was observed on all membrane discs.

The freshly made pastes and the positive control were placed directly onto the biofilm that had formed on the surface of the membrane discs. An explorer probe was used to detach the paste from a specimen used to obtain standardized discs (7mm in diameter by 1mm in height). For the negative control, 2 drops of 0.9% saline solution were dropped directly onto the biofilm. The samples were incubated at 37°C, and the contact time was 24 hours.

The membrane discs were then transferred to 1.5 mL microtubes (Ciencor Scientific Ltda, São Paulo, Brazil) containing 900 µl of 0.9% saline and vortexed for 2 minutes. After shaking, cultures were serially diluted (10^0 to 10^{-7}) to allow microbial counting and assess microbial viability (CFU / mL).

For plating, 50 µl of each dilution were dispensed on the surfaces of the culture media and spread using a Drigalski loop, exchanged every two plates of the same medium.

Determination of appropriate microbial concentration

We analyzed five microbial dilutions per culture medium to determine the appropriate dilutions for this assessment. For non-selective BHI media, concentrations from 10^{-3} to 10^{-7} were used. For the other media, concentrations from 10^{-2} to 10^{-6} were used. The plates were incubated in microaerophilic conditions for 24 h at 37ºC, and the CFU was counted and the results demonstrated by CFU / mL.

Statistical analyses

Counting colony-forming unit data were tabulated in Excel version 2013 (Microsoft©, São Paulo, Brazil) and analyzed descriptively by the mean and standard deviation. CFU quantification data were log-logically transformed into $\log_{10}$ CFU / mL, and the Mann-Whitney test was applied (significance assigned at $p<0.05$) using the software Statistical Package for the Social Science (SPSS) for Windows, version 21.0 (IBM Corp., Armonk, NY, USA).

RESULTS

All antibiotic pastes showed some degree of inhibition in CFU number against the multispecies biofilm formed by *C. albicans* and *E. faecalis* in BHI medium. 3Mix1 paste demonstrated higher CFU inhibition than the other groups ($p = 0.000$) (Figure 1).

All pastes demonstrated inhibition of CFU number in mixed biofilm formed by *C. albicans* and *E. faecalis* in CHROMagar™ medium ($p<0.05$). The CTZ paste showed a high inhibition ability, significantly different from that of the control and the other pastes ($p<0.05$) (Figure 2).

All pastes reduced the number of CFU in mixed biofilm formed by *C. albicans* and *E. faecalis* in Enterococcosel™ medium. The largest differences were observed between paste activities and the negative control ($p = 0.000$). The 3Mix1 paste showed the highest degree of inhibition ($p<0.004$), while CTZ and 3Mix3 exhibited similar inhibition potential ($p = 0.005$) (Figure 3).

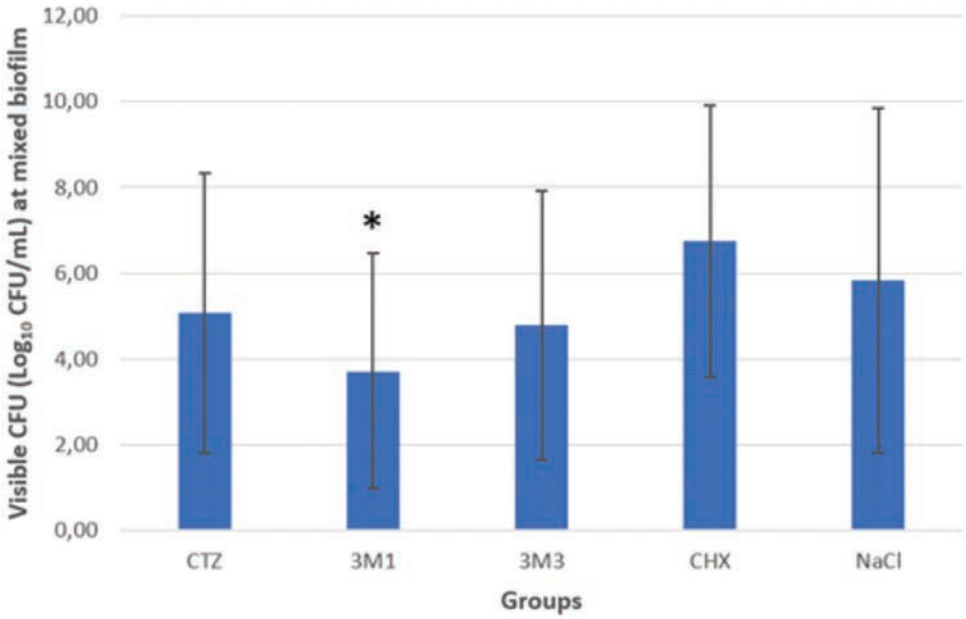

***Figure 1**: Average number of visible CFUs (Log10UFC / mL) in multispecies biofilm formed by* C. albicans *and* E. faecalis *in BHI medium per material. The vertical lines represent the standard deviation. * Significantly different compared to other materials.*

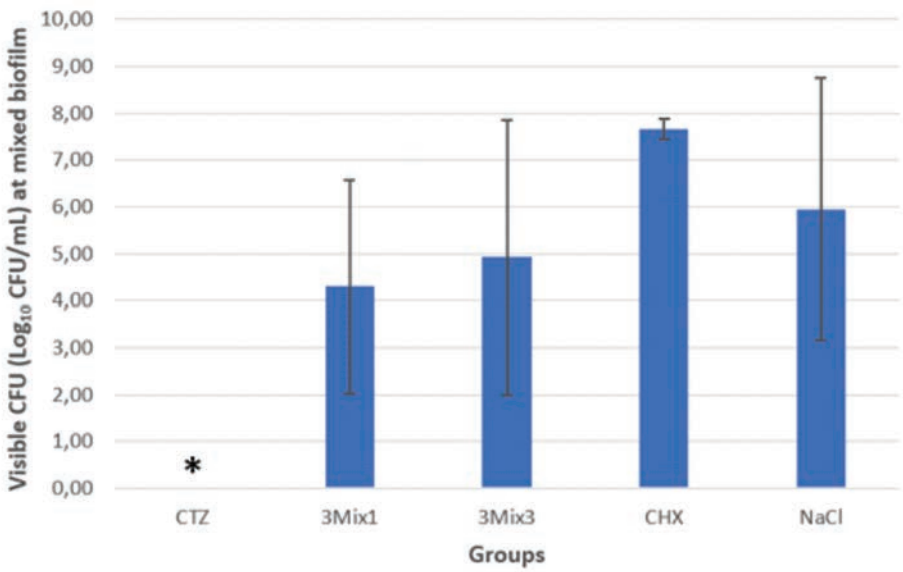

***Figure 2**: Average number of visible CFUs (Log10UFC / mL) in mixed biofilm formed by* C. albicans *and* E. faecalis *in CHROMagar™ medium per material. The vertical lines represent the standard deviation. * Significantly different compared to other materials.*

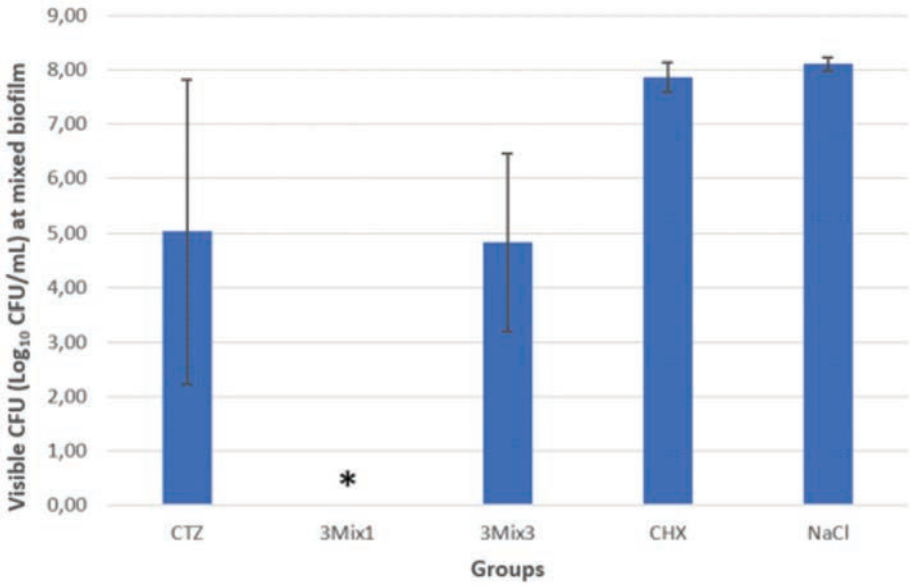

***Figure 3**: Average number of visible CFUs (Log$_{10}$UFC / mL) in mixed biofilm formed by* C. albicans *and* E. faecalis *in Enterococcosel™ medium per material. The vertical lines represent the standard deviation. * Significantly different compared to other materials.*

DISCUSSION

Pulpectomy success is directly related to bacterial reduction or elimination not only within the prepared root canals but also at the places not normally reached by chemo-mechanical preparation.[1] Tortuous root canals, the presence of multiple accessory canals and branches, large medullary bone spaces, the physiological resorption process, and, in some cases, inability to control infant behavior make the conventional treatment difficult and time-consuming.[1,15] Thus, non-instrumental endodontic treatment has been proposed as an alternative as it is a faster and easier treatment that employs antibiotic pastes to promote root canal disinfection and thus tissue repair.[16] For this reason, it is critical to understand the properties of the pastes used in this technique.

The microorganisms *E. faecalis* and *C. albicans* were chosen for this experiment since they are involved in cases of endodontic treatment failure, are antibiotic-resistant, and demonstrate virulence mechanisms that may hinder lesion management.[17]

The vehicles used in 3Mix pastes, whether saline or macrogol and propylene glycol, might have a direct influence effect on drug release, the onset of action, drug penetration into dentinal tubules, and drug dissociation.[18] The proportion of vehicles used in 3Mix pastes varies. In the studies by Hoshino et al.[11] and Lokade et al.[19], the ratio used was 1: 1 propylene glycol to macrogol, while in Takushige et al.[20], Nanda et al.[21], and Pinky et al.[22], the vehicle was propylene glycol with saline. Similarly, the proportion of antibiotics ranges from three equal parts each[4,11,19] to one-part ciprofloxacin and three parts metronidazole and minocycline.[6,20,21,22] We evaluated both antibiotic proportions and different vehicles.

Studies evaluating the antimicrobial activity of CTZ paste against *E. faecalis* demonstrated inhibition of bacterial growth.[23,24,25] Our results also showed decreased CFU count for CTZ in the selective medium for *E. faecalis*. Colony growth of *Candida spp.* on the selective medium was significantly inhibited by CTZ paste. This finding is consistent with previous results evaluated by tests such as agar diffusion.[3,22,25] In addition, the present study demonstrated, for the first time, the antimicrobial activity of CTZ on multispecies biofilms by direct contact with the paste.

The antimicrobial activity of 3Mix paste against *E. faecalis* was previously reported to be very satisfactory,[26,27,28] inhibiting all bacterial growth of single-microorganism cultures,[26] a finding corroborated by our results. In *E. faecalis* selective medium, 3Mix3 showed inhibition activity similar to CTZ, and 3Mix1 caused total inhibition of colony growth.

Most previous studies utilized a different methodological design than that in the present study, which may hinder comparison, especially in the use of multispecies biofilms, since the behavior of bacteria in their planktonic form differs greatly from their biofilm behavior.[29] This fact may explain the lower inhibition of CFU in BHI medium, a non-selective nutrient medium that promotes the growth of the two studied microorganisms. Moreover, we understand that the use of biofilm formed on a membrane does not exactly simulate the environment found inside the pulp canal

and that the number of samples used in this pilot study was small. In this sense, although the methodology was efficient for the initial screening of antimicrobial activity of pulp therapy pastes, future experiments using human or bovine teeth within multispecies biofilms on root canals are suggested.

Notably, the inhibition of CFU growth in the positive control group was not much higher than in the experimental groups. We believe this may be related to chlorhexidine concentration (0.2%) and / or gel presentation. Considering that no previous membrane methodology[30] study utilized a positive control group, a comparison is challenging. Since chlorhexidine at various concentrations is used as an irrigating solution on pulp therapy, it was chosen for this study.[31]

Chlorhexidine in higher concentrations and firmer consistencies should be evaluated in future studies. It is noteworthy that this did not impede the comparison of our results since we chose an inert negative control (0.9% saline), which allowed for the visualization of microorganism growth without antimicrobial agents. This emphasizes the importance of conducting pilot studies prior to laboratory experiments to detect methodological limitations to improve future study design.

The microbial dilutions enabled CFU counting in non-selective medium (10^{-3} to 10^{-7}) and *Enterococcus* spp. selective medium (10^{-2} to 10^{-6}). However, in the *Candida* spp. selective medium, it was not possible to quantify CFUs in 10^{-2} and 10^{-3} dilutions due to the large numbers of CFUs. Thus, we suggest that only larger dilutions be evaluated in future studies.

CONCLUSION

It was concluded that the pastes showed antimicrobial activity against the tested multispecies biofilm and that the new proposed direct contact methodology was efficient. Moreover, appropriate dilutions for this methodology were determined.

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EVALUATION OF MICROBIAL CONTAMINATION AND EFFICACY OF ANTIMICROBIAL AGENTS IN DISINFECTION OF HANDICAPPED PATIENTS' TOOTHBRUSHES

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Palavras-chave: Desinfecção. Estreptococos do grupo mutans. *Streptococcus mutans*. Escova de dentes. Pacientes especiais.

RESUMO

Objetivo: O presente estudo teve como objetivo avaliar a contaminação de escovas de dente utilizadas por pacientes especiais, por meio de cultura microbiana e formação de biofilme cariogênico, explorando dois métodos de desinfecção. **Métodos**: O estudo foi dividido em três estágios, com o mesmo intervalo de tempo entre cada estágio. No primeiro estágio, os pacientes escovaram os dentes e enxaguaram com água, em seguida, suas escovas foram borrifadas com água destilada. No segundo e terceiro estágios, as etapas foram semelhantes às do estágio I, exceto que as escovas de dente foram borrifadas com soluções de clorexidina 0,12% e cloreto de cetilpiridínio 0,05%, respectivamente. Ao final de cada etapa, as cerdas das escovas de dente foram cultivadas em meio de Caldo Sacarose Bacitracina (CaSaB). Os dados foram analisados por meio do teste não paramétrico de Friedman (nível de significância de 5%). **Resultados**: No estágio I, os estreptococos do grupo *mutans* (EM) estavam presentes em 30 escovas de dente (76,9%), e o número de colônias / biofilmes variou de 0 a +100. No estágio II, nenhuma colonização por MS foi observada. No estágio III, apenas 10,2% das escovas de dente estavam contaminadas com MS, e o número de colônias / biofilmes variou de 1 a 31. **Conclusão**: As cerdas das escovas de dente utilizadas por pacientes especiais contaminaram-se com EM após uma única escovação. A solução de clorexidina 0,12% eliminou todos os microrganismos das cerdas das escovas de dente utilizadas pelos pacientes. Ambas as soluções em spray (gluconato de clorexidina 0,12% e cloreto de cetilpiridínio 0,05%) podem ser utilizadas com eficácia para desinfecção das escovas de dente para reduzir a contaminação.

Keywords: Disinfection. Mutans group streptococci. *Streptococcus mutans. Toothbrushes. Handicapped patients.*

ABSTRACT

Objective: This study aimed to evaluate the contamination of toothbrushes used by patients with disabilities, by microbial culture and cariogenic biofilm formation, and to explore two methods of disinfection. **Methods**: Experimental procedures were divided into three stages, with the same interval between each stage. In the first stage, the patients brushed their teeth, rinsed them with water, and their toothbrushes were sprayed with sterilized tap water. In the second and third stages, the steps were similar to those of Stage I, except the toothbrushes were sprayed with 0.12% chlorhexidine and 0.05% cetylpyridinium chloride solutions, respectively. At the end of each stage, the toothbrush bristles were cultured in bacitracin sucrose broth (CaSaB) medium. Data were analyzed through Friedman's nonparametric test (5% significance level). **Results**: In Stage I, mutans group streptococci (MS) were present in 30 toothbrushes (76.9%), and the number of colonies/biofilms ranged from 0 to +100. In Stage II, no MS colonization was observed. In Stage III, only 10.2% of the toothbrushes were contaminated with MS, and the number of colonies/biofilms ranged from 1 to 31. **Conclusion**: Bristles of toothbrushes used by patients with disabilities became contaminated with MS after a single brushing. The 0.12% chlorhexidine solution eliminated all microorganisms from the bristles of the toothbrushes used by the patients. Both 0.12% gluconate chlorhexidine and 0.05% cetylpyridinium chloride spray solutions can effectively be used for toothbrush disinfection to reduce contamination.

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INTRODUCTION

According to the Clinical Guidelines and Integrated Pathways of Care for Oral Health of Persons with Learning Disabilities (2012),[1] a good oral care routine is important for everyone, especially for patients with disabilities. Unfortunately, there is evidence that patients with disabilities present poor general and oral health, they also have unmet health needs and less acceptance of screening services.[2,3] Currently, people with special needs have more dental issues, including dental caries, periodontal diseases, and missing teeth; they also experience more difficulty obtaining dental care compared with other segments of the population.[4-9] Additionally, children with disabilities appear to have higher incidence of caries and higher levels of unmet dental needs and poor oral hygiene compared with healthy controls.[6-9]

The general state of oral health is related to poor oral hygiene routine and contributes to the occurrence of systemic diseases. This fact should raise greater concern when it comes to people with special needs, who usually have systemic alterations, including immune deficiency. Toothbrushes are the primary method for removing dental biofilm. However, when bacteria survive on toothbrushes, they can reinoculate the oral cavity of the original host. The multiplication and increase in the number of these microorganisms may represent a significant risk of dissemination.[10-13] Several studies have shown that toothbrushes can be contaminated after use[14-17] by different types of bacteria,[18] viruses,[19] and fungi,[20,21] that are present in the oral cavity; *Streptococcus mutans* remain alive on toothbrushes for 44 hours. For this reason, disinfection methods for toothbrushes should be indicated, especially for patients with disabilities.[22] There are no studies that specifically examine toothbrush contamination and its effect on oral health in vulnerable populations.[23]

This study aimed to evaluate toothbrush contamination by mutans group streptococci (MS) after use in patients with disabilities. The efficacy of the use of 0.12% chlorhexidine and 0.05% cetylpyridinium chloride solutions in toothbrush disinfection was also examined.

MATERIALS AND METHODS

This study was approved by the Research Ethics Committee of the Faculty of Dentistry of the University of São Paulo, Brazil (Protocol number 2002.1.471.58.9), and written informed consent was obtained from all parents or guardians of the participants.

A total of 39 individuals with disabilities, aged 6 to 20, of both genders, participated in this study. The experimental procedures were divided into 3 stages, with a 3-day interval between Stages I and II, and II and III.

In Stage I, patients underwent a 1-minute brushing performed with dentifrice by a single dentist (Sorriso – Kolynos do Brasil Ltd, São Bernardo do Campo, São Paulo, Brazil) and using new toothbrushes taken directly from their original packaging. Then the bristles were rinsed and excess water was removed. The toothbrushes were held upright and the bristles were sprayed with sterilized tap water. In Stages II and III, a new brushing was performed with the same dentifrice and 0.12% chlorhexidine (PerioGard, Colgate-Palmolive Company, NY, NY, USA) and 0.05% cetylpyridinium chloride solutions (Reach oral antiseptic, Johnson & Johnson, New Brunswick, NJ, USA) were sprayed 6 times on the bristles at a distance of 5 cm (approximately 0.6 mL solution per toothbrush) in different areas: (1) right side, (2) left side, (3) top, (4) bottom, (5) front, and (6) the back of the toothbrush head. The excess antimicrobial solution was removed from the bristles by tapping the toothbrush gently against the sink. Afterward, the toothbrushes were kept in a closed container to avoid contact between them. They were also kept at room temperature for 4 hours to simulate the interval between uses.

After this period, the toothbrushes of each group were placed individually and vertically in 25 x 150 mm test tubes containing 10.0 mL bacitracin sucrose broth (CaSaB)-selective enrichment broth prepared with the modification of Jensen and Brattall[14] (specific medium for *S. mutans* without trypan blue) for 3 to 4 days at 37°C. The toothbrushes were placed with care in order to avoid contact between the bristles and the walls of the test tube. They were removed and rinsed in the broth with gentle agitation to remove the planktonic microbiota, leaving the sessile bacteria adhered as spike or mushroom-like colonies/biofilms. The toothbrush bristles were carefully analyzed on all sides, and *S. mutans* sessile colonies/biofilms based on colony morphology were counted under aseptic conditions with a stereomicroscope (Nikon, Tokyo, Japan) with reflected light.

After incubation, the toothbrushes with no colonies/biofilms found in the bristles (score 0) were immersed in the culture medium for 20 days to evaluate the turbidity of the medium; this would indicate growth of microorganisms other than *S. mutans*. If there was no turbidity of the medium after this period, the specimens were classified as 0 *, meaning that they were considered free of microorganisms. The confirmation that the adhered microorganisms were *S. mutans* was obtained through a sequence of steps: (1) Four to five colonies/biofilms representative of bacterial development were collected from 3 to 4 toothbrushes in each group and transferred to tubes containing 2.0 mL of phosphate buffer and glass beads; (2) Colonies were shaken for 2 minutes; (3) The resulting suspension was seeded on SB20 agar (tryptone soy yeast agar + 20% sucrose and 0.2 U/

mL bacitracin; Sigma, Saint Louis, MO, USA) and incubated in microaerophilic conditions at 37°C for 72 hours; (4) Growth of colonies biofilms was verified after the incubation period; (5) The following tests were performed for biochemical identification: fermentation of mannitol, sorbitol, raffinose and melibiose; hydrolysis of arginine and esculin; H2O2 production; and sensitivity to 2.0 IU of bacitracin.[24]

The microbiological results were statistically analyzed by Friedman's nonparametric test at a significance level of 5%, using GMC statistical software, version 8.1 (Geraldo Maia Campos - School of Dentistry of Ribeirão Preto, University of São Paulo, São Paulo, Brazil).

RESULTS

Thirty-nine patients with disabilities participated in the randomized clinical trial. All participants completed the three stages.

S. mutans colonies/biofilms were detected in 30 of 39 toothbrushes (76.9%) in Stage I (sprayed with sterilized tap water), with colonies/biofilms ranging from 2 to +100. The 9 toothbrushes (23.1%) that did not show colonization of the *S. mutans* showed turbidity of the medium, which were considered to be positive cultures.

In Stage II, in which the 0.12% chlorhexidine solution was used for disinfection, no *S. mutans* colonies/biofilms were observed in all cases, showing 100% efficacy. However, after the turbidity of the medium, other microorganisms were evidenced in 8 toothbrushes (20.5%). Absence of microorganisms (classification 0 *) was evidenced in 31 toothbrushes (79.5%).

In Stage III (disinfection with 0.05% cetylpyridinium chloride solution), only 4 toothbrushes (10.3%) were contaminated with *S. mutans*, with the number of colonies/biofilms ranging from 1 to 31. A total of 35 toothbrushes (89.7%) were not contaminated with *S. mutans*. However, the presence of other microorganisms evidenced by the turbidity of the medium was observed in 17 toothbrushes (43.6%). No microorganisms (classification 0 *) were observed in 18 toothbrushes (46.2%). All solutions differed statistically from each other (p <0.01) (Figures 1 and 2).

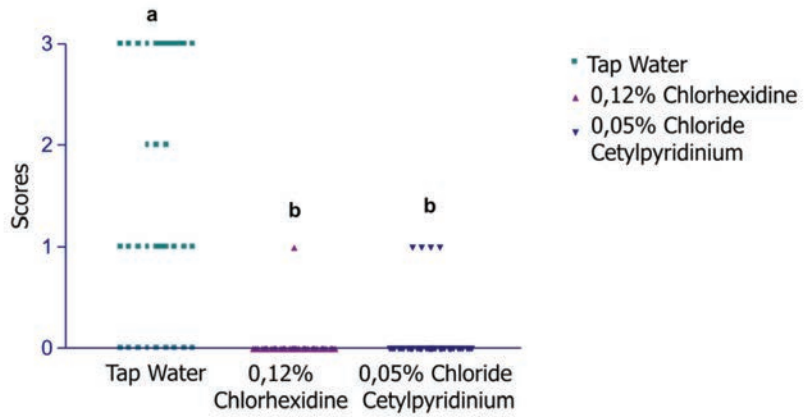

***Figure 1**: Stage I (sterilized tap water) 0 (0%) microorganism-free toothbrushes (0 *); Stage II (chlorhexidine gluconate 0.12%) 31 (79.5%) microorganism-free toothbrushes (0 *); Stage III (0.05% cetylpyridinium chloride) 18 (46.2%) microorganism-free toothbrushes (0 *). In this figure, different letters indicate statistically significant differences.*

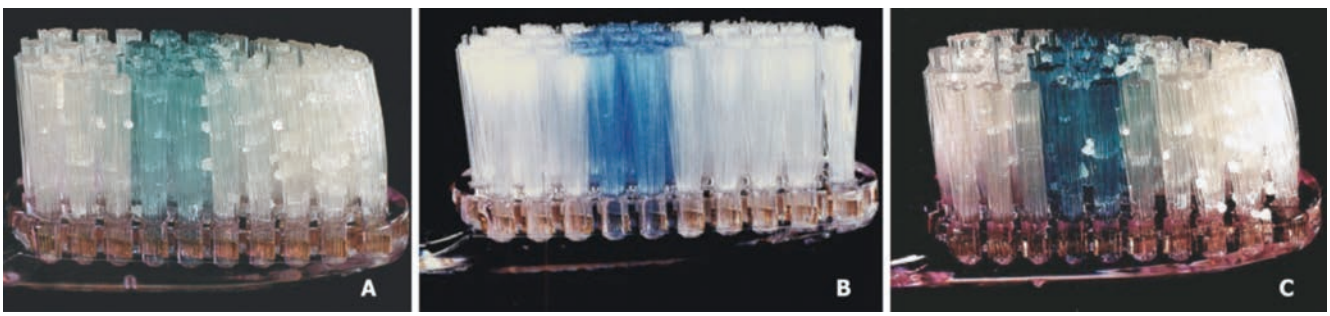

***Figure 2**: (A) Stage I (sterilized tap water) Intense development of Streptococcus mutans colonies/biofilms on toothbrush (bacterial biofilm); (B) Stage II (0.12% chlorhexidine) No development of S. mutans colonies/biofilms on toothbrush; (C) Stage III (0.05% cetylpyridinium chloride) Presence of small number of S. mutans colonies/biofilms on toothbrush (bacterial biofilm).*

DISCUSSION

The present study indicates that among the solutions tested, the best solution for the disinfection of toothbrushes for individuals with disabilities is 0.12% chlorhexidine. Our finding is in line with those of Nelson-Filho et al.[22] who evaluated the disinfection of toothbrushes in the general population. In the study by Nelson-Filho et al.[22], *S. mutans* contamination was detected in toothbrushes used by patients, after a single use. However, given the motor difficulty and immunodeficiency that patients with disabilities present, the present study becomes relevant. Additionally, patients with disabilities have a higher risk of caries and greater difficulty in finding quality treatment.[6,7,8,9,25]

The present study found that *S. mutans* contamination in toothbrush bristles used by patients with disabilities was almost completely eliminated (79.5%) through the use of chlorhexidine spray. This finding is consistent with those of other studies[4,21,22,26,27] that have found 0.12% chlorhexidine solution to be highly effective in disinfecting toothbrushes in children and adults.

The use of cetylpyridinium chloride solution as a disinfection method showed good results in the present study. Several other studies[14,20,23] have also demonstrated high efficacy in disinfecting toothbrushes with the solution spraying method.

An important aspect to consider is that toothbrushes can be contaminated by other pathogens responsible for different local and systemic diseases as well as by cariogenic microorganisms. According to Glass[15], the microorganisms found in the bristles of toothbrushes can not only cause oral diseases, but also gastrointestinal respiratory infections. In patients with disabilities, who often have several mental deficiencies and physical issues, this information is even more relevant in relation to the risk of bacteremia.

Considering the contamination of toothbrushes by a wide range of microorganisms and the effectiveness of antimicrobial sprays in preventing microbial growth and accumulation, the need to disinfect toothbrushes after each use should be widely diffused and strongly emphasized.

CONCLUSION

Bristles of toothbrushes used by patients with disabilities became contaminated with MS after a single brushing. The 0.12% chlorhexidine solution eliminated all microorganisms from the bristles of the toothbrushes, and was the most effective among the evaluated solutions (sterilized tap water, 0.12% chlorhexidine, and cetylpyridinium chloride solution). Both 0.12% gluconate chlorhexidine and 0.05% cetylpyridinium chloride spray solutions can effectively be used for toothbrush disinfection to reduce contamination.

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CEPHALOMETRIC PROFILE NORMS FOR SOUTHEASTERN AFRICAN-BRAZILIAN ADULTS ACCORDING TO THE LEGAN-BURSTONE ANALYSIS: A PILOT STUDY

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Palavras-chave: Ortodontia. Brasil. Cefalometria. Grupo de Ancestrais do continente africano. Estética.

RESUMO:

Objetivo: O objetivo deste estudo piloto foi determinar as normas do perfil cefalométrico para uma amostra de jovens adultos afro-brasileiros com oclusão excelente e, compará-las com os padrões caucasianos. **Métodos**: Cefalogramas laterais de 43 indivíduos de ambos os sexos (28 homens e 15 mulheres), com idade média de 22,40 ± 3,40 anos, foram utilizados para avaliar 13 variáveis propostas pela análise de Legan-Burstone. O teste t independente de Student foi utilizado para comparar os valores resultantes com os estabelecidos pelos padrões euro-americanos. **Resultados**: Foram encontradas diferenças significativas (p <0,001) entre afro-brasileiros e caucasianos quanto a: prognatismo maxilar e mandibular, razão vertical da altura, menor ângulo face-pescoço, menor razão vertical altura-profundidade, ângulo nasolabial, protrusão labial superior e inferior, sulco mentolabial e razão vertical lábio-mento. O ângulo de convexidade facial, a exposição dos incisivos superiores e o *gap* interlabial não apresentaram diferenças estatísticas quando comparados os grupos étnicos. Os homens apresentaram maiores ângulos face-pescoço e razões verticais lábio-queixo (p <0,05), enquanto as mulheres apresentaram maior exposição dos incisivos superiores (p <0,05). **Conclusão**: As normas cefalométricas caucasianas não se aplicam a jovens adultos afro-brasileiros. Portanto, diferenças morfológicas nas faces desses indivíduos devem ser levadas em consideração durante as etapas de diagnóstico e planejamento do tratamento ortodôntico.

Keywords: Orthodontics. Cephalometrics. African-continent Ancestry Group. Esthetics. Brazil.

ABSTRACT:

Objective: The aim of this pilot study was to determine cephalometric profile norms for a sample of African-Brazilian young adults with excellent occlusion and compare them to Caucasian standards. **Methods**: Lateral cephalograms of 43 individuals of both genders (28 male and 15 female), with average age of 22.40 ± 3.40 years, were used to evaluate 13 variables proposed by the Legan-Burstone analysis. Student´s independent t-test was used to compare resulting values with those set by European-American standards. **Results**: Significant differences were found (p < 0.001) between African-Brazilians and Caucasians as for: maxillary and mandibular prognathism, vertical height ratio, lower face-throat angle, lower vertical height-depth ratio, nasolabial angle, upper and lower lip protrusion, mentolabial sulcus and vertical lip-chin ratio. Facial convexity angle, maxillary incisor exposure and interlabial gap did not present statistical differences when ethnic groups were compared. Males displayed increased lower face-throat angles and vertical lip-chin ratios (p <0.05) while females presented increased maxillary incisor exposures (p <0.05). **Conclusion**: Caucasian cephalometric norms do not apply to African-Brazilian young adults. Therefore, morphological differences in the faces of such individuals should be taken into account during diagnosis and orthodontic treatment planning stages.

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INTRODUCTION

Facial beauty, as determined by well balanced and esthetic features, is a determining factor in dictating standards for human beauty. Portrayed by different art forms over time, facial features represent to this day, a relevant issue when it comes to social interactions and for the establishment of the individual´s self-esteem. Having said that, the pursuit of facial attractiveness is often the main reason driving patients to orthodontic or orthognathic treatments, aiming to correct facial deformities.[1,2]

Cephalometrics represents an important diagnostic tool, with vast applicability. Several authors[2-6] have proposed normative values in analyses that aim to quantify through a means of comparison, the amount of disharmony between skeletal and soft tissues, as well as to provide planning guidelines for treatment to be initiated. The Legan-Burstone soft tissue analysis is frequently used in orthodontic and orthognathic treatment planning. Nevertheless it is only applicable to populations with European or North-American ancestry, seen as it is based on patterns found in young Caucasian adults and therefore should not be used in diagnosis or treatment planning of other ethnic groups.

There are literature reports of studies that investigated facial differences in various ethnic groups, such as Chinese,[7-9] Japanese,[9-11] Korean,[12,13] Turkish,[14] Jordanian,[15] Yemenite,[16] Indian,[17,18] African[19-21] and African-American.[22-24]

African descendants living today in Southeastern Brazil are very heterogeneous in morphology, because most of them descend from African Bantu slaves who mixed with Mediterranean European colonizers and Native American Indians. The Bantu people in turn, prevail in two vast regions of the African continent: Mid-Eastern Africa, including the Old Portuguese colonies of Angola and Mozambique, as well as the Congo region; and Western Africa ranging from the Southern coast up to the Guinea Golf.[24]

Cephalometric standards for Brazilians of African-Descent have been previously published[25], however the dentoskeletal patterns were emphasized in detriment of soft tissue analysis. There are no literature records of manuscripts attempting to establish cephalometric soft tissue standards for adult African-Brazilians, justifying the present study which aims to use the Legan-Burstone analysis to determine cephalometric soft tissue norms for a sample of young adult, southeastern African-Brazilians and compare them to the Caucasian European-American standards. Therefore, the following null hypotheses were tested: the lack of differences in facial profile norms between African-Brazilians and Caucasian European-Americans; and the lack of differences in facial profile norms between male and female African-Brazilians.

MATERIALS AND METHODS

The study was approved by the Ethics in Research Committee of the Institute for General Health Studies at the Universidade Federal do Rio de Janeiro (IESC – UFRJ – statement n.66/2011). Five individuals that fitted the inclusion criteria refused to take part in the study. All other participants signed an Informed Consent that explained the nature and reason for the study previously to the start of the project. The required sample size was calculated according to a previous pilot study (power analysis at = 0.05 significance level and 80% power) using the facial convexity angle parameter (minimum clinical difference adopted was 5°) with standard deviation of 7.8°. The result showed that at least 39 patients would be necessary for the study.

Forty-three volunteers (28 male and 15 female) were selected from 396 Brazilian active duty Navy personnel attending the Naval Central Dental Clinic (Rio de Janeiro – Brazil). These individuals, born in southeastern Brazil, affirmed to having African ancestry up to the third generation. The average age in the group was 22.4 ± 3.4 years with the age ranging from 18 to 30 years. Females presented an average age of 22.00 ± 4.28 years, and males of 22.6 ± 3.10 years. All individuals were in good state of general health. The individuals were recruited between September 2011 and April 2012 following the inclusion criterion: excellent occlusion of first molars and canines in the permanent dentition (except third molars); 1 to 3 mm overjet; slight rotations of up to 2 mm permitted, distributed over the arch; anterior crowding of up to 2 mm; 20 to 30% overbite; small gaps of up to 2 mm permitted, distributed over the arch; absence of cross bites or previous orthodontic or orthognathic treatments.

Intra and extra-oral photographs, as well as study casts and cephalograms were obtained for all participants. The same operator (IMCS) was trained to take all the lateral cephalograms using the cephalostat (Ortophos Plus DS; Sirona Dental System, Bensheim, Germany) with the following settings: radiation time 15.4s, exposure time 0.4s, X-ray tube voltage 73 kV and X-ray tube current 15mA). Individuals were placed in maximum intercuspation, with lips at rest and Frankfort´s horizontal plane parallel to the ground, as in natural head position. All the digitalized images were obtained in TIFF format and 18 x 24 cm in size.

All cephalometric tracings were performed digitally using Dolphin Imaging® System 11.0 (Dolphin Imaging, Chatsworth, Califórnia, USA) by the same operator (TCPO), so that inter rater reliability was maintained. Tracings were limited to 5 to 10 per day, to minimize fatigue induced

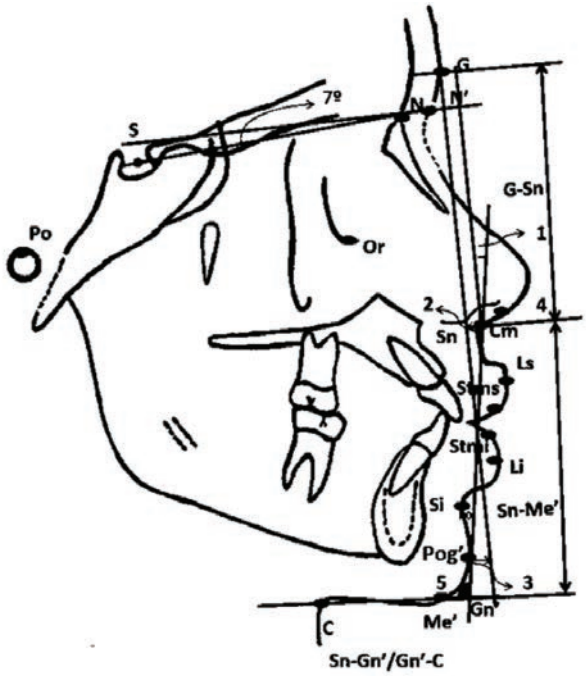

***Figure 1**: Legan-Burstone analysis: Facial morphology – Cephalometric landmarks: S (Sella); N (Nasion); G (Glabella); Sn (Subnasale); Pog´ (Soft tissue pogonion); Gn´ (Soft tissue gnathion); Me´ (Soft tissue menton); C (Cervical point); HP (Horizontal perpendicular plan). Measurements evaluated: 1, Facial Convexity Angle; 2, Maxillary Prognathism (distance from line perpendicular to HP to Sn point); 3, Mandibular Prognathism (distance between line perpendicular to HP and Pog´); 4, Facial Height Ratio (G-Sn/Sn-Me´); 5, Lower Face-Throat Ratio (Sn-Gn'-C); 6, Lower Vertical Height-Depth Ratio (Sn-Gn´/C-Gn´).*

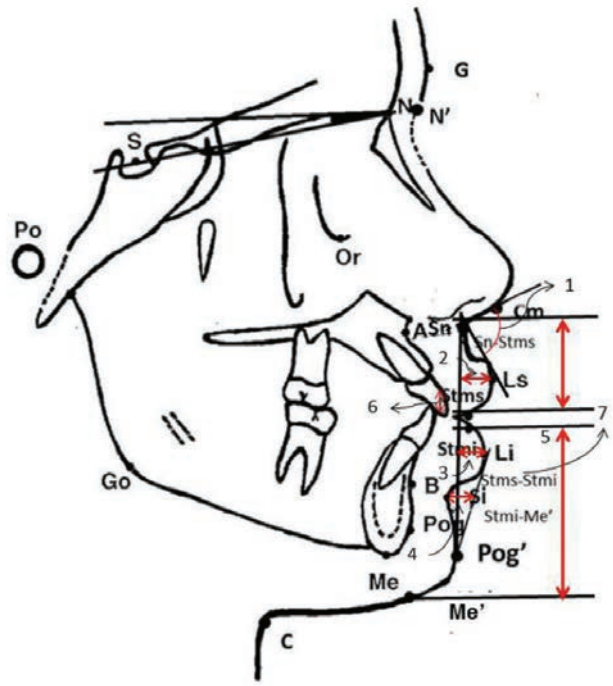

***Figure 2**: Legan-Burstone analysis: lip position and morphology. Cephalometric landmarks: S (Sella); N (Nasion); Sn (Subnasale); Cm (Columella point); Pog´ (Soft tissue pogonion); Me´(Soft tissue menton); Ls (*Labrale Superius*); Li (*Labrale Inferius*); Stms (*Stomion Superius*); Stmi (*Stomion Inferius*), Si (mentolabial sulcus). Measurements evaluated 1, Nasolabial Angle (CmSnLs); 2, Upper Lip Protrusion (Distance from Ls to Sn-Pog´ line); 3, Lower Lip Protrusion (Distance from Li to Sn-Pog´); 4, Mentolabial Sulcus (Distance from Si to Li-Pog´ line); 5, Vertical Lip-Chin Ratio (Sn-Stms/Stmi-Me´); 6, Maxillary Incisor Exposure (Stms-U1); 7, Interlabial Gap (Stms-Stmi).*

errors. Dolphin imaging system corrected X-ray distortions before tracing began, so that angular and linear measurements were not altered. Cephalometric landmarks, reference lines and planes, angular and linear measurements used in the analysis are illustrated in Figures 1 and 2.

Fifteen radiographs were measured twice with a 30-day interval checking for intrarater reliability, and the statistical significance of this procedure was verified by the I.C.C (Intraclass Coefficient Correlation).

Data were subjected to descriptive statistical analysis so that central tendency measures (mean and standard deviations) could illustrate the most common characteristics found in the studied group. Student's t test for independent samples with Bonferroni Correction (α=0.003) was used to assess differences found in African-Brazilian subjects as opposed to the European-American Caucasians norms, as well as to determine whether sexual dimorphism was significant for the studied measurements. Normality of all variables was assessed using Kolmogorov-Smirnov test. Statistical Package for Social Sciences version 16.0 (SPSS Inc., Chicago, Illinois, USA) was used in the analysis.

RESULTS

Descriptive data analysis and statistical comparison between African-Brazilian adults and Caucasian norms as defined by Legan and Burstone (1980) are presented in Table 1. Significant differences (p< 0.003) were found in the African-Brazilian group. Data on facial morphology evidenced that Brazilians of African descent have more pronounced maxillary and mandibular prognathism, smaller facial height ratios and more obtuse throat to neck angles, as well as increased lower vertical height-depth ratio. Lip position analyses showed that African-Brazilians have more acute nasolabial angles, more pronounced upper and lower lip protrusion as well as mentolabial sulcus, besides increased vertical lip-chin ratio. Variables that evaluated facial convexity angle, interlabial gap and maxillary incisor exposure did not present statistical significance when compared to Caucasian norms (Table 2).

The average age in the group was 22.4 ± 3.4 years with the age ranging from 18 to 30 years. Females presented an average age of 22.00 ± 4.28 years, and males of 22.6 ± 3.10 years."

Sexual dimorphism significant difference was not found in the measures evaluated in the present study (Table 3).

***Table 1**: Mean and standard deviation (SD) values found in angular (°) and linear (mm) measurements on soft tissue analysis of African-Brazilian adults versus European-American cephalometric standards, according to the Legan-Burstone analysis (1980). Student´s independent t-test with Bonferroni correction were used for comparison.*

Variable	African-Brazilian (Mean ± SD)	Caucasians Norms (Mean ± SD)	*p*- Value
Facial Morphology			
Facial Convexity Angle (°)	13.02 ± 5.7	12 ± 4	0.247 NS
Maxillary Prognathism (mm)	8.42 ± 3.01	6 ± 3	0.001*
Mandibular Prognathism (mm)	4.58 ± 5.13	0 ± 4	0.001*
Facial Height Ratio	0.80 ± 0.08	1.0 ± 0	0.001*
Lower Face-Throat Angle (°)	110.06 ± 9.90	100 ± 7	0.001*
Lower Vertical Height-Depth Ratio	1.39 ± 0.29	1.2 ± 0	0.001*
Lip position and form			
Nasolabial Angle (°)	89.06 ± 9.32	102 ± 8	0.001*
Upper Lip Protrusion (mm)	8.74 ± 2.16	3 ± 1	0.001*
Lower Lip Protrusion (mm)	8.44 ± 2.34	2 ± 1	0.001*
Mentolabial Sulcus (mm)	-5.63 ± 1.30	4 ± 2	0.001*
Vertical Lip-Chin ratio	0.52 ± 0.05	0.5 ± 0	0.002*
Maxillary Incisor Exposure (mm)	2.41 ± 1.74	2 ± 2	0.124 NS
Interlabial Gap (mm)	1.86 ± 0.66	2 ± 2	0.174 NS

Note: *p ≥ 0.003; not significant (NS). * significant to the level of p < 0.003.*

***Table 2**: Cephalometric data comparison of soft tissue evaluations performed in different ethnic groups* according to the Legan-Burstone analysis.*

Variable	African-Americans (Mean ± SD)	South-Africans (Mean ± SD)	African-Brazilians (Mean ± SD)
Facial Convexity Angle (°)	12.5 ± 5.9	10.7 ± 4.8	13.02 ± 5.7
Maxillary Prognathism (mm)	7.7 ± 4.2	7.0 ± 3.6	8.4 ± 3.0
Mandibular Prognathism (mm)	1.1 ± 8.3	2.1 ± 8.1	4.5 ± 5.1
Facial Height Ratio	1.0 ± 0.1	0.8	0.8 ± 0.1
Lower face-Throat Angle (°)	104.3 ± 13.3	94.1 ± 10.6	110.1 ± 9.9
Lower Vertical Height-Depth Ratio	1.4 ± 0.3	1.2	1.4 ± 0.3
Nasolabial Angle (°)	91.3 ± 14.1	82.6 ± 10.9	89.0 ± 9.3
Upper Lip Protrusion (mm)	8.6 ± 1.8	9.8 ± 1.7	8.7 ± 2.1
Lower Lip Protrusion (mm)	6.9 ± 2.7	9.9 ± 2.7	8.4 ± 2.3
Mentolabial Sulcus (mm)	-5.9 ± 1.5	5.8 ± 1.5	-5.6 ± 1.3
Vertical Lip-Chin Ratio	NA	0.5	0.52 ± 0.0
Maxillary Incisor Exposure (mm)	1.8 ± 2.2	2.3 ± 1.8	2.4 ± 1.7
Interlabial Gap (mm)	0.4 ± 1.1	0.5 ± 0.9	1.8 ± 0.6

Note: *Not significant (NS); not applicable (NA)*

***Table 3**: Mean and standard deviation (SD) values found in angular (º) and linear (mm) measurements on cephalometric soft tissue analysis of both genders of young adult African-Brazilians according to the Legan-Burstone analysis (1980). Student´s independent t-test used for comparison.*

Variable	Males (Mean ± SD)	Females (Mean ± SD)	*p*- Value
Facial Form			
Facial Convexity Angle (º)	12.37 ± 6.48	14.23 ± 3.76	0.241 NS
Maxilar Prognathism (mm)	8.45 ± 3.02	8.36 ± 3.09	0.926 NS
Mandibular Prognathism (mm)	4.93 ± 5.80	3.92 ± 3.69	0.545 NS
Facial Height Ratio	0.80 ± 0.07	0.79 ± 0.08	0.596 NS
Lower Face-Throat Angle (º)	112.57 ± 8.68	105.38 ± 10.61	0.021 NS
Lower Vertical Height-Depth Ratio	1.45 ± 0.27	1.28 ± 0.30	0.074 NS
Lip Position and Form			
Nasolabial Angle (º)	87.43 ± 9.63	92.10 ± 8.17	0.119 NS
Upper Lip Protrusion (mm)	9.05 ± 2.20	8.18 ± 2.04	0.211 NS
Lower Lip Protrusion (mm)	8.54 ± 2.35	2.38 ± 1	0.701 NS
Mentolabial Sulcus (mm)	-5.91 ± 1.16	-5.12 ± 1.42	0.056 NS
Vertical Lip-Chin Ratio	0.54 ± 0.05	0.50 ± 0.04	0.024 NS
Maxillary Incisor Exposure (mm)	1.94 ± 1.63	3.30 ± 1.64	0.013 NS
Interlabial Gap (mm)	1.91 ± 0.71	1.75 ± 0.54	0.443 NS

Note: *p ≥ 0.003; not significant (NS).*

DISCUSSION

The inclusion criteria chosen for this group of African-Brazilians selected from active duty military personnel included: black ancestry up to the 3rd generation, lack of previous orthodontic treatment, southeastern in origin, and age ranging from 18 to 30 years. The predominance of males (*n*=28) over females (*n*=15) reflect the prevalence rate found in the Brazilian Navy, where subjects were selected. Such restrictive inclusion criteria when applied to populations with high miscegenation tend to limit significantly sample sizes. Nevertheless, there are recent literature reports using groups of similar sizes.[15,25]

Despite the lack of statistical significance when compared against Caucasian norms, the facial convexity angle found in African-Brazilians was higher, so more pronounced soft tissue convexity was seen in this group than in European-Americans (12º) (Table 1). Maxillary (8.42mm ± 3.01mm) and mandibular (4.58 mm ± 5.13 mm) prognathism values were highly significant and inconstant (Table 1). This could be due to the high variation in sagittal positioning of the glabella,[18] and a shorter skull base (Sella-Nasion-SN) found in African-Brazilians. There was a posterior dislocation of Nasion point and possibly also of the reference line, which is dropped from the glabella perpendicular to the horizontal reference plane (HP), constructed by drawing a line through Nasion 7º up from Sella-Nasion line (SN).[20]

The lower face-throat angle was found to be more obtuse in African-Brazilians. Its appreciation is critical when it comes to treatment of sagittal discrepancies, as a more obtuse angle indicates that procedures with a potential to reduce chin prominence should be avoided. The increased lower facial height-depth ratio (1.39±0.29) showed that African-Brazilians have a shorter neck, which reinforces that care should be taken with chin-reducing procedures. The smaller vertical height ratio (0.80±0.08) characterized the predominance of lower facial height (Sn-Me') over upper facial height (G-Sn) (Table 1).

Mild differences were observed while comparing sexes. Males had more obtuse lower face-throat angles (112.57º ± 8.68º) than females (105.38º±10.61º), as well as a higher vertical lip-chin ratio (0.54± 0.05) than females (0.50 ± 0.04). In contrast, women presented higher values for incisor exposure (3.30mm ± 1.64 mm) than men (1.94 mm ± 1.75mm) (Table 2).

Significant differences were found while comparing African or African-descending ethnic groups to the Legan-Burstone Caucasian pattern (Table 3). Flynn *et al*[23] studied African-American individuals and found more convex faces, with more pronounced maxillary and mandibular

prognathism, lower nasolabial angle, more protruding lips and pronounced mentolabial sulcus, when compared to European-Americans. In a similar study, Naidoo and Miles[21] evaluated a group of black South-African adults and compared them to Caucasians. It was shown that the first group displayed smaller facial convexity, more pronouced lip protrusion, more acute lower face-throat angle and nasolabial angle as well as shallower mentolabial sulcus. Except for mandibular prognathism and upper lip protrusion, average values found in all analyzed variables for African-Brazilians were closer to African-American findings than to South African findings. This is probably due to the similar heterogeneous origin of African ancestors that were brought to the American Continent, which aside from gathering different African ethnic groups, also interconnected with Native American Indians and European colonizers. Therefore, morphological differences in the faces of such individuals should be taken into account during diagnosis and orthodontic treatment plan.

This research has some limitations such as the possible magnification difference of the devices used to obtain the radiographic images compared to the previous studies[2-6] used as European standard. Nevertheless, these same studies are used in the orthodontist's routine as usual. The number of male and female included in our sample does not comprise enough power to comparisons for sexual dimorphism evaluation, and maybe the reason is associated to the small sample size and difference of individuals number from each sex. In addition, it would be interesting to compare this Afro-Brazilian group to another African standards and with a control group of white southeastern Brazilians.

CONCLUSIONS

The null hypotheses proposed by this study were rejected. Caucasian cephalometric norms do not apply to African-Brazilian young adults.

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MAPPING OF SUPERNUMERARY ELEMENTS IN PATIENTS SEEKING ORTHODONTIC TREATMENT

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Palavras-chave: Epidemiologia. Anormalidades dentárias. Dente supranumerário.

RESUMO

Introdução: Alterações de dimensão, número e forma são anomalias dentárias comumente observadas. **Objetivo**: O objetivo foi mapear a frequência de dentes supranumerários na população estudada, sua localização preferida e os tipos mais prevalentes. Além disso, avaliar a interferência que os dentes supranumerários podem causar na erupção ectópica da série dental normal. **Métodos**: A pesquisa possui desenho retrospectivo observacional. A coleta de dados foi realizada pela avaliação de prontuários odontológicos dos pacientes atendidos em uma clínica ortodôntica. Foram analisados radiografias, fotografias e modelos de gesso dental dos pacientes e as informações foram registradas em arquivos de protocolo do estudo. A coleta de dados foi realizada por uma estudante de graduação e uma da pós-graduação, previamente calibradas. A coleta durou dois meses e foram avaliados registros de 1984 a 2019. Os dados foram tratados no programa Microsoft Office Excel (version 2016) com análise descritiva dos dados. **Resultados**: Dos 920 prontuários analisados, 2,7% apresentavam pelo menos um dente supranumerário, com localização preferida na área superior anterior e na área parapremolar mandibular. O tipo mais prevalente foi o dente suplementar, com orientação de erupção normal e localização alveolar normal. **Conclusão**: Os dentes supranumerários da população estudada neste estudo mostraram pouca interferência na erupção ectópica da série dental normal. A maioria dos dentes supranumerários estava em posição de impactação. E, aproximadamente um terço dos dentes supranumerários apresentaram desvios de erupção.

Keywords: Epidemiology. Tooth Abnormalities. Tooth Supernumerary.

ABSTRACT

Introduction: Dimension, number and shape alterations are frequently observed dental anomalies. **Objective**: The aim of this study was to map the frequency, the preferred location and the most prevalent types of supernumerary teeth, in the studied population. In addition, to assess the interference that supernumerary teeth may cause in the ectopic eruption of the normal dental series teeth. **Methods**: This is an observational retrospective study. Data collection was performed by evaluation of dental records of patients treated in an orthodontic clinic. Patients' radiographs, photographs and gypsum dental models were analyzed and data recorded in protocol files, by previously trained undergraduate and postgraduate students. Records from 1984 to 2019 were evaluated, and evaluation lasted two months. Data were stored in Microsoft Office Excel (version 2016) for descriptive analysis. **Results**: From the 920 patients' records analyzed, 2.7% presented at least one supernumerary tooth, with preferred location on the anterior maxillary area and mandibular parapremolar area. The most prevalent type was the supplemental tooth, with normal eruption orientation and normal alveolar location. **Conclusion**: The supernumerary teeth of the studied population showed little interference in the ectopic eruption of the normal dental series. Most of the supernumerary teeth were impacted, and, approximately one third of the supernumerary teeth showed deviated eruptions.

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INTRODUCTION

The dental eruption pathway begins in the germ intraosseous position moving towards the oral cavity, until tooth eruption is completed. Any deviation from the normal course of the tooth eruption into an atypical location is considered an ectopic eruption.[1] This pathological process of eruption may present multifactorial etiologies, being associated with genetic, local or systemic factors.[2,3] However, the impact of these factors is not consistently explained in the literature.

Several dental development anomalies described in the literature may be observed in clinical practice. Such deviations from normality may be related to the size, shape, number and the eruption pathway of teeth.[4] The identification of these anomalies is crucial for the correct diagnosis and, consequently, appropriate planning and treatment.

Supernumerary tooth, or accessory tooth,[5] constitutes a development disorder defined by the presence of one or more dental teeth beyond the number considered normal. The deciduous dentition consists of 20 teeth and the permanent dentition of 32 teeth.[6-9] Supernumerary teeth do not usually present the same anatomical features as teeth of normal series. They may be single or multiple, and may develop in the mandible, maxilla or on both arches. They are asymptomatic, in most of the cases, but may cause pain if related to pericoronitis.[10]

The recognition of the anatomical shape and the location and orientation of supernumerary teeth are important to determine the required clinical intervention. Supernumerary teeth may present different shapes: conical (small, conoid); tuberculate (small, with multiple cusps and rudimentary root); supplemental (similar to normal series) and odontoma (grouping of irregular-shaped teeth).[5,6,11-14] The location of supernumerary teeth may be defined as mesiodens (when located between the central maxillary incisors), parapremolars (when located in the premolars area), paramolars (when located in the molars area) and distomolars (when located distally to the molars teeth). Supernumerary teeth may also be rarely found in the maxillary sinus and nasal cavity.[12-14] As for the tooth orientation, the supernumerary teeth can be normal/vertical, oblique, inverted or transverse.[5,12,15]

The diagnosis of supernumerary teeth and their characteristics are obtained by clinical and radiographic means, mainly through panoramic radiograph, with complementary periapical radiographs.[11] The role of the orthodontist in the context of identification of these variations from normality is important. The aim of this study was to map the frequency, location and types of supernumerary teeth in the documentation of an orthodontic patient population. Another aim was to identify ectopic eruption of the normal dental series in the same population.

MATERIALS METHODS

The research has an observational retrospective design and was approved by the Research Ethics Committee of the Hospital Universitario Clementino Fraga Filho of the Federal University of Rio de Janeiro, under protocol 3.302.723. There was no need for sample calculation, as it was an epidemiological survey. The sample was selected from the analysis of orthodontic documentation requested for purposes of treatment and/or orthodontic monitoring, from the archives of the Orthodontics Clinic of the School of Dentistry, Federal University of Rio de Janeiro (UFRJ). The sample inclusion criteria was to be an orthodontic patient undergoing treatment or restraint at the Department of Pediatric Dentistry and Orthodontics, of the same school UFRJ, with complete orthodontic records and radiographs in good condition for analysis. Patients with syndromes, congenital deformities and systemic diseases, as well as incomplete orthodontic documentation, were not included.

After applying inclusion and exclusion criteria, dental records of 920 patients were selected and evaluated with the sole intention of locating patients with the presence of supernumerary elements. Data collect was carried out from orthodontic patients' records. Plaster models and photographs were inspected in order to detect erupted supernumerary teeth. However, imaging exams were fundamental for evaluation: panoramic and periapical radiographs or cone beam computed tomographies (CBCTs), depending on the availability. The oldest records had analogical radiographs, while the most recent ones had digital images.

Data collection was performed by two researchers (an undergraduate student – initials I.C.P.C. and a master's degree in orthodontics – initials B.C.T.C.), under the supervision of two experienced orthodontists (initials A.M.B. and M.M.G.S.). The researchers were initially trained by two experienced orthodontists (initials A.M.B. and M.M.G.S.). Then, data collection started in 30% of the sample and this investigation was repeated after 10-14 days of the initial data collection, to ensure that the reliability of the data was 100%. The collection lasted two months. Records from 1984 to 2019 that presented radiographs in good condition were evaluated. The data were stored in Microsoft Office Excel (version 2016) and the results were shown descriptively.

RESULTS

From the 920 patient's records, there were 25 records showing at least one supernumerary tooth, constituting 2.7% of the sample. No record was excluded. Mean age for the population was 12.5 (± 4.3) and 56% was male. The records from the included 25 orthodontic patients presented 41 supernumerary teeth, being 63.4% in the maxilla and 36.6% in the mandible. The normally oriented dental position was more prevalent, expressed by 68.3% of the cases, and the supplemental shape observed in 63.4% of the cases. (Table 1) The most common location were mesiodens (Figure 1) and parapremolar (Figure 2A), both found in 41.4% of the cases.

When the location was analyzed in relation to the correct axis of eruption, most of the sample was located in the center of the alveoli (26.8%) (Figure 3), and the other location were palatal (Figure 2B) and lingual (22% and 17%, respectively) (Figure 2C). Furthermore, 31.7% of the supernumerary teeth showed eruption deviations from the correct axis of the normal dental series (Figure 4), and 3 cases exhibited divergence of adjacent roots, no other case presented different type of change. Besides that, 9 (22%) of the supernumerary teeth could not have location classified along the long axis because they had only 2D images. Of these, only two caused an ectopic eruption (4.8%), and 29 teeth (70.7%) were impacted.

***Table 1**: Frequency of supernumerary dental anomalies in the studied population.*

		Total		Maxilla		Mandible	
		N=41	**%**	**N=26**	**63.4%**	**N=15**	**36.6%**
Eruption Pathway	Ectopic	N=2	4.8%	N=2	100%	N=0	0%
	Impacted	N=29	70.7%	N=16	39%	N=13	31.7%
Shape	Conical	9	22%	9	100%	0	0%
	Tuberculate	5	12.2%	3	60%	2	40%
	Supplemental	26	63.4%	13	50%	13	50%
	Odontoma	1	2.4%	1	100%	0	0%
Orientation	Normal	28	68.3%	16	57.1%	12	42.9%
	Oblique	8	19.5%	6	75%	2	25%
	Reverse	0	0%	0	0%	0	0%
	Transverse	5	12.2%	4	80%	1	20%
Location	Mesiodent	17	41.5%	17	100%	0	0%
	Distomolar	0	0%	0	0%	0	0%
	Parapremolar	17	41.5%	5	29.4%	12	70.6%
	Paramolar	5	12.2%	2	40%	3	60%
	Palate	2	4.8%	2	100%	0	0%
Location in relation to the axis of eruption	Palatal	9	22%	9	100%	0	0%
	Buccal	5	12.2%	3	60%	2	40%
	Lingual	7	17.0%	0	0%	7	100%
	In the long axis	11	26.8%	8	72.7%	3	27.3%
	Not classified	9	22%	-		-	
Divergence of roots	Mesiodent	3	7.3%	3	100%	0	0%

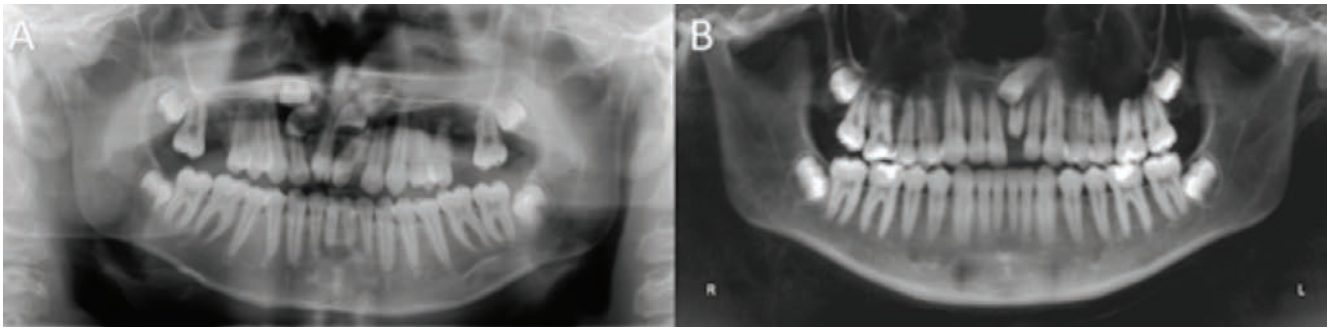

***Figure 1**: Mesiodentes: causing ectopic eruption of teeth 11 and 21 (A). Intercepting the correct axis of eruption of tooth 21 (B), on panoramic radiographs.*

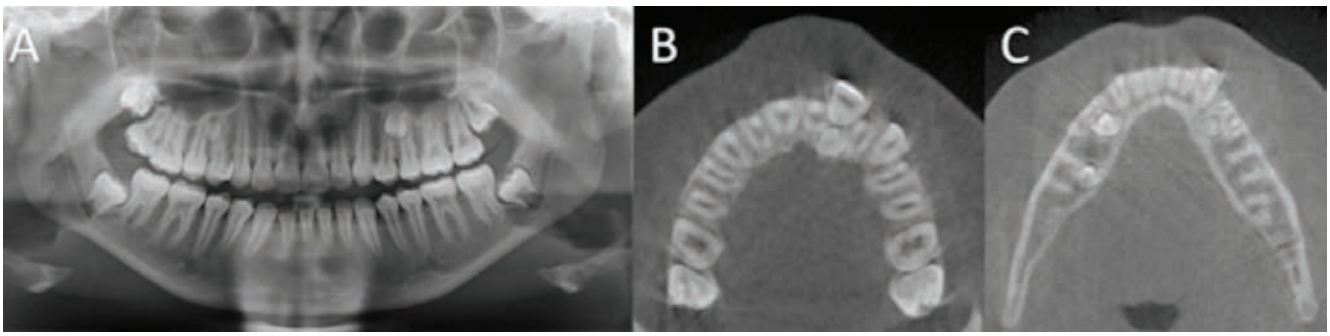

***Figure 2**: Supernumerary teeth observed in different patients: on panoramic radiograph in the upper premolars regions (A), the palatal position (B) and the lingual position in relation to the teeth of the normal series seen in axial sections of cone beam computed tomography (C).*

***Figure 3**: Supernumerary tooth occupying the position in the alveoli and displacing the tooth of the normal series for vestibular, intraoral upper arch occlusal view (A) and intraoral frontal view (B).*

***Figure 4**: Diastema caused by a supernumerary tooth visualized in cone beam computed tomography (A), two-dimensional projection of the cone beam computed tomography (B) and intraoral clinical view (C).*

DISCUSSION

This epidemiological study on the prevalence of supernumerary teeth in orthodontic documentation of a selected population found that 2.7% of the sample presented the problem. In the literature, this anomaly of number affects up to 2% of the population,[16-18] however the present study involved a distinct population, of individuals seeking orthodontic treatment. In addition, the institution demands accurate records, such as CBCTs, in order to achieve correct diagnosis and to provide the best treatment plan, especially in cases with supernumerary elements, as expected. A proper indication for a CBCT exam can be an excellent tool for the clinician, not only for the orthodontist, in the diagnosis of a supernumerary teeth, providing a better treatment plan.

It should be noted that more than half of the supernumerary teeth were presented in the supplemental form and exhibited normal eruption axis orientation, and just over a quarter were well located in the alveolar process, in relation to the axis. Although there are reports showing the predilection for the mandible in certain populations,[19,20] the literature shows that preferential area for the formation of supernumerary teeth is in the maxillary anterior segment, especially in cases where there are multiple supernumerary teeth.[4,11,14,16-21] In fact, in this sample, the frequency of supernumerary teeth in the maxilla occurred in more than half of the sample. The majority of these teeth were mesiodens, which is the most prevalent location described in the literature.[5,13,14,17] These mesiodens comprised slightly less than half of the cases in this study, which directly interferes in the aesthetics of the individual. The parapremolars were as frequent as the mesiodens and were located in the mandible in twelve of the cases, while only five were in the maxilla. Supernumerary teeth may also occur in the deciduous dentition, but the permanent dentition is more frequently affected.[5,11,12,16,19,21]

The gender of the patients with supernumerary teeth presented, approximately, a 1:1 ratio, while other authors reported a male/female ratio of 2:1.[4,5,12,13,16,17,19,21] We do not know the reason for this difference.

Despite all the data reported in the literature, the etiology of supernumerary teeth is not well established. Factors such as the hyperdevelopment of dental lamina, resulting from disturbances in the initiation stage of tooth formation may lead to the development of single or multiple supernumerary teeth (hyperdontia) or its absence (hypodontia).[12] Trauma involving the anterior region of the maxilla during the development of the dental follicle may also cause the development of supernumerary teeth, by tooth division.[5,12] It is also valid to consider the dichotomy theory of the tooth bud[19] that may lead to two teeth of the same size or a normal tooth and a dysmorphic one.[7] However, despite the various described theories, the literature highlights the hyperactivity of the dental lamina as the most likely etiology.[7,12,19]

Hereditary/genetic factors have been described in the etiology of supernumerary teeth, in which a genetic component would be linked to autosomal dominant inheritance with incomplete penetration.[4] The association with a hereditary syndrome may also occur. However, it is important to stress that the presence of supernumerary teeth is inherent to syndromes as cleidocranial dysostosis and Gardner syndrome, and may or not occur in association with cleft palate and cleft lip.[4,12,22]

Regarding the curious theory of atavism, researchers point out that the phenomenon of supernumerary teeth would be the resurgence of features lost for generations, in an attempt to revoke the dentition of the ancestors, i.e. the reappearance of teeth suppressed or eliminated in the evolutionary process, featuring a reverse evolution.[4,12,22]

Although there are controversies regarding the etiological factors, it is well known that supernumerary teeth can develop relevant clinical complications. When supernumerary teeth are impacted, they may delay or prevent the eruption of other teeth, lead to rotations or deviations from the normal pathway, cause root resorption to adjacent teeth, and also develop cysts with possible bone destruction.[5] Once the supernumerary teeth have erupted, they may cause crowding, teeth misalignment in the arches and possible midline diastema. In any case, they will cause some sort of malocclusion.[12,13]

There are controversies in relation to the management of supernumerary teeth.[11] First question is the indication for dental extraction as soon as supernumerary is identified. However, this can lead to psychological insecurity in children, and may promote ankylosis, root canal or adjacent tooth deformation. Furthermore, if postponing dental extraction until the root of the adjacent tooth is completely formed is recommended, this also shows consequences as weakening of the eruptive force of the normal permanent teeth, losing space in the arches and promoting crowding. The choice of treatment will be influenced by factors such as: patient's age and collaboration, stage of development of the adjacent teeth and the supernumerary tooth position, due to the surgical access and bone loss.[5,16,23] Some authors state that supernumerary teeth interfering with occlusion must be extracted, as long as it doesn't hurt the root development of the adjacent teeth.[24]

As an epidemiologic study, this research has the limitation of evaluating a restricted population, since there was only access to patients who sought a solution to the

problem that they themselves recognized. However, the representative prevalence of dental anomalies has not shown important differences, when compared to other studies.

This epidemiological study is of scientific importance, since there is a growing interest in the epidemiology scenario by researchers. From data collection and identification of suggestive images at the moment of diagnosis, it is possible to modify the planning approach and guidance to the patient, aiming at the improvement of the results during and at the end of treatment, demonstrating the clinical importance of the research.

CONCLUSION

The frequency of supernumerary teeth in the studied population was of 2.7%, with preferred location on the anterior maxillary area and mandibular parapremolar area. The most prevalent types of supernumerary teeth were the supplemental form, with normal eruption orientation and normal axial alveolar location. The supernumerary teeth of patients in this study showed minor interference in the ectopic eruption of the normal dental series. Most of the supernumerary teeth were impacted, and approximately one third showed eruption deviations from the correct axis, and only few cases exhibited divergence of adjacent roots.

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AURICULOTHERAPY FOR SLEEP BRUXISM IN CHILDREN: A SERIES OF CASES

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PALAVRAS-CHAVE: Auriculoterapia. Bruxismo. Bruxismo do Sono. Crianças.

RESUMO

Introdução: Bruxismo do sono é definido como um comportamento que causa atividades musculares durante o sono. Na infância, leva a consequências que podem variar de desgaste dentário na dentição decídua a sintomas de disfunção temporomandibular. Não há estudos que demonstrem melhora de casos de crianças com bruxismo do sono durante e após tratamento com auriculoterapia. **Objetivo**: portanto, esta série de casos visou avaliar o efeito da auriculoterapia em crianças apresentando este quadro. **Métodos**: Doze pacientes foram inclusos neste estudo, com a media de idade de 6,9. O diagnóstico foi avaliado pela pergunta "Seu filho range os dentes quando dorme?". O tratamento foi executado por um especialista em acupuntura de forma padronizada. A terapia foi feita por três semanas e o efeito foi avaliado através de um diário do sono, no qual os pais anotavam se a criança rangeu os dentes enquanto dormia antes (baseline) e durante a terapia (T1 a T3). Bruxismo do sono foi categorizado como presença ou ausência de ranger de dentes e a frequência variou de 0 a 7 (baseline), 0 a 5 (T1), 0 a 7 (T2) e 0 a 4 (T3) entre os pacientes. A intensidade foi comparada de acordo com os períodos pelo teste-T pareado (α=0,05). **Resultados**: Foi observado que a frequência de relatos diminuiu significativamente de baseline a T3. **Conclusão**: Estes resultados sugerem que auriculoterapia pode ser uma terapia alternativa para o bruxismo do sono na infância, uma vez que demonstrou reduzir sua frequência neste estudo, embora os pacientes possam apresentar efeitos diferentes devido a variabilidade biológica.

KEYWORDS: Ear Acupuncture. Bruxism. Sleep Bruxism. Children.

ABSTRACT

Introduction: Sleep bruxism is defined as a behavior that causes masticatory muscle activities during sleep. Sleep bruxism in childhood leads to consequences, which may vary from teeth wear in deciduous dentition to temporomandibular disfunction symptoms. There's no data that demonstrates improvement of children with sleep bruxism during and after auricular acupuncture treatment. **Objective**: Therefore, this case report series aimed to evaluate the effect of auriculotherapy on children presenting sleep bruxism. **Methods**: Twelve patients were included in this study, in the mean age of 6,9. The diagnosis was evaluated by the question: "Does your kid grind their teeth while sleeping?". Treatment was performed by an acupuncture specialist in a standardized way. The therapy was given for three weeks and the effect was evaluated through a sleep diary, in which the parents noted whether or not their child grinded teeth while sleeping before (baseline) and during therapy (T1 to T3). Sleep bruxism was categorized as presence or absence of nocturnal teeth grinding and the frequency varied from 0 to 7 (baseline), 0 to 5 (T1), 0 to 7 (T2) and 0 to 4 (T3) between patients. The intensity of the reported sleep bruxism was compared according to the periods by pared T-test (α=0.05). **Results**: It was observed that the frequency of reports decreased significantly from baseline to T3. **Conclusion**: These results suggest that ear acupuncture may be an alternative therapy for sleep bruxism in childhood, once it demonstrated to reduce its frequency in this study, although patients may present different effects to therapy due to biological variability.

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INTRODUCTION

Sleep bruxism (SB) is defined as a parafunctional behavior that implicates masticatory muscle activities during sleep.[1] Clinically, it can be detected by signs of accentuated wear of deciduous dentition.[2] Also, masticatory muscles and temporomandibular joint pain and fatigue may be observed, due to the increase of occlusal forces provoked by the parafunctional habit.[3,4] Studies show higher prevalence of this behavior in anxious and hyperactive children with respiratory issues and low quality of sleep.[5]

The cause of this behavior is originated in the central nervous system (CNS) and it's considered multifactorial, since the causal factors can be local, systemic, psychological or hereditary.[6] Therefore, the therapeutic approach should perceive the patient in a holistic and multidisciplinary view, including dentistry, sleep medicine and psychology professional.[7]

Bruxism can be classified as primary or secondary. The first one is idiopathic, as it is not related to any medical cause. Secondary bruxism is related to respiratory and neurological disorders.[7,8]

When it comes to children, conservative treatments should be prioritized.[7] Local therapies, such as occlusal splints, act on the clinical consequences of the bruxism, but not on its etiopathogeny.[9] Alternative and holistic therapies, like acupuncture, however, can be effective for controlling and decreasing the frequency of the affliction episodes, as they act in the central nervous system.[7]

According to Traditional Chinese Medicine (TCM), health is achieved by the balance of the Qi energy, the natural life flow. Problems in emotional and psychological fields can develop an imbalance of the forces of nature (yin and yang) and the Qi energy flow is affected, causing diseases of many kinds.[10] Acupuncture is an alternative therapy used in TCM, focused on the cause rather than the symptom, aiming to energetically balance the patient by reestablishing Qi energy flow. The practice consists on stimulating specific regions of the skin with high concentrations of sensory nerve endings, denominated acupoints.[11] The peripheral stimulation of these points enables direct stimulation to the CNS.[12]

This procedure can be performed in different techniques, such as needling, pressure and heat. Also, it can be applied to the whole body or it can summarize to the ear, method known as auricular acupuncture or auriculotherapy.[13]

Until this point, there is no data that demonstrates improvement of patients with sleep bruxism during and after auricular acupuncture treatment, hence, since this affliction influences children's life quality, there's a need for better understanding of the effect of this therapy in children with SB.[7,13] Therefore, this report of cases aimed to evaluate the effect of auriculotherapy on children presenting SB.

MATERIALS AND METHODS

Case series selection

This series of cases was performed according to the Declaration of Helsinki. The convenience sample of this study was composed by children in the age range of 3 to 10 that sought treatment at the Pediatric Dentistry Clinic at Universidade Federal do Paraná, whose parents agreed to participate on this research and assigned the Informed Consent term. The inclusion criteria was children with probable diagnosis of primary SB that presented clinical signs of temporomandibular disorder (TMD) or wear of dentition.[14,15] Children presenting secondary SB, sleep apnea, in orthodontic treatment or using anxiety or depression medicine were excluded. A total of 12 children were selected.

For the clinical signs, a clinical examination was performed by a pediatric dentistry expert considering mouth opening, teeth wear and presence of TMD symptoms. TMD symptoms were evaluated by a questionnaire according to the American Academy of Orofacial Pain (AAOP)[16]. Dental wear surfaces were analyzed by a trained examiner through visual examination. The probable SB diagnosis was evaluated by the question "Does your kid grind their teeth while sleeping?", added to clinical signs.

Auricular acupuncture treatment

Treatment was performed by an acupuncture specialist in a standardized way and acupuncture points were anatomically identified according to Chinese Traction Medicine (CTM). Those points were selected in order to decrease anxiety and establish the patient's overall balance, therefore, according to each patient's needs individually. They were stimulated by applying mustard seeds weekly for a period of four weeks (Figure 1). The patients and parents were asked to manually stimulate the points three times a day.[17]

Parental report evaluation

Therapy effects were evaluated by a parental report of SB, in which the parents filled in a form daily noting the presence or absence of nocturnal episodes of their children's teeth grinding. To do so, they were previously oriented to take notes a week before therapy (baseline) and weekly during the three weeks of the procedure. The number of episodes per week were computed on baseline, T1, T2 and T3.

Statistical analysis

The data were analyzed on the SPSS software (IBM, USA, version 20.0). The dependent variable (frequency of SB episodes reported) was analyzed as a numerical variable. The independent variables were gender and TMD symptoms. The TMD symptoms were categorized in presence of TMD (in case of positive answers on the American Academy of Orofacial Pain questionnaire) and absence (for negative answers on the questionnaire). The reported SB presented a normal distribution by Shapiro-Wilk test ($p>0.05$). The frequencies of reported SB were compared at different periods (baseline, T1, T2 and T3) by paired T-test. The episodes of SB at baseline were also compared between gender and presence or absence of reported TMD by independent T-test. The significance level of 0.05 was adopted.

RESULTS

The sample consisted on 50% of girls and 50% of boys, in the age range of 4 to 9 years old, with a mean age of 6.9 years old. Regarding the TMD symptoms, there was a higher frequency of children with headache, facial or neck pain (55.6%). None of the children related pain or difficulty chewing, talking or moving the mouth (Table 1).

At baseline, it could be observed that the related SB episodes differ among the patients, varying from 0 to 7 episodes per week, indicating heterogenicity on the severity of the disorder (Figure 2). The episodes of SB did not present difference between genders (p=0.295) at baseline week, however, girls presented a mean of 4.16 episodes, while boys presented a mean of 2.83 episodes.

The mean of SB episodes at baseline week did not present significant difference between presence or absence of TMD symptoms (p=0.320), but children with any TMD symptoms presented a mean of 3.85 episodes per week, while children without TMD symptoms presented a mean of 2.00 episodes per week.

There was a significant decrease of SB episodes during the three weeks of auricular acupuncture (Table 2). It was noticed that there was a gradual decrease of episodes from baseline to T3, demonstrating the cumulative effect of the therapy (Table 2; Figure 3). On T2, a patient presented as outlier, that is, didn't show improvement on that week (Figure 3).

Regarding the individual response to auricular therapy, the outcome varied among patients, however, in most patients, there was a positive reduction of SB episode from baseline to T3. Some of the patients demonstrated episode decreases on T1, others on T2 and others on T3. Due to the therapy's cumulative effect, most patients presented a gradual decrease of episodes each week. One of the patients did not indicate variations on SB frequency at all times (Figure 4).

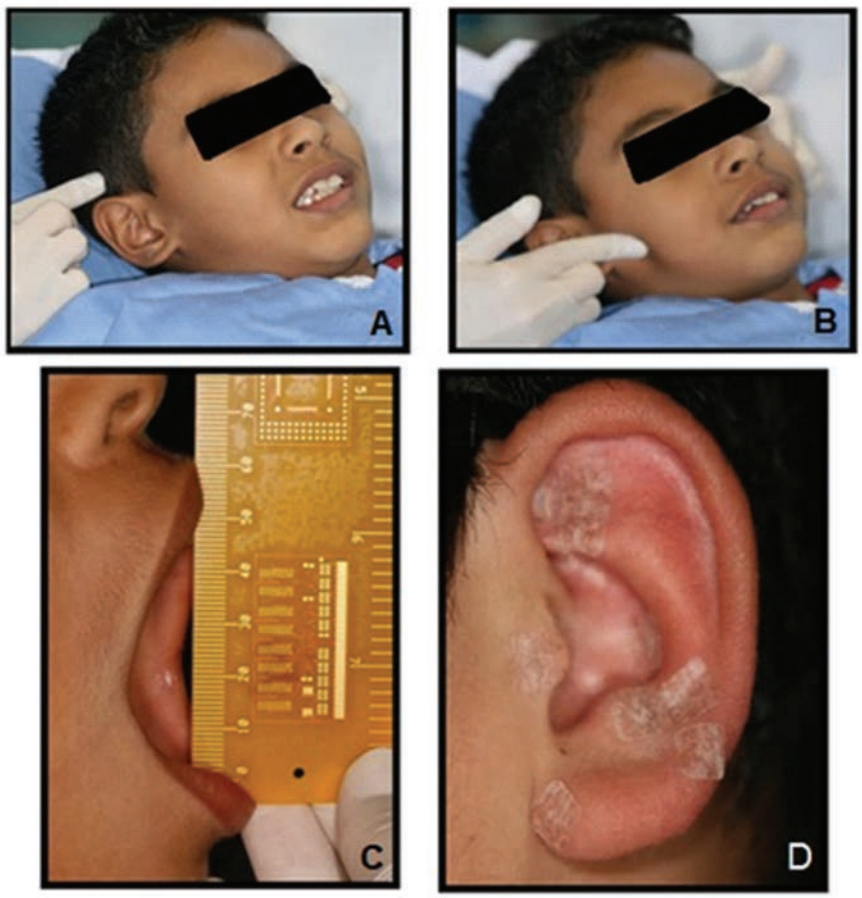

Figure 1: *Initial clinical examination and auricular acupuncture using mustard seeds. (A) palpation of the masseter muscle. (B) palpation of the termporal muscle. (C) mouth opening. (D) auricular acupuncture using mustard seeds.*

Table 1: *Frequencies of temporomandibular disfunction sypmtoms.*

Questions	Frequency n(%)	
	Yes n (%)	No n (%)
Do you have difficulty. pain or both when openining your mouth to yawn. for example?	2 (22.2)	7 (77.8)
Has your mouth ever been “stuck” or has your chin “dropped”?	0	9 (100)
Do you have difficulty. pain or both when chewing. talking or moving your mouth?	0	9 (100)
Do you notice any noise around your ears when opening you mouth or chewing?	4 (44.4)	5 (55.6)
Do you usually feel your face tired. hard or tense?	2 (22.2)	7 (77.8)
Do you feel pain near your ears. on the sides of your head or on the cheeks?	5 (55.6)	4 (44.4)
Do you often have headaches or neck pain?	5 (55.6)	4 (44.4)
Do you often have pain in your teeth? 2 (22.2)	7 (77.8)	
Have you recently had a blow to the head. neck or chin?	3 (33.3)	6 (66.7)
Have you noticed any recent changes in your bite without going to the dentist?	1 (11.1)	8 (88.9)
Have you ever received any treatment for facial pain or other issue around the ear region?	1 (11.1)	8 (88.9)

Table 2: *SB parental report frequency descriptive analysis according to the evaluation period (n=12, Curitiba, Paraná, 2017)*

Period	Mean (SD)	Minimum and maximum values
Baseline	3.50 (2.11)[a]	0 - 7
T1	2.58 (1.83)[b]	0 - 5
T2	2.33 (1.96)[b]	0 - 7
T3	1.91 (1.24)[b]	0 - 4

Note: *SD: Standard Deviation; Different letters indicate differences statistically significant by paired T-test. Significance level of 0.05.*

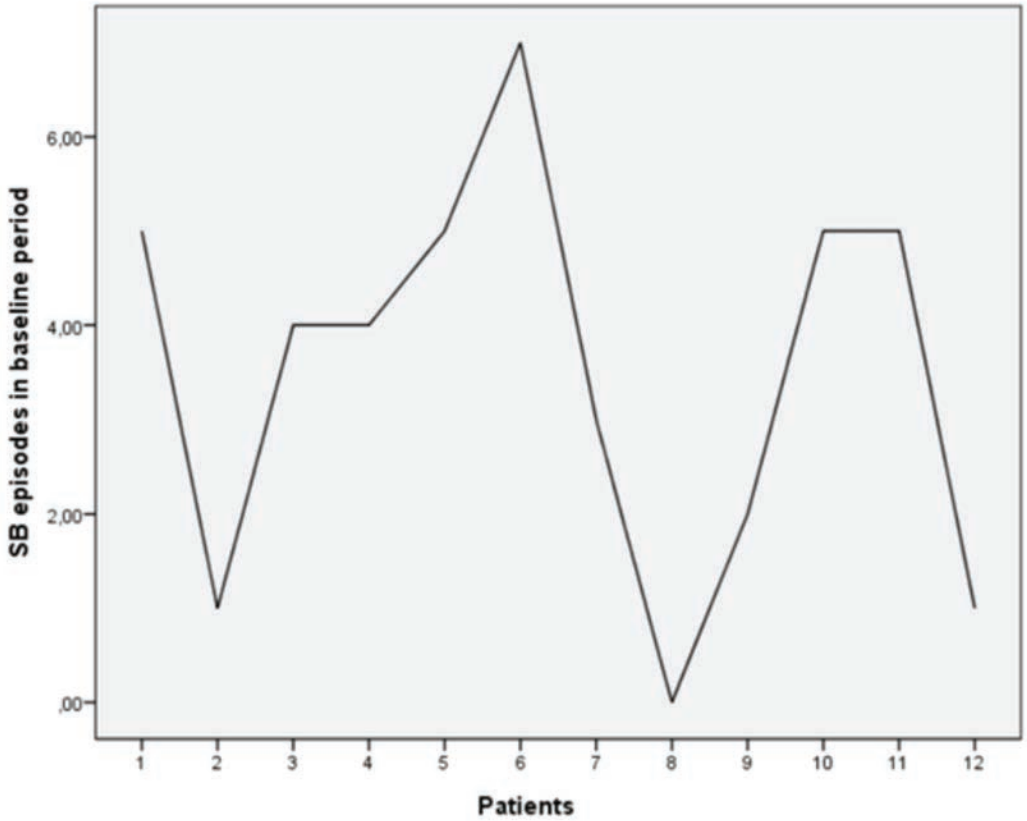

Figure 2: *Frequency of SB episodes in baseline period.*

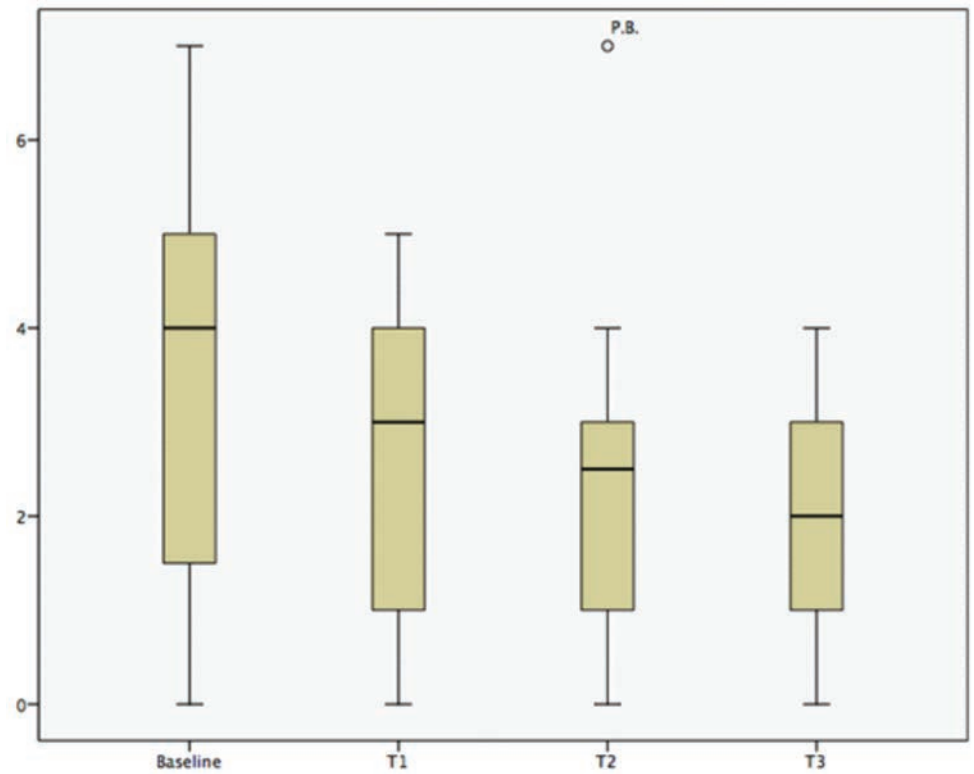

Figure 3: *Description analysis of the SB episodes according to the evaluated periods.*

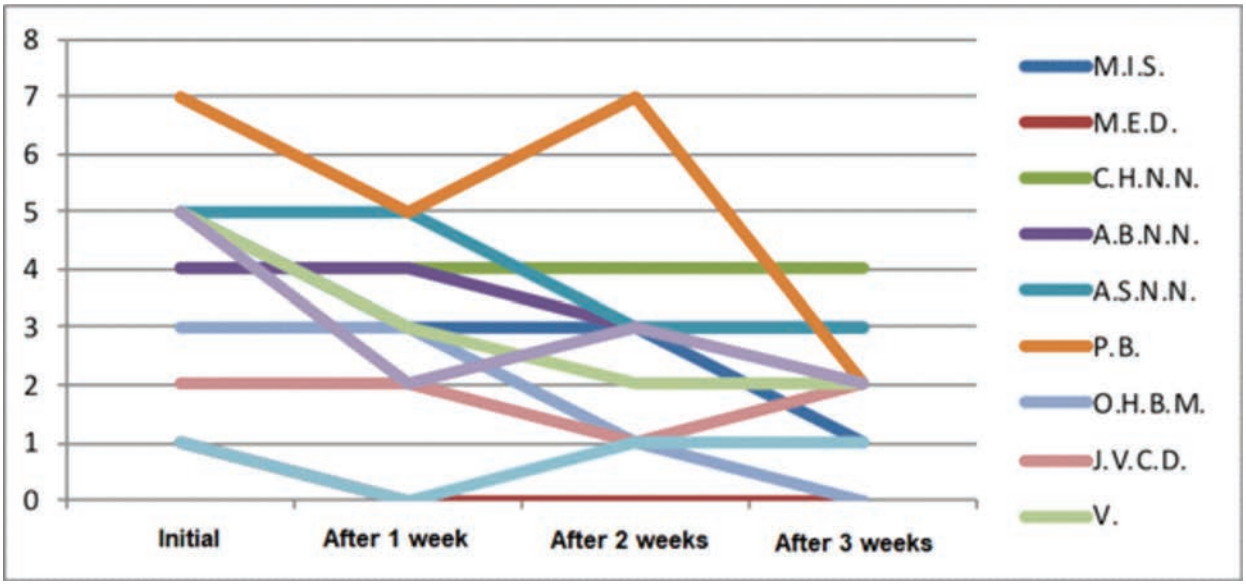

Figure 4: *SB episodes in the evaluated periods.*

DISCUSSION

In this study, children presented probable sleep bruxism diagnosis, frequently reporting grinding of teeth at night and other clinical signs such as dental wearing, temporomandibular dysfunction (TMD), headache, myofascial and neck pain and restless sleep. After auriculotherapy, grinding of teeth decreased in most patients. In general, there was a reduction in the sleep bruxism episodes gradually each week, which can be explained by the cumulative effect of the therapy.

The response varied between the patients: some responded immediately, just after the first week, others responded subsequently. That can be explained by the bruxism severity difference between them or individual biological response.

Regarding the cause of the SB, current literature accepts a multifactorial concept, in which there is CNS mediation.[13] It is well known that anxiety, hyperactivity and psychological factors are associated with grinding of teeth while sleeping, as well as low quality of sleep in children.[18] Although no significant difference was observed between SB episodes and the independent variables, such as gender and TMD symptoms, in this case series, it was observed more episodes of SB in girls and children with TMD symptoms, suggesting a possible relation between these factors.

In the examined sample, one of the cases didn't present improvement of SB in the evaluation period. This can be explained by the presence of perpetuating factors, like breathing disorders, sleep apnea or other extrinsic anxiogenic factors.[5]

So far, there is still lack of longitudinal studies that evaluate treatments for SB in children. There is no gold standard treatment established for this behaviour.[19] From etiology point of view, acupuncture can be considered an effective alternative, since it acts on the anxiety and sleep quality.[7] Plus, it's a holistic and non-invasive approach, which is important especially when it comes to children. It can also act as complementary therapy to other pathologies, such as headaches and muscular pain.

This study demonstrated how acupuncture can be an efficient technique on treating or controlling SB in children. A previous study on acupuncture showed its efficacy on TMD treatment in a 34 year old patient that reported pain in temporomandibular joint and bruxism episodes since the patient was 25 years old. The patient underwent acupuncture and auricular acupuncture sessions and related significant improvement on her sleep quality and no more joint pain.[20] Other studies also indicated pain relief, improvement of life quality and less grinding teeth episodes in most cases, even when combined with other treatments. [21,9] That indicates that acupuncture therapy in dentistry can be beneficial and improve patients qualify of life, whether used as a complementary or single therapy.

Considering the limitations of this study, one important point is that although it was a convenience small sample, it could indicate some tendency of factors associated to episodes of SB. The results suggest that auricular acupuncture using mustard seeds may be a complementary therapy on SB treatment, since it carries a holistic view aiming to reduce anxiety.[13] Further researches with larger samples and longer observation periods are required to obtain a deeper knowledge of mechanism of action and acupuncture efficacy in patients presenting bruxism.

CONCLUSION

• According to the limitations of this study, it could be concluded that:

• Auriculotherapy promotes reduction in SB frequency in children;

• The beggining of therapy efficacy varied between cases; suggesting that the individual response to therapy is influenced by individual biological variability;

• Auricular accupuncture may be a supportive therapy for SB in childhood, in an effective and holistic approach.

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WITHOUT MINI-PLATES, MINI-IMPLANTS AND SURGERY: TREATMENT OF SEVERE ANTERIOR OPEN BITE IN AN ADULT PATIENT - A CASE REPORT

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Palavras-chave: Mordida Aberta. Adulto. Step-bends. Elásticos. Dispositivo de Ancoragem Temporário. Cirurgia.

RESUMO

Introdução: Atualmente, existe uma tendência de tratar a mordida aberta com mini-implantes, miniplacas, cirurgias ortognáticas e levantes de mordida, quando estes protocolos nem sempre são indicados e a sua aplicação pode ser desnecessária e excessiva. **Objetivo**: Este relato de caso descreve o tratamento de uma mordida aberta anterior grave em paciente adulto com "step bends" e elásticos verticais. **Relato do caso**: A paciente tinha 29 anos e 8 meses de idade e relatou ter baixa autoestima; portanto ela queria fechar sua mordida aberta não tratada. Ao exame, um perfil convexo, padrão de crescimento vertical, desvio da linha média dental e exposição da língua podiam ser vistos ao sorrir. A relação sagital dental e esquelética era de Classe II. O *overjet* de +5 mm e o *overbite* anterior de -5,5 mm. A mordida aberta esquelética grave envolveu os primeiros molares até os dentes anteriores e foi tratada apenas com "step bends" e elásticos verticais por pouco mais de 2 anos. **Resultados**: Melhoria facial significativa, exposição dos incisivos superiores ao sorriso estético, sobremordida e *overjet* adequados foram observadas. As linhas médias dentárias superior e inferior adequadas à linha sagital. Foi observada rotação da mandíbula no sentido anti-horário. A mordida aberta esquelética grave foi tratada. **Conclusão**: A má oclusão grave da mordida aberta esquelética tratada com "step bends" e elásticos verticais em pacientes adultos demonstrou correção eficiente, previsível e estável da mordida aberta.

Keywords: Open Bite. Adult. Step-bends. Elastics. Temporary Anchorage Dispositive.

ABSTRACT

Introduction: Currently, there is a tendency to treat open bite with mini-implants, miniplates, and orthognathic surgeries and build ups when these protocols are not always indicated and to be apply them unnecessarily and excessively. **Objectives**: This case report describes treatment of a severe anterior open bite in an adult patient with step bends and vertical elastics. **Case report**: The female patient was 29 years and 8 months old and reported that she had low self-esteem; therefore, she wanted to have her untreated open bite closed. By examination, a convex profile, vertical growth pattern, dental midline deviation, and tongue exposure could be seen upon smiling. The dental and skeletal sagittal relationship was Class II. The overjet was +5 mm and the anterior overbite was -5.5 mm. The severe skeletal open bite involved the first molars to the anterior teeth, and it was treated only with step bends and vertical elastics over 2 years. **Results**: Significant facial improvement, maxillary incisor exposure upon aesthetic smiling, and adequate overbite and overjet were observed. The upper and lower dental midlines fit to the sagittal line. A counterclockwise rotation of the mandible was observed. The severe skeletal open bite was treated. **Conclusions**: Severe skeletal open bite malocclusion treated with step bends and vertical elastics in adult patient demonstrated efficient, predictable and stable open bite correction.

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INTRODUCTION

Severe anterior open bite (AOB) is still a challenging malocclusion to be treated by the orthodontist. The incidence is higher in females (64.9%). The AOB etiology is resulted of genetic and environmental factors or both as well.[1,2] However, the OAB in adults is more difficult because of complicated problems and oftentimes when the surgical correction is requested.[1-3]

The miniplates and miniscrews are also variations used nowadays to correct AOB as others.[4] Due to the their high success rates to treat AOB,[5] resistance is coming up from the orthodontists/buccal-facial surgeons to treat using conventional protocols without surgeries and temporary anchorage dispositive (TAD).[6,7] Disadvantages attributed to the miniplates are the applicability of a specialized surgery, higher medical costs and probably biological damages.

After identifying the etiological agent and defining the diagnosis and case planning, the use of mini-screws, miniplates and any surgery aproach[4-7] can be disregarded to continue the treatment of an AOB. This case report aimed to show a severe adult AOB treatment performed without extractions and no use of TADs, only with the use of elastics and steps bended in the orthodontic stainless steel archwires.

CASE REPORT

Diagnosis and Etiology

A 29-year and 8-month-old female patient scheduled an appointment with an orthodontic private clinic. Her chief complaints were as follows: "I feel myself with low self-esteem because I use orthodontic appliances for more than three years with another professional, but my AOB is the same as when I started treatment; therefore, I'd like to close it". Orthodontic brackets without archwires and tongue interposition could be seen while she was talking.

Given that a new treatment would have to be started and the unfinished one would have to be terminated, the author asked for the previous initial radiographs, casts and photographs; however, the patient said that none were prescribed, and as a result, they were unavailable. Therefore, the author prescribed only new registers as when the patient arrived at the office and adopted these registers as the new references starting from that moment (Figures 1A-O; 2 A-D). In this way, the need for a second set of radiographs, casts and photographs just after the removal of the previous appliance removal was avoided, preventing additional costs and radiation administration to the patient.

By examination, there were fillings in the molars. Maxillary dental midline deviation of 1.0 mm from the left in relation to the midfacial plane, lip incompetence at rest, and tongue interposition were noticed (Figure 1A-O). The dental sagittal relationship was Class II on the right (Figures 1D-I). The patient had a convex profile (S-Lsup +4, S-Linf +4) and projecting incisors (1-NA 7 mm, IMPA 98, 1-NB 9). The third molars were absent according to X-ray assessment (Figure 2). The incisors showed mild root absorption with a large periodontal ligament. The 5° ANB was characteristic of a Class II skeletal discrepancy. The GoGn-SN, Y Axis and FMA angles, 38°, 66°, and 32°, respectively, indicated an increased lower anterior face height (vertical growth pattern) associated with an AOB. The skeletal open bite involved the anterior (-5.5 mm) and posterior teeth up to the first molars. The overjet was +5 mm. Symptoms were not reported at the temporomandibular joint, which was shown to have normal function and structure. The patient was diagnosed with dental and skeletal Class II, severe open-bite malocclusion, mild lower face height increased, dental midline deviation and tongue exposure upon smiling.

Treatment Objectives

The orthodontic treatment objectives were to treat the AOB, correct the upper dental midline deviation, and achieve a Class I canine and molar relationship. Further objectives included an ideal overbite and overjet, improvement of facial aesthetics, and a new swallow pattern.

Treatment Alternatives

Three treatment alternatives were considered: (1) surgical correction treatment,[5,8] (2) posterior teeth intrusion + TADs + anterior teeth extrusion with elastics,[10] and (3) step-down bends in the upper arches + anterior teeth extrusion with elastics.[11] The patient strongly rebutted orthognathic surgery and the use of TADs.[9] After clear explanation and discussion about the treatment alternatives and limitations with the patient, the third option was chosen.

Treatment Progress

First, it was made clearer to the patient that she would be required to completely restart treatment. Therefore, new orthodontics radiographs, casts and photographs were made preserving the same appliance she had in her mouth. Once the new registers received, the entire appliance she had was removed, and a new one was placed, with 0.022" x 0.028" edgewise bracket slots. Along with the orthodontic treatment, the patient agreed to orofacial myofunctional therapy with a speech therapist. The archwires were changed approximately every 25-30 days or when a changed was deemed necessary. The 0.014", 0.016", and 0.018" CrNi leveling and alignment archwires had mesial Omegas adjacent to the accessories welded in the molar bands. Both 0.016" x 0.022" and 0.019" x 0.25" CrNi archwires were used in the

finalization period. The treatment was conducted as follows:

a) First four months: A 0.014" archwire were set in the both arches. Mild step-down bends into upper orthodontic archwire, starting at the interproximal contact point of the posterior molars and bending until the mesial surface of the lateral incisors. Each time the 0.014" archwires were changed during these first four months, all the original bends were increased. The elastics prescribed in this report case (São Paulo, Morelli, Brazil) had to be changed every two days. Square elastics (5/16" light, 80 gf, only at night), began to be used after the third month of treatment. At the end of these first four months, the severe AOB had decreased by + 2,0 mm.

b) Five to eight months: A 0.016" archwire was set in both arches. Bends were made in the same proportion as those in the last 0.014" archwire. Class II and square elastics (5/16" light, 80 gf, only at night, 12 h/day), began to be used, as shown in Figure 3 A-E. After the 8th months of treatment, the AOB decreased by + 1.5 mm, showing a – 2.0 mm overbite. The overjet was + 4.0 mm.

c) Nine to twelve months: 0.016"/0.018" wires were set in the upper/lower arches, respectively. Periapical X-rays were made at this phase (Figure 3 F-G). The elastics remained unchanged in terms of size and duration of use (Figure 3 H,I). The AOB had decreased by an additional + 3.0 mm, and a positive overbite of 1.0 mm was achieved. The overjet was 3 mm.

d) 13 to 16 months: 0.018"/0.016 x 0.022" wires were set in the upper/lower arches, respectively, and bends were applied where necessary. Class II (5/16" medium, 100 gf, 24 h/day) and square elastics (5/16" medium, 100 gf, only at night) were used, and changed every two days. The AOB had decreased by an additional + 1.5 mm. An overjet of 2.5 mm and a Class I molar and canine relationship were established. The anterior upper teeth brackets were repositioned to avoid step down bends in the next archwires.

e) 17 to 20 months: 0.018"/0.016 x 0.022" wires were set in the upper/lower arches, respectively. Class II elastic elastics began to be used only on the right side at night (5/16" medium, 100 gf), and 3/16" triangle elastics (5/16" medium, 100 gf, 24 h/day) were installed with their apex bared at the upper canine hooks and the base of the first and second bicuspids, which were changed every two days. The premature occlusal contacts were removed with occlusal adjustment.[12] Individual bends were made as necessary. The AOB decreased by an additional + 1,0 mm, resulting in a total AOB reduction of 9,0 mm and representing a change from an initial overbite of -5,5 mm to a final overbite of +3,5 mm, which was finally considered an overcorrection of the AOB (Figure 3 A-I). In the vertical relationship, it is considered normal for the upper anterior teeth to overlap the lower teeth by 2 to 3 mm; moreover, this is considered to increase the vertical overbite.[13] In this case, the overcorrection was purposeful due to the high epidemiological prevalence of recurrence.[13]

f) 21 to 24 months (end of treatment): In this finalization period, 0.016" x 0.022" and 0.019" x 0.026" CrNi upper and lower archwires, respectively, were set. The Class II and triangular vertical elastics were gradually removed. In the first of the last four months, the elastics were used only at night and were changed every night. In the second of the last four months, the elastics were worn only every other night, and in the remaining two months, no more elastics were used through the end of the treatment. During the last four months of treatment, the overbite and overjet were maintained, and neither tongue interposition nor the atypical swallowing were observed.

After 24 months of orthodontic treatment, the appliance was removed, and the central upper incisors received aesthetic procedures. The wrap-around retainer (in the maxilla) was used 24 h/day in the first 8 months, half a day (at night) for an additional 3 months and every other night in the last month of use. A lower retainer in the six anterior teeth (3-3) were set for undetermined ending time (Figures 4K,M; 4A). The patient was urged to maintain her orofacial myofunctional therapy with the speech therapist for additional 12 months. The treatment progress performed is summarized in Table 1.

Treatment Results

Significant facial improvements can be seen in Figure 4. The profile is symmetrical in terms of the new position of the upper and lower lips; maxillary incisor exposure upon aesthetic smiling, adequate overbite (+3.5 mm) and overjet (+ 2.5 mm), and Class I functional relationships can be observed, and the upper and lower dental midlines fit to the sagittal line. Root absorption and periodontal conditions did not suffer greater damage than that observed at the beginning. Mandibular projection was observed, and the convexity and vertical relationship had decreased due to a counterclockwise movement of the mandible (Figure 5, Table 2).

The overlaps confirmed that the cephalometric changes were an extrusion of the upper and lower incisors and an intrusion of the upper molars (Figure 5 E, F). Symptoms were not reported at the temporomandibular joint. Conventional orthodontics provided physiological and aesthetic results and met the most urgent needs of the patient. In a posttreatment follow-up of 12 months, no significate relapses were verified. Despite these limitations, the amount of vertical and facial improvements was considerable, and the patient's chief complaints were satisfied.

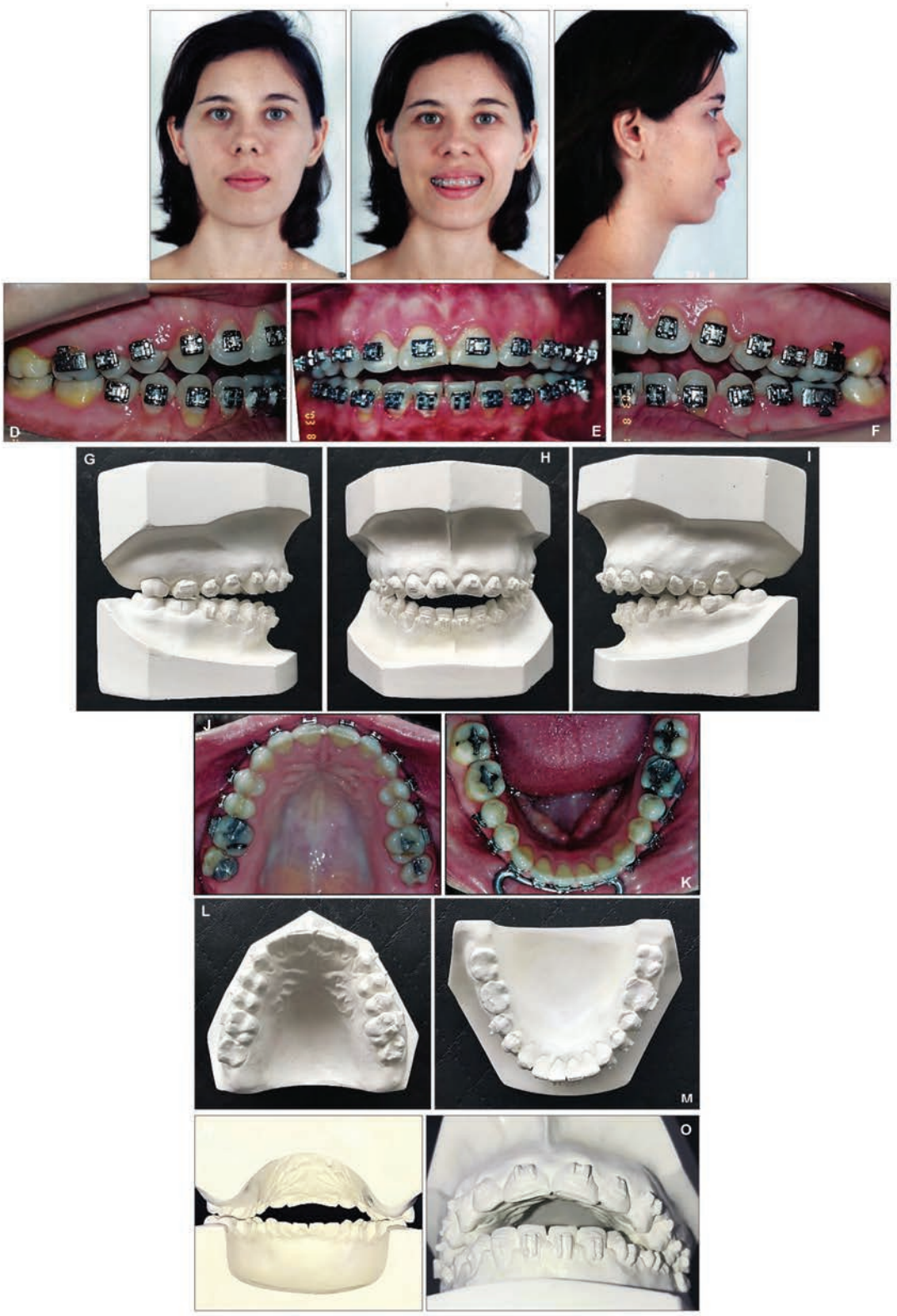

***Figure 1**: Photos when patient presented to the office. Extra-orals (A-C); intra-orals: (D-M); details of posterior (N) and anterior-inferior (O) occlusion, showing the severe open bite from the first molars including the anterior region of the arches.*

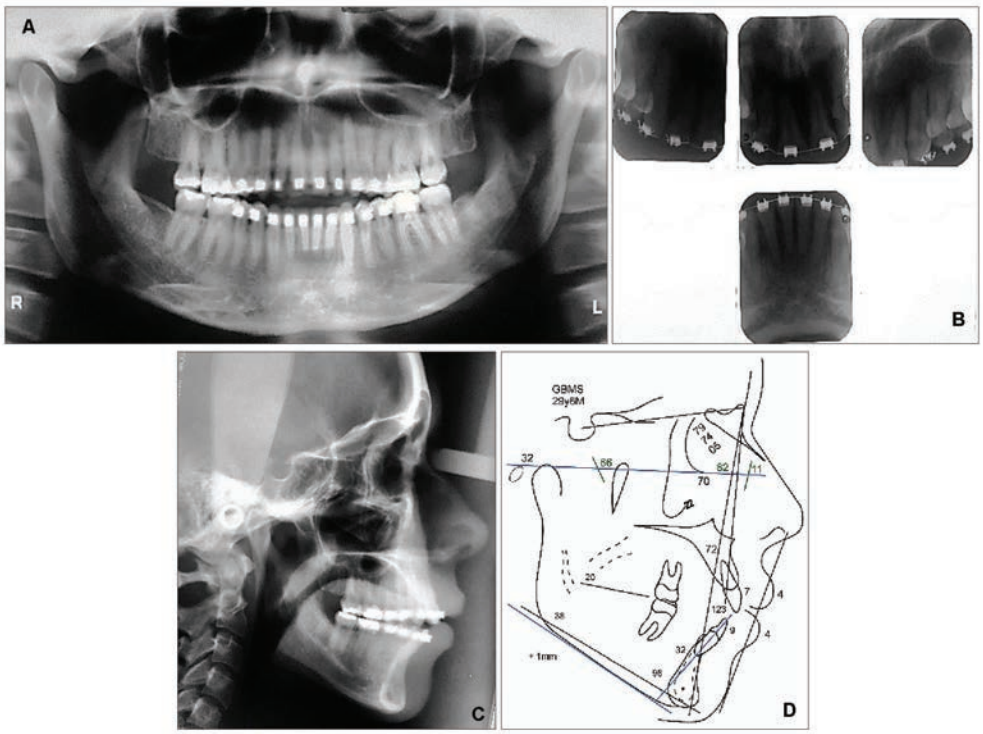

Figure 2: Initial X-rays (A-C). Periapical X-rays brought by the patient, with orthodontic wires (B). Initial cephalometric tracing (D).

Figure 3: *Intermaxillary elastics (5/16"). Square and Class II verticals: closed mouth (A-C); opened mouth (D, E). X-rays (F, G). After overjet and overbite establishment: open mouth (H), closed mouth (I).*

Figure 4: *Final photos. Extra-orals (A-C); intra-orals (D-M); details of posterior (N) and anterior-inferior occlusion, showing the severe open bite correction (O).*

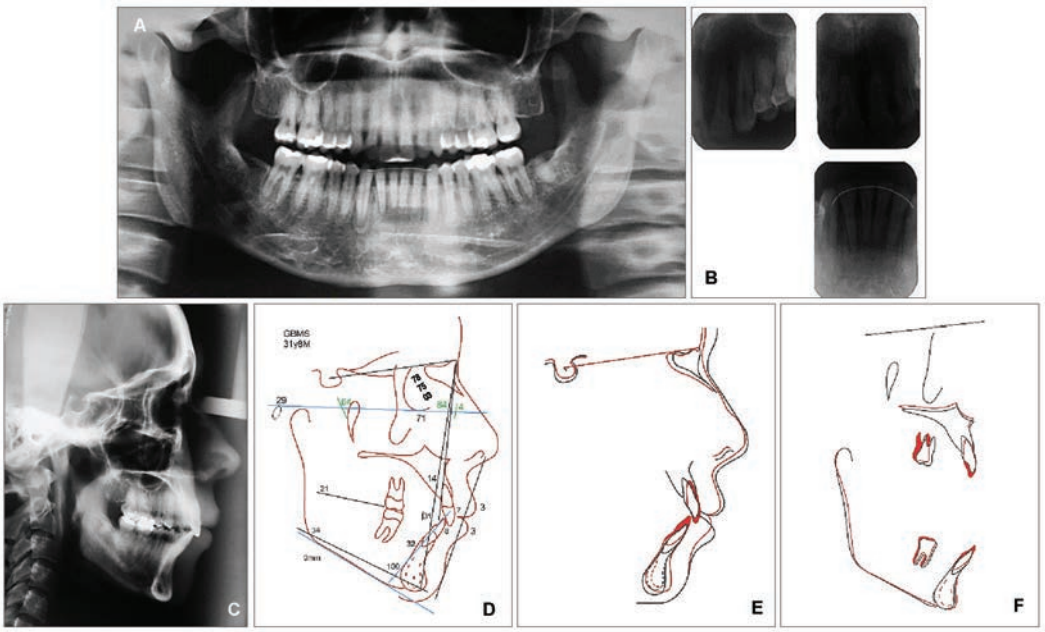

***Figure 5**: X-rays: panoramic (A); periapical (B) and final cephalometric (C). Final cephalometric tracing (D). Overlaps: N recorded (E), best-fit of maxilla and internal contour of mentonian symphysis (F).*

Table 1: *Summarized conducts performed in the- treatment of a severe anterior open bite, dental and skeletal class II sagittal relationship, in adult patient, with vertical elastics and step bends without the use of temporary anchoring devices nor surgery.*

Months	**1-4**	**5-8**	**9-12**	**13-16**	**17-20**	**21-24**
Speech Therapy Orofacial myofunctional therapy with a speech therapist along the treatment.						
Archwires size						
Upper	0.014"	0.016"	0.016"	0.018"	0.018"	0.016" x 0.022"
Lower	0.014"	0.016"	0.018"	0.016" x 0.022"	0.016" x 0.022"	0.019" x 0.025"
Archwires Bends						
Upper	Vertical step-down bends: Starting at the posterior teeth until the mesial of lateral incisors. Mild increased by each archwire changes			1st, 2nd order bends where necessary to a/n		1st, 2nd, 3rd finalization bends
Lower	———	1st, 2nd order bends where necessary to a/n		Added 3rd orders bends with ideals torches.		
The elastics prescriptions						
Beginning	3th	5th	9th	13th	17th	21th
Changes	Every two days					Cl. II and Triangle elastics gradually removed
Direction	Square	Class II and Square		Cl. II / Square	Cl. II	Triangle
24 h/day	——	——		Yes / ——	——	Yes
at night 12 h/day	Yes	Yes		—— / Yes	Yes right side	——
Magnitude	80 gf			100 gf		
Size	5/16" light			5/16" medium	5/16" medium	3/16"
Initial Overbite = - 5.5 mm						
Overbite decreased	+2.0mm	+1.5mm	+3.0mm	+1.5 mm	+1.0 mm	Final overbite
Overbite achieved	-3.5mm	-2.0mm	+1.0mm	+2.5 mm	+3.5 mm	+3.5 mm
Initial Overjet = + 5.0 mm						
Overjet decreased	-0.5mm	-0.5mm	-1.0mm	-0.5 mm	——	Final overjet
Overjet achieved	+4.5mm	+4.0mm	+3.0mm	+2.5 mm	+2.5 mm	+2.5 mm
Retainers						
Maxilla	Wraparound					
Use	24 h/day in the first 8 months, half a day (at night) for an additional 3 months and every other night in the last month of use					
Mandible	A lingual fixed set in the lower anterior six teeth (3 – 3)					
Use	No ending time determined					
Speech Therapy	Additional orofacial myofunctional therapy with a speech therapist for one year					

Table 2: *Values of the cephalometric tracings: initial (T0) and final (T1).*

	Analysis Type	NORMA	T0 29y 8m	T1 31y 8m	Diferences between T0-T1
Steiner	SNA	82	79	78	-1
	SNB	80	74	75	+1
	ANB	2	5	3	-2
	1.NA°	22	22	14	-8
	1-NA (mm)	4	7	7	none
	1.NB°	25	32	32	none
	1-NB (mm)	4	9	8	-1
	1:1	131	123	131	+8
	Ocl.SN	14	20	21	+1
	GoGn.SN	32	38	34	-4
	S-Ls (mm)	0	4	3	-1
	S-Li (mm)	0	4	3	-1
	Pog-NB (mm)	---	2	2	none
Downs	Å Facial	87.9	82	84	+2
	Å Convexity	0	11	4	-7
	Å Y Axis	59.4	66	64	-2
Tweed	FMA	25	32	29	-3
	FMIA	68	50	51	+1
	IMPA	87	98	100	+2

DISCUSSION

Currently, there is a great tendency of treatment plans for AOB, whether anterior, posterior, skeletal, or dental, to be bold, involving TADs and orthognathic surgery.[5,6,8-10] Such procedures can be unnecessary and computerized topographies and magnetic resonances as well.[14] This was avoided in the treatment described in this report.

a) Mechanical extrusion vs the impact to the root apex by molar intrusion

The choice to extrude the anterior teeth instead of intrude the molars was made due to a report in the literature[15] that indicated that the intrusion of molars causes approximately four times more root resorption than incisor extrusion. The rounding root apexes observed in the incisors can be attributed to the lingual interposition in addition to the use of vertical elastics.[15]

b) Vertical elastics/TADs vs counterclockwise rotation

The outcomes of this case report showed anterior teeth extrusion, a counterclockwise rotation of the mandible, positive vertical overbite and dental midline deviation correction, in addition to improvements to the patient's facial profile and the maintenance of passive lip sealing (Figures 4 and 5D-F). These results are predictable, efficient, and have good stability for open bite correction, even with the absence of TADs.[16,17]

The elastics are disposable, their activation is increased by jaw movement, and they have predictable mechanics, if used correctly;[16] however, the TADs requires more caution regarding inflammation in the adjacent soft tissues, bone density,[9] root injuries, mobility, fractures due to excessive force of the operator and possible reinstallation.[18]

c) Strength and time of elastics

In the literature,[19] similar to the observations in this case report, the use of the same elastics for a period between 1 and 2 days can maintain the remaining strength, and the triangular elastics contributed to the maintenance of the AOB correction, even in the face of potential side effects. When tip backs and Omega stops are used adjacent molar accessories with the most rigid wires, extrusion and mesioinclination are minimized, which avoids tilting the occlusal plane downward.[19] The use of intermaxillary elastics can promote signs and symptoms of temporomandibular disorder.[20] In this clinical case, these symptoms were not observed.

At the one-year follow-up after appliance removal, a mild relapse was detected, but since the treatment produced an overcorrection of the anterior open bite, the final aesthetic results and functional movement were not affect. Besides, the literature says that relapses can also occur also with the use of TADs[6,8] In addition, the patient continued to practice with the previous tongue therapy.

CONCLUSIONS

In this case report, a severe skeletal open bite malocclusion in an adult patient was treated only with step bends and vertical elastics, which demonstrated an efficient, predictable and stable open bite correction.

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MANAGEMENT OF AN UNERUPTED TOOTH AND ODONTOMA AFTER TRAUMA IN PREDECESSOR

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Palavras-chave: Odontoma. Traumatismo Dentário. Dente não erupcionado. Cirurgia. Ortodontia.

RESUMO

Objetivo: O objetivo deste relato de caso foi descrever a exposição cirúrgica e o tratamento ortodôntico de um incisivo central superior direito ectópico e não irrompido após trauma do predecessor decíduo. **Relato do caso**: Uma menina de 11 anos de idade foi encaminhada à Clínica de Odontopediatria devido ao atraso na erupção do incisivo central superior direito. As radiografias mostraram o incisivo central impactado localizado abaixo da espinha nasal anterior e seu ápice paralelo ao plano palatino e a presença de um odontoma. A cirurgia para remoção do odontoma foi realizada sob anestesia geral e duas perfurações na coroa do dente impactado foram realizadas para a tração ortodôntica. O alinhamento correto foi alcançado após 18 meses e não foram encontradas alterações clínicas ou radiográficas significativas. **Conclusão**: O manejo ortodôntico foi realizado com sucesso, e um resultado estético positivo combinado à oclusão adequada demonstrou os resultados satisfatórios deste caso.

Keywords: Odontoma. Dental Trauma. Included Tooth. Surgery. Orthodontics.

ABSTRACT

Objective: The purpose of this case report was to describe the surgical exposure and orthodontic management of an unerupted and ectopic maxillary right central incisor after trauma to the primary predecessor. **Case report**: An 11-year-old girl was referred to the Pediatric Dentistry Clinic due to eruption failure of the maxillary right central incisor. Radiographs showed the impacted central incisor located below the anterior nasal spine and its apex parallel to the palatal plane and the presence of an odontoma. General surgery was performed to remove the odontoma and two perforations in the crown of the impacted tooth were made to carry out orthodontic traction. Correct alignment was achieved after 18 months and no significant clinical or radiographic alterations were founded. **Conclusion**: The orthodontic management was performed successfully, and a positive esthetic outcome combined with adequate occlusion demonstrated the satisfactory results of this case.

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INTRODUCTION

The presence of an anterior impact tooth usually occurs in the early stage of the mixed dentition, since comparison with other children of the same age and even with the contralateral tooth generates a concern of those responsible.[1] The majority of traumatic injuries occur at the age of 2 years, during the developmental stage of the permanent crown.[2,3] Depending on the severity of the trauma and the age of child in the moment of dental trauma the chances to found alterations as enamel hypoplasia, root and crown dilacerations, dental impaction and odontomas are greater.[4,5] An unerupted tooth may be related with supernumerary teeth, odontomas, cysts, crown or root malformations, or ectopic development of tooth germs.6 Odontomas represent over 65% of all odontogenic tumors.[7] Their etiology can be associated with different factors such as trauma, local infection, genetic mutations, or even hereditary have been suggested.[8-10] Odontomas are usually found during routine radiographic examinations and appear as small, solitary or multiple radiopaque lesions.[11,12] They can cause disturbances to the eruption such as impaction, delayed eruption or retention of primary teeth.[11,13] The treatment of odontoma involves surgical management and the prognosis is favorable, with low rates of recurrence.[13,14] Surgical exposure associated with orthodontic treatment of the included tooth is considered a therapeutic approach with a high success rate. Orthodontic traction after surgical exposure is a current treatment modality, but includes possible failures due to ankylosis, external root resorption, or root exposure. Moreover, if the tooth is successfully brought into occlusion an unaesthetic gingival margin could appear.[15] The aim of this case report was to describe a successful management of an unerupted maxillary central incisor in an ectopic localization impacted by an odontoma in a pediatric patient after trauma to the primary predecessor with combined surgical and orthodontic treatment.

CASE REPORT

An 11-year-old girl was referred to the Pediatric Dentistry Clinic, Rio de Janeiro, Brazil, with esthetic complaints related to the difference in size of the teeth located in the upper anterior maxillary arch.

During anamnesis, the mother reported that the patient was generally healthy but had a traumatic injury history to the anterior region of dental arch when she was around 2 years old but no treatment was carried out at that time. The clinical examination revealed the absence of the maxillary right permanent central incisor, although there was adequate space for the incisors. In addition the presence of teeth 12, 21, 22 and 23 with complete erupted, also teeth 53, 52 and 51 with prolonged retention. However, tooth 13 was in eruption process with accentuated mobility of tooth 53 (Figure 1A). The patient was in mixed dentition and had an angle Class I molar relationship.

Although computed tomography is considered a routine exam for orthodontic traction, it was not possible to perform this exam on this patient because the treatment was performed at a public institution and the exam was not available at the time of the appointment. In addition, due to the cost, the patient cannot do in other services. However, other radiographic exams showed radiopaque mineralized masses suggestive to an odontoma-like malformation located in the vestibular position. Teeth 12, 21 and 22 present closed apex. While tooth 52 showed external resorption, however tooth 51 demonstrated any signal of resorption. (Figure 1B). The maxillary right central incisor was located parallel to the palatal plane, without dilacerations and was in intimate relation with the nasal cavity (Figure 1C, 1D).

The treatment plan consisted in a surgery, performed under general anesthesia, to remove teeth 52 and 51, the radiopaque mass and to access the impacted tooth (Figure 2A, 2B). The clinical and radiographic appearance of the radiopaque mass was characteristic to a compound odontoma, which was confirmed by histopathology (Figure 3).

Since there was inadequate access to bond a button on the crown and the field was contaminated with blood and saliva, two holes (for safety precautions) were drilled through the incisal edge of the tooth and two separated braided flexible orthodontic wires were inserted through the perforations (Figure 2C, 2D).

Two weeks before surgery an orthodontic appliance with standard edgewise brackets (Morelli, SP) for the anterior segment of the arch were bonded for alignment and leveling purposes as well as to prevent any possible space loss.

After a-one-month period for healing of the surgical area and to evaluate if there was any spontaneous movement of the impacted tooth, the closed-eruption technique for traction was started (Figure 4A, 4B). As the patient had aesthetics complaints, a resin restoration was carried out on the crown of the extracted deciduous central incisor to resemble the appearance of the permanent incisor and a bracket was bonded improving the aesthetics of the patient. Different types of orthodontic mechanisms with elastic chains (to apply traction) and NiTi wires were used. The direction of force was adjusted to guide the impacted central incisor into its correct position without disturbing the other teeth. The tooth was aligned and leveled until a stainless steel rectangular arch wire (0.019 x 0.026 inch) could be used for support for traction.

For 11 months, the tooth was under retraction but without being clinically visible. After this time it was possible to observe the tooth in the oral cavity (Figure 4C, 4D) and the holes were restored with calcium hydroxide and glass ionomer cement and a bracket was bonded to facilitate the traction. Alignment and leveling were achieved with round and rectangular wires (0.12"Niti, 0.14"Niti, 0.16"Niti, 0.18" stainless steel ligature wire, 0.20" stainless steel ligature wire, 0.18x0.24" stainless steel ligature wire, in sequence).

The orthodontic attachments were removed after 18 months when the alignment of the upper incisors was achieved and a short period of retention was observed (around 6 months). Subsequently, the restoration was substituted for a composite resin.

Although the discrepancy between the level of gingival tooth exposure and its neighboring teeth were observed, patient was satisfied with the aesthetics and in addition it was decided to avoid further manipulation of the area. Finally, at the end of the treatment the occlusion, alignment and overall aesthetics were satisfactory. Even though the patient not present any significant clinical or radiographic alterations, it's possible to observe a defect in gingival contour and a rounding of the root apex (Figure 4E, 4F). Follow-up is important to evaluate the surgical procedure and during the entire follow-up period (18 months) no signs of odontoma recurrence were observed.

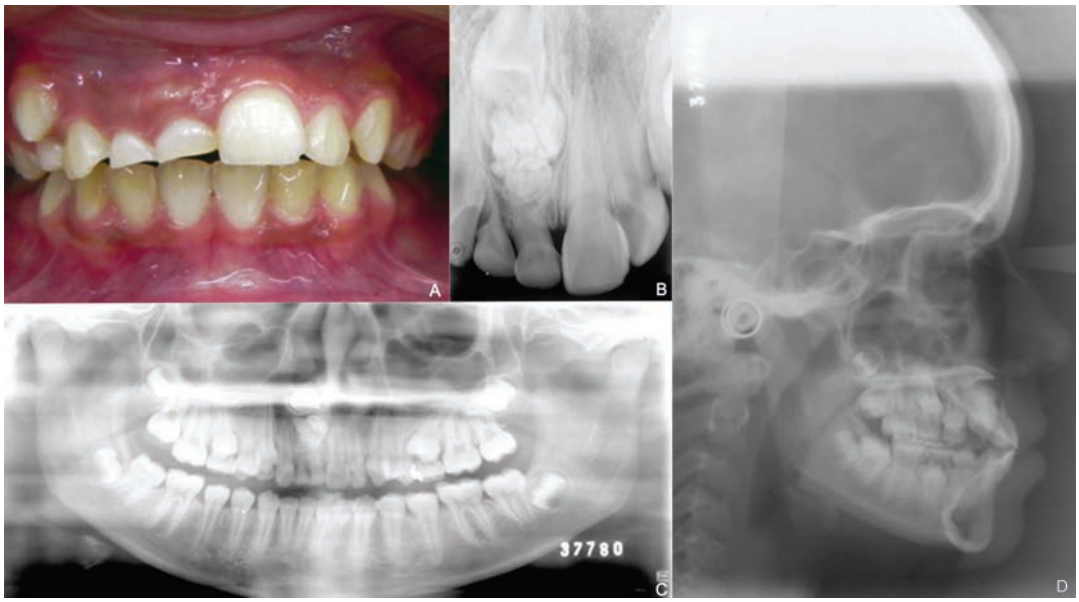

Figure 1: *(A) Patient's occlusion in front view. (B) Periapical radiography. (C) Panoramic radiography. (D) Perfil radiography.*

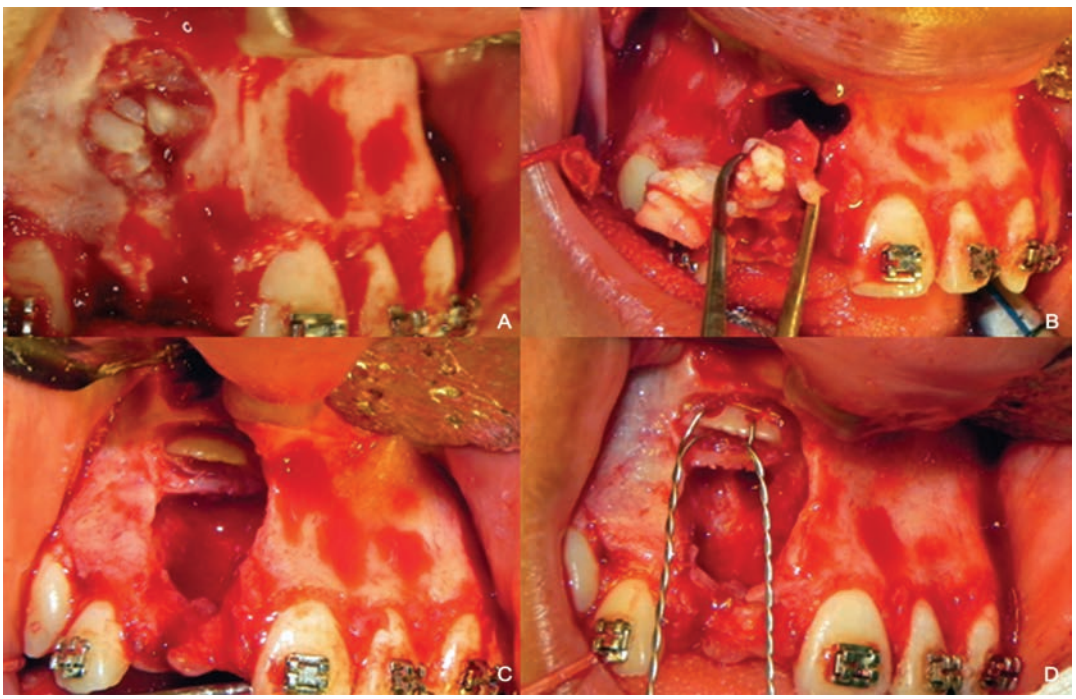

Figure 2: *(A) after extraction of deciduous teeth and showing the radiopaque mass. (B) removal of the radiopaque mass. (C) exposure of the permanent tooth. (D) braided flexible orthodontic wires inserted through the perforations.*

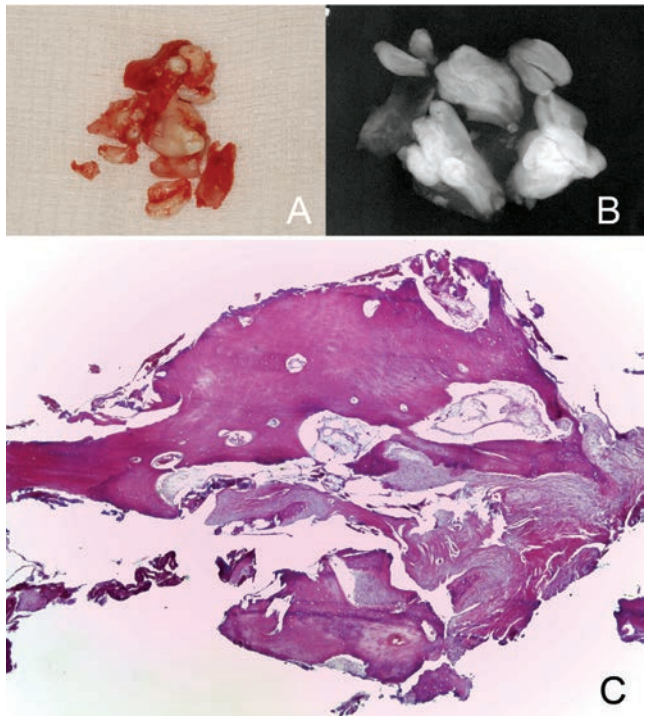

Figure 3: *(A) clinical view of odontoma. (B) radiographic view of odontoma. (C) histopathological characteristics.*

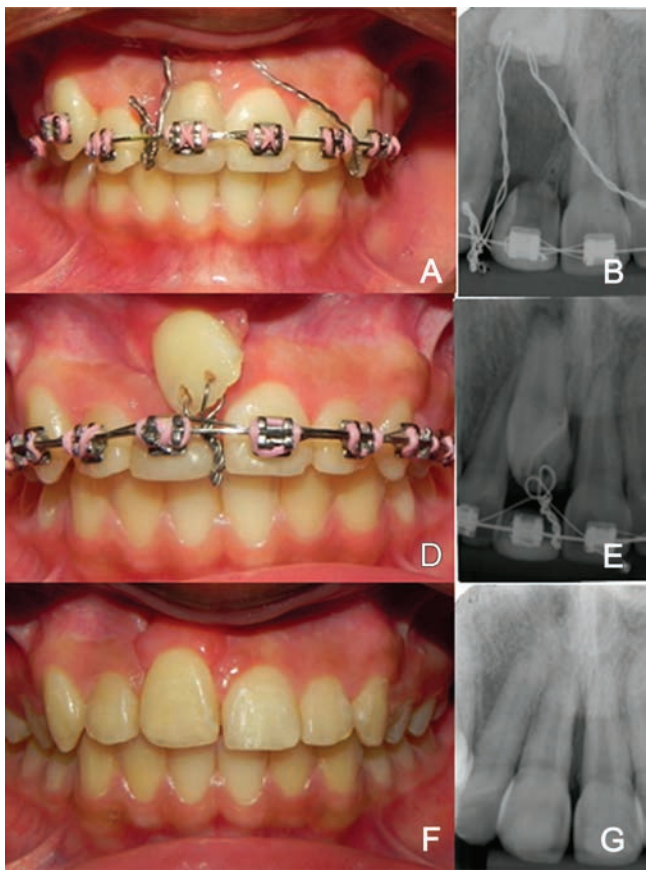

Figure 4: *(A) clinical view after 1 month, with temporary crown in place. (B) radiography after 1 month. (C) clinical view after 12 months. (D) radiography after 12 months. (E) final view of occlusion without any appliance. (F) final radiography.*

DISCUSSION

The main reason for our patient to seek treatment was the delayed eruption of the permanent maxillary central incisor. The radiographic exam detected the presence of an odontoma in the region, acting as a physical barrier and causing the ectopic position of the impacted tooth. The literature show that traumatic injuries in primary dentition can result in alterations to permanent teeth, especially if dental trauma occurs during the early developmental stages of permanent dentition.[4] During anamnesis, the mother reported a history of dental trauma in primary dentition, which could be one of the causal factors of the odontoma and ectopic location.

The treatment of choice for an odontoma is surgical excision.[16] Some authors reported the spontaneous eruption of an impacted tooth after removal of an odontoma.[13,17] A less conservative approach is exposure of the unerupted tooth at the time of surgery and begin the orthodontic traction.[18,19] The literature emphasizes the advantages and disadvantages of buccal and palatal access and also open and closed approach.[20,21]

In this case, access was performed by the vestibular due to location of the odontoma and impacted tooth. Palatal access would result in increased bone loss during surgery. Due to the location of the tooth, the difficulty of surgical access and maintenance of a dry and not contaminated surgical field, our treatment choice was to remove the odontoma and then drill two perforations in the crown of the impacted incisor where the two braided flexible orthodontic wires were tied. The most common procedure is the bonding of devices for traction of included teeth, but due to the position of the tooth in the bone it was impossible to sufficient exposure of the crown for bonding. However, despite the risk of injury to the pulp tissue during perforation of the crow, the orthodontic traction through perforations in the crown of the impacted tooth is a good option when the spontaneous eruption of the tooth does not occur and/or bonding of an orthodontic apparatus is not possible.

The maxillary central incisor is an important esthetic and functional concern for patients.[6] In this case, the recovery of the aesthetics was achieved, during traction, by fixing a temporary crown, made from the extracted primary incisor, with a bracket. The age and collaboration of the patient were both important for the success of the treatment.

The successful alignment of an impacted tooth depends on several factors, including the position and direction of the impacted tooth, the degree of root completion, the degree of dilaceration, and the availability of space for the impacted tooth.[21] In our case, the position and direction of the impacted tooth and complete root formation were some of the factors that hindered the satisfactory alignment of the tooth. Depending on the characteristics of the impacted tooth, the periodontal status of the exposed incisor after orthodontic treatment may reveal an acceptable gingival margin, eliminating the need for gingival recontouring surgery.[19,22] In our case and in other cases, the traction may result in poor gingival margin, inadequate gingival tissue attachment and a discrepancy of gingival levels between the exposed tooth and its neighboring teeth.[16,18] These fact can be explain by the traction wire rested on the mucosa during surgery due the tooth position.

Since the patient was only 12 years old and very frightened of surgical procedures, the gingival plastic reconstructive surgery was delayed for a few years, until the gingival contour returns to normal after fixed appliance removal and until bone healing at the interproximal area occurs. The authors believe that this loss is related to extensive bone loss during the time of surgery because the size of odontoma and the position of the affected tooth. McDonald and Yap,[23] found that the more bone removed initially, the greater the bone loss after orthodontic treatment. Sometimes the plastic surgery may be necessary due to poor margins, inadequate tissue attachment and discrepancy of gingival levels, as well as the type of surgery performed and the orthodontic traction. It is very important to considerate the patient expected treatment outcome and that a simple improvement in incisor aesthetic can have a positive effect on self-reported attributes such as confidence and happiness.[24]

Some limitations could be seen in this case report. The removal of an odontoma is indicated for teeth with complete root formation and an ectopic position. The surgical procedure was considered invasive due to the size of the odontoma and the necessary amount of bone removed. The child's age and the time needed for healing, traction and alignment make treatment difficult, since they need the collaboration of the child and his family. Thus, multidisciplinary approach was essential for the success of the prognosis of the case in which it was able to return aesthetics and function to the patient.

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SURGICAL TREATMENT OF ANKYLOGLOSSIA USING AN OPHTHALMIC TOPICAL ANESTHETIC AND A TENTACANNULA FOR TONGUE ELEVATION: A CASE REPORT

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Palavras-chave: Freio Lingual. Fonética. Administração Tópica. Anestesia local. Procedimentos cirúrgicos orais. Instrumentos cirúrgicos.

RESUMO

Introdução: A anquiloglossia caracteriza-se pela presença de um freio lingual curto que pode inserir-se desde o rebordo alveolar até o ápice lingual e, até promover uma verdadeira fusão da língua ao assoalho. Um freio lingual curto poderá gerar vários problemas como distúrbios fonéticos. **Objetivo**: descrever uma técnica cirúrgica para tratamento da anquiloglossia utilizando um anestésico tópico oftálmico e uma tentacânula para elevação da língua. **Relato do caso**: Uma paciente com 15 anos de idade foi encaminhada para cirurgia do frênulo lingual devido à comprometimento da fala. O exame clínico revelou a presença de anquiloglossia, dificultando a pronúncia dos fonemas T, D, L e, reduzindo a mobilidade da língua. A técnica cirúrgica escolhida foi a frenectomia lingual. Um anestésico tópico oftálmico foi aplicado inicialmente nas bordas laterais do freio com o paciente na posição vertical e na presença de aspiração adequada. Com o auxílio de uma tentacânula, a língua foi elevada e o frênulo foi gradualmente liberado com uma tesoura serrilhada Goldman-Fox. O anestésico tópico foi continuamente gotejado para o local cirúrgico durante a cirurgia. Resultados: Nenhuma dor pós-operatória foi relatada pelo paciente, a cicatrização ocorreu normalmente e não houve recorrência da inserção anormal do frênulo. **Conclusão**: As vantagens dessa técnica em comparação aos métodos convencionais que utilizam anestesia infiltrativa, incluem menor trauma e uma avaliação mais precisa dos movimentos da língua durante a cirurgia, pois haverá um melhor controle da mobilidade do paciente quando comparado às técnicas infiltrativas.

Keywords: Lingual frenum. Phonetics. Topical administration. Local anesthesia. Oral surgical procedures. Surgical instruments.

ABSTRACT

Introduction: Ankyloglossia is characterized by the presence of a short lingual frenum that can be inserted from the alveolar ridge to the lingual apex and, until promoting a true fusion of the tongue to the floor. A short lingual frenum can generate several problems such as phonetic disorders. **Objective**: To describe a surgical technique for the treatment of ankyloglossia using a topical ophthalmic anesthetic and a tentacannula for tongue elevation. **Case report**: A 15-year-old female was referred for lingual frenulum surgery due to speech impairment. Clinical examination revealed the presence of ankyloglossia which was both hindering the pronunciation of T, D, L phonemes and reducing tongue mobility. The surgical technique chosen was a lingual frenectomy. An ophthalmic topical anesthetic was initially applied to the lateral borders of the frenum with the patient in an upright position and in the presence of adequate aspiration. With the aid of a tentacannula the tongue was raised and the frenulum gradually released with a Goldman-Fox serrated scissor. The topical anesthetic was continuously trickled onto the surgical site during surgery. Results: No postoperative pain was reported by the patient, healing occurred normally and there was no recurrence of abnormal frenulum insertion. **Conclusion**: The advantages of this technique in comparison to conventional methods which use infiltrative anesthesia include less trauma and a more precise evaluation of tongue movements during surgery, because there will be better control of mobility for the patient when compared to infiltrative techniques.

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INTRODUCTION

Etymologically, ''ankyloglossia'' originates from the Greek words ''agkilos" (curved) and ''glossa" (tongue).[1] Ankyloglossia, commonly known as tongue-tie, is a congenital oral anomaly characterized by a short, thick lingual frenulum, a membrane connecting the ventrum of the tongue to the floor of the mouth.[2] Ankyloglossia varies in degree of severity, from mild cases characterized by mucous membrane bands to complete ankyloglossia in which the tongue is tethered to the floor of the mouth.[3-5] The anomaly may contribute to difficulty in the articulation of specific tongue-thrust sounds. It has also been implicated as a cause of poor sucking, chewing or swallowing.[5] Some have also suggested that ankyloglossia contributes to periodontal disease[3] and to lower incisor diastema[6] due to its high insertion in the alveolar ridge.

The attachment of the lingual frenulum in newborn babies goes from the tip of the tongue to the lower jaw.[7] The tongue is an important oral structure for the newborn infant because it affects swallowing and nutrition. As the jaw grows vertically, there is an increase in vertical dimension, as well as lingual enlargement and tooth eruption. The lingual frenulum, then migrates to its definite position in the middle portion of the ventral tongue. With ankyloglossia, however, the lingual frenulum has an anterior attachment near the tip of the tongue and may also be unusually short.[8]

The mobility of the tongue is related to the lingual frenulum, which originates from an embryonic fusion of the tongue and floor of the mouth. These two structures are later separated as normal growth occurs.[8]

The treatment of ankyloglossia may be either conservative or radical. Conservative treatment includes speech therapy which promotes stretching of the tongue via exercises and may help the child to pronounce sounds more clearly. The radical approach is the surgical removal/repositioning of the frenum.[9]

Authors have referred to three methods of lingual frenulum surgery: a frenectomy, a procedure which involves the removal of the frenulum; a less extensive clipping of the frenulum (sometimes referred to as frenotomy), and surgical repositioning of the lingual frenulum attachment which is sometimes referred to as frenuloplasty.[10,11]

A study investigating methods of assessment and management of ankyloglossia was conducted among health workers of three different areas: otolaryngologists, speech pathologists and dentists. There was a consensus regarding the assessment of tongue-tie among the professionals, but there was disagreement regarding the primary indication for surgery.[12]

Frenectomy for tongue-tie release using a topical ophthalmic anesthetic 1% was first indicated for infants,[13] because local infiltrative anesthesia was thought to represent a risk. In the technique used the topical anesthetic is applied to the ventral surface of the tongue. This technique has also been used in adults without any postoperative complications and minimal bleeding and discomfort as long as it is indicated and executed properly.[14]

The frenectomy procedure requires a clear view of the operative field and complete stabilization of the tongue,[15] which may be accomplished by using a grooved surgical retractor also known as "tentacannula" which is commonly used in medicine for the drainage of abscesses.

The purpose of this clinical case report is to present a different frenectomy technique with the use of an topical ophthalmic anesthesic and the aid of a tentacannula for tongue elevation on a teenage patient with speech articulation problems.

CASE REPORT

A 15-year-old female patient complaining of improper speech was referred by a speech pathologist for surgical correction of ankyloglossia. Oral examination revealed short and forward ankyloglossia[16] (Figure 1) and restriction of tongue tip elevation which hampered proper articulation of tongue sounds – such as "t", "d" and "l". Patient without any systemic or oral changes other than ankyloglossia.

The procedure chosen was a frenectomy using a tentacannula (Thimon, Sao Paulo, SP, Brazil) (Figure 2) for tongue elevation. The tentacannula, at its active end, has a slit in which the frenulum settles and a flat side surface next to this slit, in which the tongue ventrum comes into contact. Posteriorly, an ophthalmic anesthesic applied to the tongue ventrum adjacent to the frenulum (Figure 3), after initial drying with gauze in the frenulum region. The composition of this anesthetic is: each ml (31 drops) contains 10 mg of tetracaine hydrochloride (0.322 mg/drop) and 1 mg of phenylephrine hydrochloride (0.032 mg/drop). The use of a powerful aspirator placed on the floor of the mouth is paramount (Figure 4) and the patient should be operated in an upright position in order to avoid swallowing the ophthalmic solution.

Before the surgical procedure, an extra-oral antisepsis was performed with 1% chlorhexidine digluconate and mouthwash with 0.12% chlorhexidine digluconate for 1 minute.

After adequate anesthesia was confirmed, the tentacannula was used to elevate the tongue and tense the frenulum and cuts were made along the tongue ventrum

with a Goldman-Fox scissor (Figure 5). During the procedure, an ophthalmic topic anesthesic "Oculum" (Allergan®, São Paulo, Brazil, www.allergan.com.br) was continuously trickled onto the surgical site and the patient was asked to move the tongue to allow visualization for subsequent cuts until complete release of the frenulum.

The anesthetic step from the form of use to its quantity could be described in detail in the following way: two bilateral aspirators are placed in the frenulum region and two gauzes are also placed bilaterally to prevent the flow of eye drops to the oral floor region. After lifting the tongue with the aid of the tentacannula, 4 drops are slowly deposited, at intervals of 30 seconds on average, in the region of the frenulum where the beginning of the frenectomy with the Goldman-Fox serrated scissors will begin. After 2 minutes, the sensitivity was checked with a small touch on the region with tweezers. After the absence of sensitivity, frenectomy can be started. In this case, the placement of two more gutters laterally to the site of the beginning of the primary surgical wound was also complemented, not requiring the addition of drops until the end of the procedure. In all, 18 drops were deposited.

After release of the frenulum, the surgical wound was sutured with a 4-0 Ethicon® silk-suture (Johnson-Johnson®, Sao Paulo, Brazil, www.jnjbrasil.com.br) (Figure 6). There was no excessive bleeding or pain during the procedure. Postoperative instructions were given as non-narcotic analgesics were prescribed to alleviate possible discomfort and the patient was discharged (Dipyrone 500mg was instituted every 6 hours on the first day and a more pasty and cold diet).

During follow-up reattachment of the frenum by excessive scarring was not observed and the patient did not report postoperative pain. The patient was then referred back to the speech language pathologist for proper post-surgery exercises in order to achieve a successful outcome. The patient was followed up for 6 months and, after returning at 1 year, didn't show any sign of recurrence.

Attention is drawn in the present case report that, taking into account that in the anesthetic tube in concentrations at 2% there is 36mg of the anesthetic, it can be related that, in the case of collyrium, with a condition of at most 18 drops, around 5mg of anesthetic (tetracaine) is used. Since it is associated with a vasoconstrictor, phenylephrine, a sympathomimetic agent with vasoconstrictor action, there is a limitation to systemic absorption of tetracaine, prolonging the anesthetic effect. Considering that the desensitization conditions are not obtained in the amount of drops indicated above, the infiltrative technique would be considered again for use in the procedure.

***Figure 1**: Intraoral view of the patient with ankyloglossia.*

***Figure 2**: Tentacannula.*

***Figure 3**: Use of the ophthalmic topical anesthetic and tentacannula.*

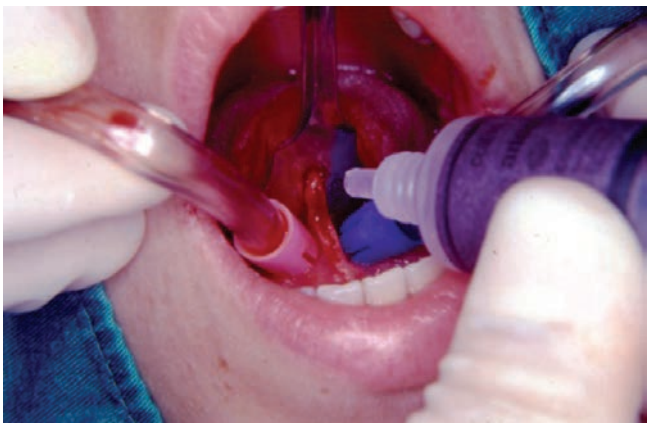

***Figure 4**: Aspiration essential to avoid swallowing the anesthetic.*

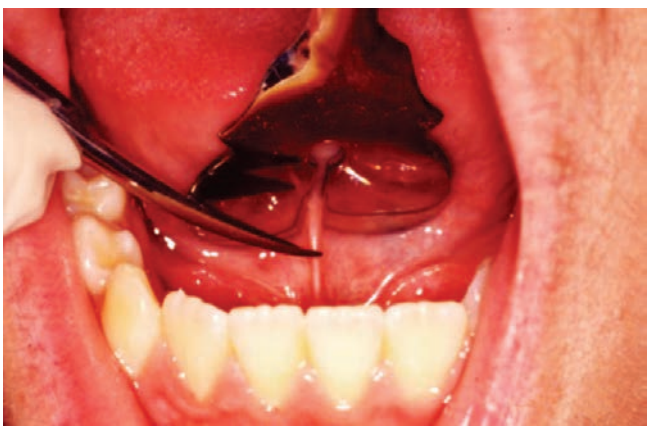

***Figure 5**: Elevation of the tongue and cut of the tongue ventrum.*

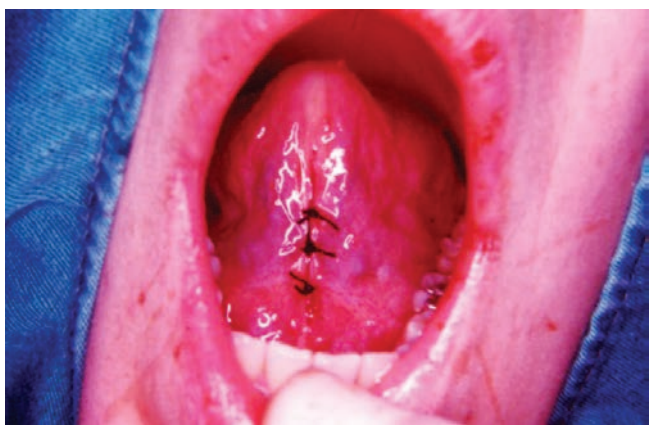

***Figure 6**: Suture.*

DISCUSSION

Ankyloglossia, or tongue-tie, is a congenital anomaly in which a short, lingual frenum or a highly attached genioglossus muscle restricts tongue movement. This can lead to a range of problems such as difficulties in breast feeding in infancy, swallowing, mandibular prognatism and speech articulation defects[8,9] as presented in our case report.

A short lingual frenum limits tongue movements hampering adequate pronunciation of certain words[9]. Clinically, the patient in our case report was not able to articulate lingual sounds and sibilants such as T, D and L as a manifestation of symptomatic tongue-tie.[5,17] Evidence[3] indicates that three in each 10000 children with tongue-tie have difficulty in the articulation of certain speech sounds.

There is no consensus in the literature as to the optimal time for surgery. Some advocate early surgical intervention, as soon as the frenum is diagnosed as abnormall.[4] Correction at an early age reduces the risk of development of incorrect speech movements and swallowing. Others, on the other hand, suggest that surgery must be delayed until the age of four or five.[5,17] Optimal management of tongue tie including timely and appropriate surgical intervention should involve a multidisciplinary team with the participation of dentists, speech pathologists and pediatricians, the latter in the case of infants.[8]

Although the frenectomy technique using topical anesthesia and a tentacannula was originally indicated for babies,[13] adults may be treated using the same technique if proper evaluation and precautions are undertaken.[14] The use of the tentacannula in a lingual frenectomy is a tool that facilitates the procedure by keeping the tongue in a stable position allowing a better view of the operative field.[15]

In the frenectomy procedure here reported the tentacannula was used to hold the tongue up towards the roof of the mouth and make the frenum taut, facilitating its delimitation and subsequent excision of the area of tissue to be eliminated[7]. The greatest advantages of the use of a tentacannula is that the tongue is elevated without the need for transfixation of its tip with a suture as performed in conventional frenectomy techniques and is a good alternative to the the tongue stabilization (a big problem for professionals in performing frenectomy).

The lingual frenectomy presented in this paper was performed as recommended in literature: the initial cut begins at the free border of the frenum and proceeds posteriorly.[7] Each cut provides some release, allowing visualization for subsequent cuts. Extreme care must be taken not to incise any vascular tissue or cause damage to Wharton's ducts. Once tissue margins are undermined and wound edges are approximated, closure may be achieved

with a simple sutures.[18] It must be said however that whereas standard frenectomies may be carried by the general practitioner, ankyloglossia due to the anomalies of the genioglossus muscle, previously mentioned[8,9] should only be surgically treated by oral surgeons.[10]

According to the literature,[8] there weren't postoperative complications, the discomfort is brief and less when moving the tongue. The patient should be referred to a speech therapist for postoperative exercises.

The option for topical anesthesia used, as well as tentacannula, advantages and disadvantages in relation to other formulations available for anesthesia and techniques can be explained as follows: taking the necessary precautions, this technique has the advantage of allowing the patient to have greater control over the movement of the tongue during the transoperative stage, which helps to verify the release by the movements performed by the patient. In addition, the possibility of not using infiltrative anesthesia can be a differential for patients more anxious or reactive to local anesthesia. It should also be emphasized that the design of the tentacannula enables an adequate immobilization of the tongue, effectively exposing the lingual frenum, which facilitates the surgical stage, mainly in its use in pediatric patients, for example.

CONCLUSION

This technique has been used in adults/teenagers patients and among its main advantages is the fact that the patient can be operated without the standard infiltrative local anesthesia which is more easily accepted and allows the patient a better control of tongue movement during the procedure.

A number of surgical procedures have been used to treat ankyloglossia. This article reported on the possibility of performing lingual frenectomies in adults/teenagers with the use of an ophthalmic topical anesthetic and a tentacanula for tongue retraction. It is proposed that with proper training this relatively simple frenectomy technique may be performed by the general dentist.

In short, the advantages of this technique in comparison to conventional methods which use infiltrative anesthesia include less trauma and a more precise evaluation of tongue movements during surgery, because there will be better control of mobility for the patient when compared to infiltrative techniques.

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PERIODONTAL MANAGEMENT OF A PATIENT WITH CHRONIC KIDNEY DISEASE: A CASE REPORT

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Palavras-Chave: Doenças Periodontais. Nefropatia. Anlodipino. Crescimento excessivo da gengiva.

RESUMO

Introdução: A associação entre doença periodontal e doença renal crônica (DRC) tem sido reconhecida nos últimos anos. O crescimento gengival excessivo pode ser um efeito colateral de alguns medicamentos prescritos para pacientes com DRC. **Objetivos:** O objetivo deste estudo foi relatar o manejo odontológico de um paciente com DRC que apresentava periodontite e aumento gengival. **Relato do caso:** Um paciente do sexo masculino, 55 anos, procurou atendimento odontológico e foi diagnosticado com periodontite generalizada em estágio avançado e crescimento gengival associado ao uso de anlodipina, um bloqueador dos canais de cálcio de ação prolongada. O tratamento consistiu em interrupção da anlodipina, sessões de instruções de higiene bucal e terapia periodontal básica. Posteriormente, foi realizada terapia periodontal convencional, com raspagem e alisamento radicular dos quatro hemiarcos, seguida de cirurgia periodontal a retalho e gengivectomia. Considerando os sítios periodontais com profundidade de bolsa à sondagem (PBS) ≥ 4mm no início do tratamento, a média de PBS foi reduzida (início: 5,94 ± 1,80; final: 2,76 ± 1,38), bem como a média do nível clínico de inserção (início: 5,55 ± 1,51; final: 4,52 ± 1,47).A doença periodontal foi controlada e não houve recorrência do crescimento gengival após 18 meses de acompanhamento. **Conclusão:** O tratamento odontológico deste paciente com DRC e envolvimento periodontal incluiu a interrupção da anlodipina, terapia periodontal básica e avançada e gengivectomia. A higiene bucal adequada pode ajudar a prevenir a recorrência do crescimento gengival excessivo e a manutenção de um estado periodontal saudável.

Keywords: Periodontal Disease. Kidney Diseases. Amlodipine. Gingival Overgrowth.

ABSTRACT

Introduction: The association between periodontal disease and chronic kidney disease (CKD) has been recognized over the years. Gingival overgrowth may be a side effect of some of the drugs prescribed for patients with CKD. **Objective:** The objective of this manuscript was to report the dental management of a patient with chronic renal disease who presented periodontitis and gingival overgrowth. **Case report:** A 55 years old male patient sought dental treatment, and was diagnosed with generalized periodontitis in advanced stage and gingival overgrowth. The overgrowth was associated to the use of amlodipine, a long-acting calcium channel blocker. The treatment consisted of interruption of amlodipine, sessions of oral hygiene instruction and basic periodontal therapy. Thereafter, conventional periodontal therapy, with scaling and root planning of the four hemiarches, surgical periodontal therapy and gingivectomy of the overgrowth were performed. Considering periodontal sites with a probing depth (PD) ≥ 4mm at baseline, mean PD was reduced (baseline: 5.94 ± 1.80; follow-up: 2.76 ± 1.38), as well as mean clinical attachment loss (baseline: 5.55 ± 1.51; follow-up: 4.52 ± 1.47). Periodontal disease was controlled and there was no recurrence of gingival overgrowth after 18 months of follow-up. **Conclusion**: The management of the reported patient with CKD and periodontal involvement included discontinuation of amlodipine, basic and advanced periodontal therapy and gingivectomy. Proper oral hygiene may help to prevent recurrence of the gingival overgrowth and to maintain periodontal health.

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INTRODUCTION

Chronic kidney disease (CKD) is an abnormality of the kidney structure or function for more than three months, being considered a risk factor for premature death. There is an increasing prevalence of CKD due to the growth of the elderly population and the increasing rates of diabetes mellitus and hypertension.[1] Patients with chronic renal failure may require special dental care, since oral involvement of patients with CKD include oral manifestations of the disease itself, or side effects of its treatment. The most frequent oral manifestations of patients with CKD are pale mucosa, low salivary flow rates, altered salivary composition, dysgeusia, halitosis, increased dental calculus formation, uremic stomatitis, and osteodystrophia.[2,3]

CKD and periodontitis have common risk factors, such as smoking and diabetes mellitus.[4,5] The association between both diseases has been increasingly recognized over the last decades.[5-7] The influence of periodontitis on CKD may be explained by the burden of systemic inflammatory mediators resulting from periodontal infection, which exacerbates the existing metabolic disorder. Then, it could be expected that non-surgical periodontal therapy might decrease the pro-inflammatory state.[8,9] However, there is insufficient evidence to assume a potential benefit of periodontal treatment on renal function in CKD patients with periodontitis.[5,7] Although inconclusive, the opposite direction has also been investigated: CKD influencing the onset and/or progression of periodontal disease, possibly mediated by diabetes and hypertension.[6,10]

Gingival overgrowth may be a side effect of drugs used in patients with CKD, including calcium channel blockers, like amlodipine, to treat hypertension, and cyclosporine, an immunosuppressant commonly used in kidney transplantation recipients. The gingival overgrowth may hamper satisfactory oral hygiene, which complicates the periodontal condition [(11)].

Dentists need to know how to manage patients with kidney impairment during dental treatment.[12] The use of anticoagulant drugs and increased risk of bleeding should be investigated prior to oral invasive procedures. Prescription of drugs with renal metabolism may require adjustment of the dosage, mainly for patients under hemodialysis.[4]

The aim of this manuscript was to report the periodontal treatment approach of a patient with chronic renal disease, who presented generalized periodontitis and localized gingival enlargement associated to amlodipine.

CASE REPORT

A 55-year-old male with a history of CKD and severe hypertension was referred for dental treatment at the Periodontology Division of the Naval Dental Center (*Odontoclínica Central da Marinha/OCM*), Rio de Janeiro, Brazil, from the Nephrologist Division of the Hospital Naval Marcílio Dias, in October 2017. Patient complained of tooth mobility, changes in teeth position and gingival pain and bleeding. Anamnesis has revealed that the patient was not under dialysis, at that moment. Laboratory test results showed creatinine levels varying from 5.0 to 6.0 mg/dL, in the last four years. Intake of medications included losartan, furosemide, calcium carbonate, simvastatin, allopurinol, vitamin D and amlodipine. He had no history of smoking or alcohol use. He reported that kidney impairment was a result of 20 years with hypertension and no adherence to treatment.

During oral exam, an extensive mass was observed in the region of the inferior labial gingiva, measuring nearly 8 cm in diameter, presenting pinkish to reddish color, of soft consistency, with few superficial ulcerations on the surface, and bleeding on touch (Figure 1A). Biofilm accumulation was observed in the area, since the gingival overgrowth represented a challenge for oral hygiene. There were deep periodontal pockets in the region. The mass appeared to be a benign soft tissue lesion, with clinical aspect aggravated by biofilm accumulation. The differential diagnoses were gingival overgrowth attributed to the amlodipine, pyogenic granuloma, giant cell granuloma, and brown tumor of hyperparathyroidism. On radiographic evaluation, signs of bone involvement were observed (Figure 1B).

Periodontal parameters such as probing depth (PD) and clinical attachment level (CAL) were measured at six sites (mesial, distal, and middle sites of the buccal and lingual sides) on each tooth, using a North Caroline periodontal probe (Hu-Friedy®, USA). Additional assessment of periodontal status included the presence of bleeding on probing (BOP). Out of 138 evaluated periodontal sites at baseline, PD and CAL equal or higher than 4mm were observed in 49 (35.5%) and 51(36.9%) sites, respectively, and BOP was present in 61% of the sites. Periodontal exam revealed periodontitis stage IV, which is the most severe stage of periodontitis.

The evaluation of the panoramic radiography revealed the absence of teeth 26, 36 and 46; tooth 16 endodontically treated; and, multiple teeth with restorations. Vertical bone loss, extending to the apical third, compatible with advanced stage periodontal disease was also observed. The region adjacent to teeth 18, 17, 28 and 45, which presented clinically high level of mobility, showed imaging suggesting periapical lesions, therefore were referred to surgical extractions. Loss of lamina dura was identified

around some of the roots. No root resorption and cortical or medullary bone resorption were observed.

The objective of the treatment was to improve oral health by removing the gingival overgrowth, controlling periodontal disease. and enhancing oral selfcare. This way, treatment planning included oral hygiene instruction, periodontal therapy and gingivectomy. Discontinuation of causative medication was discussed with nephrologist, and amlodipine was interrupted in October 2017.

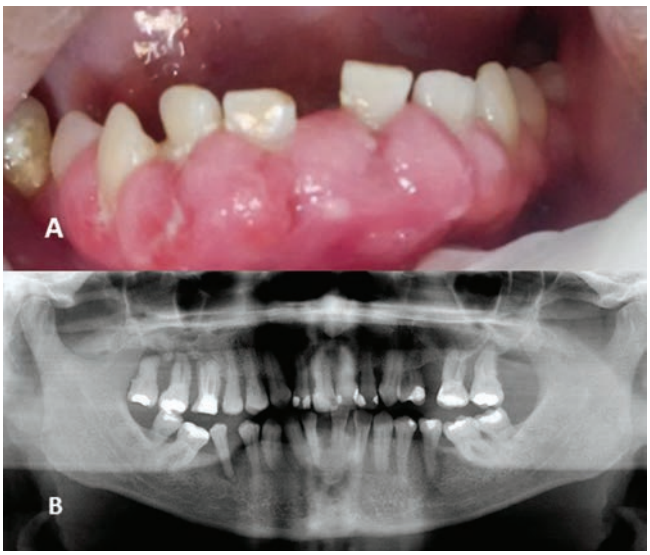

***Figure 1**: (A) Clinical aspect of gingival overgrowth; and (B) Panoramic image showing severe and generalized alveolar bone loss at baseline (October 2017).*

Two sessions of oral hygiene instruction and basic periodontal therapy were conducted by an oral hygienist. The need of an accurate self-oral hygiene was stressed, including the use of interdental brushes. Scaling and root planing, were performed by a periodontist, in four sessions of conventional therapy. Mouthwashes with 0.12% chlorhexidine were recommended every 12 hours for 15 days. At follow up examination, patient presented adequate oral hygiene, and periodontal therapy was completed in April 2018.

Although notably reduced, the gingival overgrowth was not completely eliminated after periodontal scaling. Patient was then scheduled for surgical periodontal treatment and gingivectomy (Figure 2). Before surgery, a complete hemogram, glicosis and creatinine levels were checked. His nephrologist was contacted, to confirm that the patient was able to receive an invasive oral procedure at that moment.

Surgical removal of the gingival overgrowth was planned not only for cosmetic, but also for functional reasons, as the lesion formed niches for the retention of bacterial biofilm and hampered patient's mastication. The surgical removal was performed on the lower anterior teeth region, through an internal bevel incision (Figure 2). A full-thickness flap was lifted and the flap was thinned with scissors. During surgical procedure, scaling and root planning were performed for removal of subgingival biofilm and calculus. Simple interrupted sutures were performed with 5.0 nylon thread.

***Figure 2**: Gingivectomy procedure (April 2018).*

Amoxicilin 500 mg was prescribed every 8 hours, for the seven days after surgery. Additionally, dipiron 500mg was prescribed for pain relief, every 6 hours, for the first three days, if necessary. Patient was also instructed to rinse with 0.12% chlorhexidine twice a day, for 15 days. Excised gingiva tissue was sent for histopathological analysis, and diagnosed as inflammatory gingival hyperplasia. The postoperative clinical aspect at 15-day showed a satisfactory result (Figure 3).

***Figure 3:** Fifteen days postoperative (May 2018).*

Patient did not attend the next scheduled follow-up dental visits. He came back to the clinic only one and a half year later, when he presented an acceptable oral hygiene pattern. There was BOP in 25% of the teeth and the periodontal disease was controlled (Figure 4). Data from mean PD and CAL comparing baseline with follow-up are shown in Table 1.

In the meanwhile, he was been treated by an orthodontist, and he was wearing an orthodontic appliance, since he complained about the changes in teeth position, due to advanced periodontal disease. His systemic condition had worsened, and presented 11.2 mg/dL serum creatinine. The medications in use were losartan, furosemide, calcium carbonate, simvastatin, allopurinol and vitamin D, and erythropoietin. Amlodipine was suspended. He was now on hemodialysis and referred to kidney transplantation by the nephrologist.

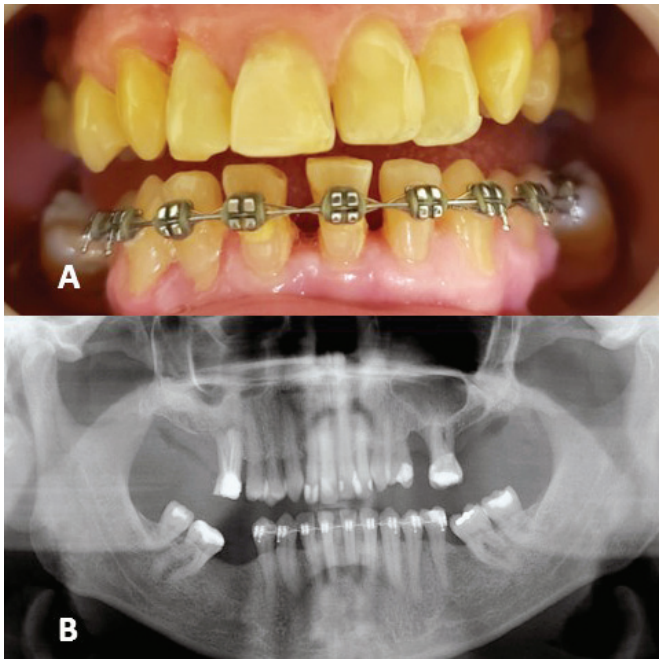

***Figure 4**: Clinical aspect at 18 months from periodontal therapy and gingivectomy (A); and follow-up panoramic image (B), (November 2019).*

***Table 1:** Data on probing depth and clinical attachment loss at baseline and follow-up.*

Periodontal parameter	PD		CAL	
	baseline	follow-up	baseline	follow-up
All sites (n=138)	3.38 (2.25)	2.13 (1.16)	3.43 (1.93)	3.09 (1.16)
sites ≥ 4mm *	5.94 (1.80)	2.76 (1.38)	5.55 (1.51)	4.52 (1.47)

*Notes: * sites ≥ 4mm: n= 49 for PD and n=52 for CAL. CAL: clinical attachment loss; PD: probing depth. Data presented by mean (standard deviation).*

DISCUSSION

It is estimated that 90% of patients with chronic kidney disease will have oral symptoms, either related to the disease or to its treatment. Periodontal disease is prevalent, severe, and under-recognized in patients with renal failure. Patients should be followed by a multiprofessional healthcare team and early oral exams should be reinforced.[13] This case report showed a successful periodontal approach of a male patient with CKD who presented periodontitis and amlodipine-induced gingival overgrowth. Males were considered three times as more than females to develop clinically significant overgrowth.[14]

Proposed mechanism connecting periodontitis with chronic kidney disease (CKD) involves systemic inflammation.[10] It is possible that CKD may influence the onset or progression of periodontal disease, possibly mediated by diabetes and hypertension. On the other direction, inflammatory cytokines involved in periodontitis may lead to the progression of CKD. Another theory suggests that periodontal bacteria enter the systemic circulation and exert their effects beyond the periodontium.[8,9] Reducing inflammation and bacterial load by periodontal treatment seem to improve kidney function, but further studies are necessary to determine whether prevention or treatment of periodontitis reduces the incidence or the severity of CKD.[5,7]

This case report study presented a patient with periodontitis stage IV grade C. At this advanced stage, periodontitis causes considerable damage to the periodontal support and may cause significant tooth loss, which implies in loss of masticatory function. Lack of control of the periodontitis and adequate rehabilitation, may lead to tooth loss. In fact, four teeth were lost in the beginning of periodontal treatment in the reported case.[15,16] There was a notable shift in periodontal parameters after non-surgical periodontal therapy, as shown by the reduction in means of PD and CAL. Other authors have stated that non-surgical periodontal therapy can effectively improve periodontal status in patients on end-stage renal disease. It is a relatively simple intervention, which has showed improved systemic effects in this population.[8] However, the improvement of the periodontal condition of the reported patient did not present a positive impact on the progression of CKD.

The patient of this case report presented a 20 years

history of hypertension, with no adherence to treatment. Hypertension and dyslipidemia may account to poor periodontal condition. In hypertension, changes in microcirculation can cause ischemia in the periodontium, which favors periodontal disease[17]. There might also be an interaction between periodontitis and hypertension, with the underlying inflammatory process interfering with the endothelial function. This could have implications for blood pressure control and the development of lesions in target organs.[17] Simvastatin intake, used to control dyslipidemia, was also reported by the patient. Periodontitis may be associated with dyslipidemia via systemic inflammation.[18] In the other direction, many cytokines released in periodontitis may stimulate hepatic free fatty acid synthesis, resulting in increased synthesis of very low-density lipoprotein and hypertriglyceridemia.[18]

Studies have reported that the use of calcium channel blockers, like amlodipine, may contribute to gingival overgrowth. Large deposit of gingival biofilm and calculus were observed in the reported patient at baseline, which may have led not only to the gingival overgrowth, but to periodontitis progression. Proper oral hygiene can help to prevent progression of medication induced gingival overgrowth, but does not resolve the condition in many cases.[19] The presence of gingival inflammation is an important cofactor for the expression of this effect.[14]

Individuals and healthcare professionals play important roles for the long-term success of periodontal treatment.[20] The reported patient presented 21% of BOP when he returned one and a half year later, comparing to 61% at baseline. Bleeding on probing should be the primary parameter to set thresholds for gingivitis. This emphasizes the need for a more comprehensive maintenance and surveillance of the successfully treated patient with periodontitis. A patient with gingivitis can revert to a state of health, but a patient with periodontitis requires life long supportive care to prevent recurrence of disease.[16]

Improved patient self-care leading to reduction of dental biofilm is one of the main aims for maintaining periodontal health. Although the patient did not attend the scheduled dental visits for one and a half year, the long-term success of the periodontal therapy relied on the patient, who was able to adequately perform oral hygiene. Therefore, it is emphasized that the contribution of the patient to the control of periodontal disease through improved oral self-care on a daily basis, is of paramount importance.[20]

It is worthy to mention that the management of the nephropathic patient requires cooperation amongst the heathcare team. Communication with the nephrologist, as reported, is advisable specially in cases when an invasive oral procedure needs to be performed.

In conclusion, the present case report highlights the importance of individualized oral care for patients with CKD. Health care professionals need to be aware of the oral features related to CKD, and patients should always be referred to dentists for oral evaluation.

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MINIMALLY INVASIVE AESTHETIC TREATMENT OF WHITE SPOTS BY DENTAL FLUOROSIS IN CHILDREN: CASE REPORT

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Palavras-chave: Fluorose Dentária. Microabrasão do Esmalte. Clareamento Dental.

RESUMO

Introdução: A presença de manchas brancas por fluorose dentária pode causar desconforto estético, sendo um dos fatores para busca de tratamento odontológico. **Objetivo:** Relatar um caso clínico em que a queixa estética foi resolvida através da associação do clareamento dentário à técnica de microabrasão. **Relato do caso:** Paciente do sexo masculino, 13 anos, compareceu a Clínica Integrada da Faculdade de Odontologia da UFRJ, com fluorose, principalmente nos dentes ântero-superiores e queixa estética. Inicialmente, realizou-se clareamento imediato com peróxido de hidrogênio a 35%, em 3 sessões de 15 minutos, para suavizar a disparidade de tons entre mancha-dente. O resultado obtido foi insuficiente e a técnica de microabrasão dentária foi adotada. Uma pasta de pedra pomes foi aplicada juntamente com gel de ácido fosfórico a 37% sob isolamento relativo, perfazendo um total de 8 aplicações (1 minuto cada). Ao final de cada aplicação, foi realizada lavagem abundante com água, polimento com disco de granulação fina montado em micromotor e aplicação tópica de NaF2 neutro em gel (4 minutos cada aplicação) para eliminar possível sensibilidade pós-operatória. **Conclusão:** O clareamento dentário e a técnica de microabrasão promoveram resultados clínicos imediatos satisfatórios que elevaram a autoestima do paciente, de maneira minimamente invasiva para estrutura dentária.

Keywords: Fluorosis, dental. Enamel Microabrasion. Tooth Bleaching.

ABSTRACT

I**ntroduction**: The presence of white spots due to dental fluorosis can cause aesthetic discomfort, being one of the factors for a search for dental treatment. **Objective**: Report a clinical case in which the aesthetic complaint was solved through the association of the dental bleaching to the microabrasion technique. **Case report:** Male patient, 13 years, attended to the Integrated Clinic of the School of Dentistry of the Federal University of Rio de Janeiro, with fluorosis, mainly in the antero-superior teeth and aesthetic complaint. Initially, it was made an immediate bleaching with hydrogen peroxide at 35%, in 3 sessions of 15 minutes each, to soften the disparity of shades between tooth-stain. The result was insufficient and the dental microabrasion technique was adopted. A pumice paste was applied together with gel of phosphoric acid at 37% under relative isolation, in a total of 8 applications (1 minute each). At the end of each application, it was made an abundant water washing, microengine mounted fine-grained disc polishing and topical application of neutral NaF2 in gel (4 minutes each application) to eliminate possible postoperative sensitivity. **Conclusion:** The dental bleaching and the microabrasion technique promoted satisfactory immediate clinical results that increased self-esteem of the patient in a minimally invasive way to dental structure.

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INTRODUCTION

Dental stains, irregularities on the enamel surface and unwanted coloring are clinical conditions that interfere in the smile aesthetics, which can be solved by obtaining clear, aligned teeth with defined anatomical shapes.[1] In this context, the search for aesthetic treatments has increased in all areas of Dentistry. Therefore, researchers are encouraged to develop and qualify materials and techniques for removal of stains and irregularities on the dental surface to achieve satisfactory aesthetics.[1]

Dental fluorosis is clinically characterized by changes in the enamel color, like whitish streaks crossing the tooth surface, opaque white spots and brownish spots to areas where the enamel is intensely hypomineralized, at risk of even rupture.[2] Besides that, has different degrees of severity and the clinical aspect determines the type of treatment to be performed. Thus, the dental microabrasion technique is a conservative therapeutic procedure indicated in cases of mild and moderate fluorosis, however restorative treatments are necessary when there is loss of structure or in extremely unpleasant aesthetic situations.[2]

Aiming to remove these color changes, acids, in different concentrations, the technique known as microabrasion of the dental enamel is used. It is an effective and low-cost alternative for treatment of the surface stains because it allows the problem to be solved with minimal wear on the dental structure.[2]

Therefore, the objective of this paper is report a clinical case in which the aesthetic complaint was solved through the association of the dental bleaching to the microabrasion technique.

CASE REPORT

Male patient, 13 years, attended to the Integrated Clinic of the School of Dentistry of the Universidade Federal do Rio de Janeiro (UFRJ), with his mother, with aesthetic complaint of teeth. Informed consent form signed by the patient's guardian and after clinical examination, it was noted whitish spots on the dental surface, especially on the anterior superior teeth, characterizing the fluorosis (Figure 1). The characterization of the degree of fluorosis presented by the patient was based on the Thylstrup and Fejerskov[3] (TF) index, being defined as TF = 4 (surface exhibits marked opacity or appears chalky white).

Initially, it was applied gingival barrier of light-curing resin (Top Dam, FGM Produtos Odontológicos- SC - Brazil) (Figure 2A) and, next, it was made an immediate bleaching with hydrogen peroxide at 35%[4] (Whiteness HP, FGM Produtos Odontológicos - SC - Brazil), in 3 session of 15 minutes each, to soften the disparity of shades between tooth-stain. The result obtained was insufficient (Figure 2B) and the dental microabrasion technique was applied.

Thus, aiming at a conservative and minimally invasive approach, the treatment chosen was the use of the microabrasion technique, from the handling and application of a phosphoric acid-based paste at 37% (Condac, FGM Produtos Odontológicos - SC – Brazil) mixed with pumice (SS White – RJ - Brazil) of fine grain (Figure 3A), with the purpose to promote the removal of a thin layer of surface enamel safely and effectively in a total of 8 application of 1 minute each (Figure 3B), according to Powell & Craig protocol.[5]

At the end of each application (Figure 4A), it was made abundant water wash, fine-grained disc polishing (Microdont – SP - Brazil) assembled in microengine (KAVO do Brasil Industria e Comercio LTDA – RJ - Brazil) and topical application of neutral fluorine gel (NaF 2% - Nova DFL, Jacarepaguá-RJ, Brazil) during 4 minutes to eliminate possible postoperative sensitivity. The patient returned 2 years later for clinical follow-up and satisfactory aesthetic conditions were observed, performing only finishing and polishing the anterior superior teeth (Figure 4B).

Figure 1: *Initial photo of the smile.*

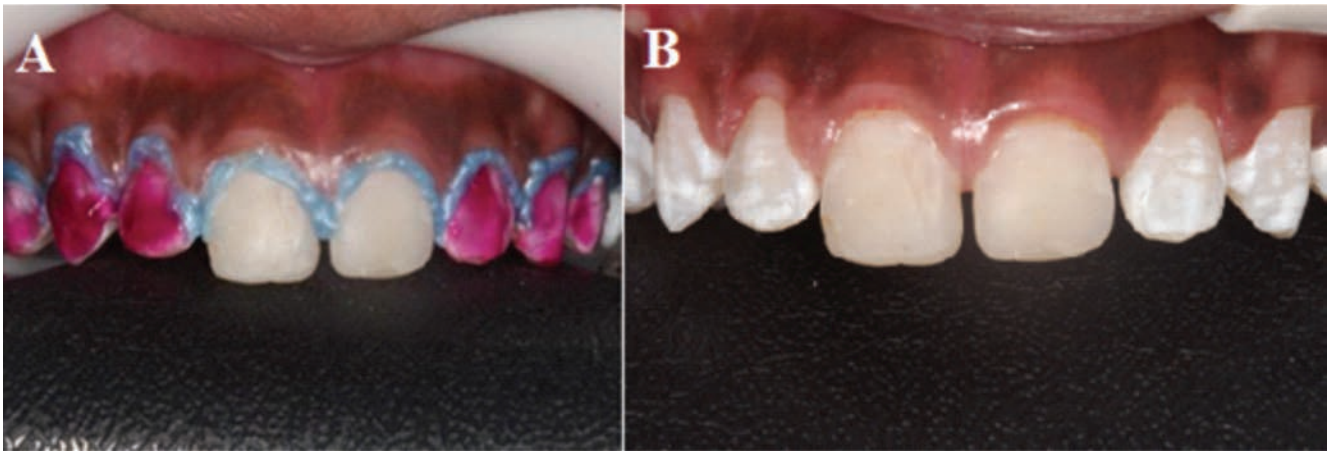

***Figure 2**: (A) Tooth whitening process; (B) Post whitening aspect.*

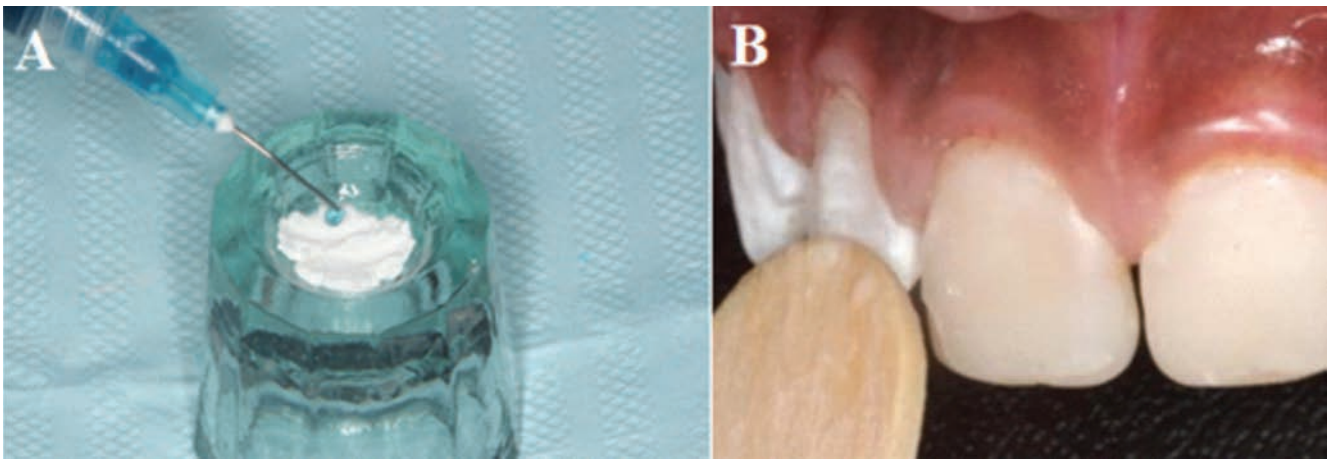

***Figure 3**: (A) Pumice stone with 37% phosphoric acid; (B) Handling with wooden spatula.*

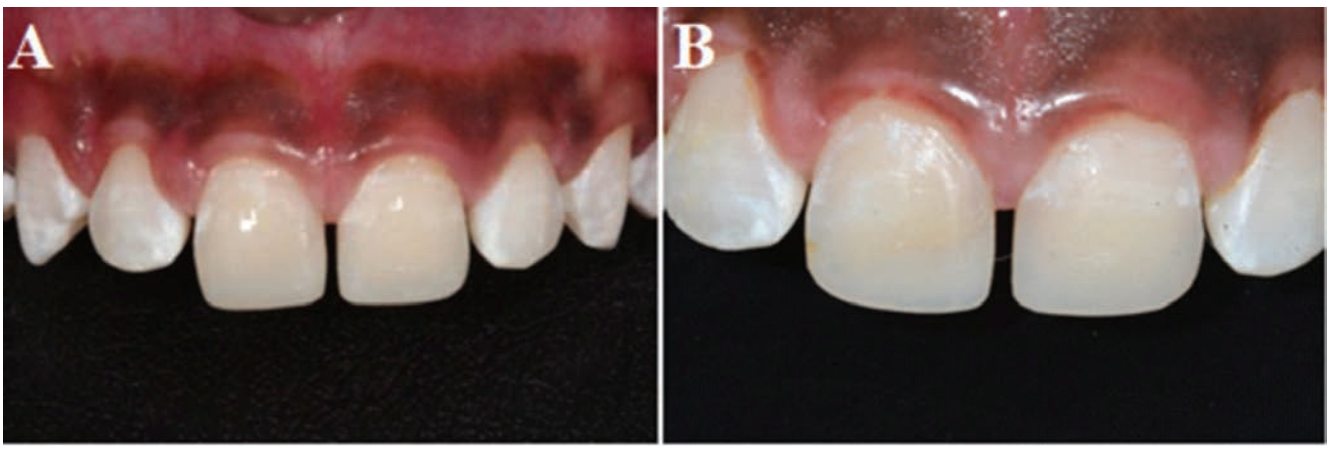

***Figure 4**: (A) Final aspect after microbrasion; (B) Follow-up after 2 years.*

DISCUSSION

Dental developmental defects are associated with intrinsic changes, and the pigment accumulation is related to extrinsic causes. Fluoride, incorporated into public water, table salt, vitamin supplements, toothpastes, mouthwashes and dental floss, is considered a key agent for the control of dental caries, and has been the subject of several researches due to its proven efficacy. However, the excessive accidental ingestion causes structural complications on the enamel surface and, in more severe cases, intoxication.[6]

The aesthetic solution of stains in the dental structure, in different colors, is one of the biggest challenges for the dentist due to the variation in etiology, extension and depth. Previously, these cases of changes in the structure and enamel color were fixed, mostly, by surface wear and restoration.[7]

Close clinical examination and anamnesis contributed to the final diagnosis of white spots suggestive of fluorosis in this clinical case, corroborating the reports of Wray *et al.*[8] about the need of a detailed anamnesis to do the treatment.

In this case report, the complaint of mother and son was associated with the improvement of the smile aesthetic. This way, after establishing the diagnosis and treatment plan, we chose the microabrasion associated with tooth whitening, since the patient had no structural defects in the enamel. The combination of the techniques reduced the stains with minimal loss of the tooth enamel, resulting in a uniform and shiny enamel surface, corroborating the clinical findings of Bussadori *et al.*[4]

In this case report, it was used the enamel microabrasion technique released by Croll & Cavanaugh[9], characterized by the joint action of an erosive agent (acid) and an abrasive agent (stone), showing a deeper layer of enamel with normal characteristics.

According to these surveys, Powell & Craig (1982)[5] reported a technique that was known to be simple, fast and safe since there was no use of caustic materials, and this protocol was adopted for this study. It was used phosphoric acid at 37%, and the stains could be removed in 2 sessions. The acid played a conditioning role. In the first session, it was made a cleaning with pumice and glycerine, application of the phosphoric acid at 37 % in the affected areas around 2 to 3 minutes, washing of the area and polishing with pumice and glycerine.

The hydrochloric acid aggressively wears out the tooth enamel, so it was chose the use of phosphoric acid, promoting a more selective wear, around 5.5 ìm in enamel, besides presenting lower volatility (gel).[10,11,12]

The short treatment time, safety, ease of execution, immediate result and low cost without causing damage to the pulp and periodontal tissues are factors that contribute to the use of dental bleaching and microabrasion (combined or not) by professionals, especially in Pediatric Dentistry, because it is a minimally invasive and conservative technique.[13] The study by Bussadori[4] and Bertassoni[14] states that the most conservative techniques, such as whitening and microabrasion, are used when the tooth has no cavitated or very deep lesions. The data in this case report corroborate with these authors who reported that tooth whitening with 35% hydrogen peroxide can be performed before dental microabrasion, enabling favorable aesthetic results.[15] In this sense, other studies report that the use of tooth whitening with 35% carbamide peroxide as an aesthetic treatment for dental fluorosis in children and adolescents is an effective method that does not cause irreversible damage to the tooth structure, when the dentist has time control and follows the protocol correctly.[16,17,18,19]

Due to the greater depth of the spots that the canines had, it was decided to carry out only two microabrasion sessions in order to avoid any type of damage to the enamel, especially cavitation. As the final aesthetic result was satisfactory, a third session of microabrasion was spared in these elements. The harmonic aesthetic result lasted in the post-treatment. This fact was observed in the follow-up after 2 years of the initial treatment.

As final stage, the subsequent polishing of the dental surfaces was made to maintain the aesthetics and to avoid optical change of the surface, since procedures with acids cause dental dehydration.[19]

CONCLUSION

The correct diagnosis and the combination of techniques enabled an effective aesthetic treatment with satisfactory results, minimally invasive for dental structure.

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ANTERIOR OPEN BITE TREATED WITH PALATINE CRIB: A CASE REPORT WITH CEPHALOMETRIC, SPEECH AND ELECTROMYOGRAPHY ANALYSES

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Palavras-chave: Mordida Aberta. Ortodontia Interceptativa. Fala. Eletromiografia.

RESUMO

Objetivo: Este relato de caso descreve um tratamento interceptivo da mordida aberta anterior (MAA) com grade palatina fixa usando dados clínicos, cefalométricos, eletromiográficos e de fala. **Relato do caso:** Menina de 8 anos de idade apresentando maloclusão Classe I de Angle e MAA. A documentação ortodôntica completa foi obtida e os músculos periorais foram avaliados pela eletromiografia durante as atividades de sopro, sucção e sorriso, antes e após o tratamento. A avaliação acústica da fala foi realizada através das frequências dos formantes para avaliar a posição da língua. **Resultados:** O MAA foi corrigida em seis meses com redução do transpasse vertical, diminuição dos ângulos cefalométricos 1: NA e 1: NB e aumento do ângulo interincisivo. Durante o movimento do sorriso, foi possível observar a diminuição da atividade muscular do músculo orbicular superior e o aumento da atividade muscular do orbicular inferior. No movimento do sopro, houve uma tendência a diminuir a atividade muscular. Direções opostas foram observadas no momento da instalação da grade nas frequências dos formantes. Quando a grade foi removida, a língua foi abaixada e posteriorizada em relação ao tempo de instalação inicial do aparelho. Quando comparados os momentos final e inicial, observou-se predomínio da posição inferior da língua, além de posteriorização em algumas vogais e anteriorização em outras. **Conclusão:** Após o uso da grade palatina fixa como tratamento interceptivo para a MAA, a mordida foi fechada e foi possível observar harmonia no perfil da paciente e melhora da musculatura periorbital e posicionamento da língua.

Keywords: Open Bite. Interceptive Orthodontics. Speech. Electromyography.

ABSTRACT

Objective: This case report describes an interceptive treatment of anterior open bite (AOB) with fixed palatine grid using clinical, cephalometric, electromyographic and speech analysis data. **Case report**: An 8-year-old girl, Angle Class I malocclusion presenting AOB. The complete orthodontic documentation was obtained and the perioral muscles were evaluated using the electromyography during blowing, sucking and smiling activities, before and after treatment. Speech acoustic evaluation was performed through the frequencies of the formants to assess the position of the tongue. **Results**: The AOB was corrected in six months with reduction of vertical transpass, decrease of cephalometric Angles 1: NA and 1: NB and increase of interincisal angle. During the smile movement, it was possible to observe the decrease of the muscular activity of the superior orbicularis muscle and the increase of the muscular activity of the inferior orbicularis. In the blow movement, there was a tendency to decrease muscle activity. Opposite directions were observed at the time of installation of the grid in the frequencies of the formants. When the grid was removed, the tongue was lowered and posteriorized in relation to the installation time. When compared the final and initial moments, it was noted a predominance of tongue lower position, besides posteriorization in some vowels and anteriorization in others. **Conclusion**: After the use of the fixed palatine crib as an interceptive treatment for AOB, the bite was closed and it was possible to observe an harmony in the patient profile and improvement in periorbital musculature and tongue positioning.

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INTRODUCTION

The anterior open bite (AOB) is characterized by the lack of vertical contact between upper and lower front teeth and it is one of the malocclusions with the greatest aesthetic and functional influence.[1,2] Its prevalence is associated with age and ethnicity[2] and, in the primary dentition it occurs from 31.1% to 36.8%.[3] It is also reported that the prevalence of the AOB reduces in the mixed dentition (13.5%-18.6%).[2]

This type of malocclusion is usually caused by habits such as sucking finger, low tongue posture or tongue/lip thrusting (during speech or swallowing) and these habits are commonly associated with relapses after the treatment of AOB.[4,5] It is known that is important to interrupt the negative habit so the correction of AOB may happen spontaneously if the patient has a good facial growth patter[2] once soft tissue pressure is a factor that influences craniofacial growth and development.[6] Furthermore, it is related that early treatment of AOB increases the stability of morphologic correction.[7]

The speech acoustic evaluation includes consonants and vowels, however, this analysis is commonly used for vowels, as observed in some studies[8,9,10] The articulation of the consonants can be directly affected by orthodontic appliances and it may cause some estimation errors, thus, it is not common when compared to the vowels analysis.[10]

One of the most common appliance used for the treatment of AOB is the palatal crib and it works as an obstacle to the fingers when non-nutritive sucking occurs and maintains the tongue in a better position when problems with tongue posture is present, preventing its interposition between the incisors.[11] Thus, the aim of this work is to report the case of one patient diagnosed with AOB and treated with a fixed palatine crib and, besides that, show a more detailed evaluation of the functional aspects of speech and muscle activity.

CASE REPORT

Diagnosis and aetiology

A 8-year-old girl was referred to the Orthodontic Clinic at the Federal University of Rio de Janeiro, Brazil, for orthodontic treatment due to the patient presented AOB. The mother reported that the patient had digital sucking habit. In order to make it possible to publish this case report, it was approved by the Research Ethics Committee of the Research Institute and Collective Health of the Federal University of Rio de Janeiro, under the number N062011N282010.

A clinical evaluation revealed that the patient was in mixed dentition, Angle Class I malocclusion, negative overbite (-5.5mm) besides inadequate phonation and lingual interposition. The patient also presented a slight unilateral crossbite (top-to-top bite) due to transverse maxilla deficiency caused by the digital sucking habit and the wrong tong position.

The orthodontic documentation was composed by extra-oral clinical photographs (front rest, front smile and profile) (Figure 1; A and B) and intra-oral (front, right lateral, left lateral, upper occlusal and lower occlusal) (Figure 1 C); study casts and cephalograms (Figure 2).

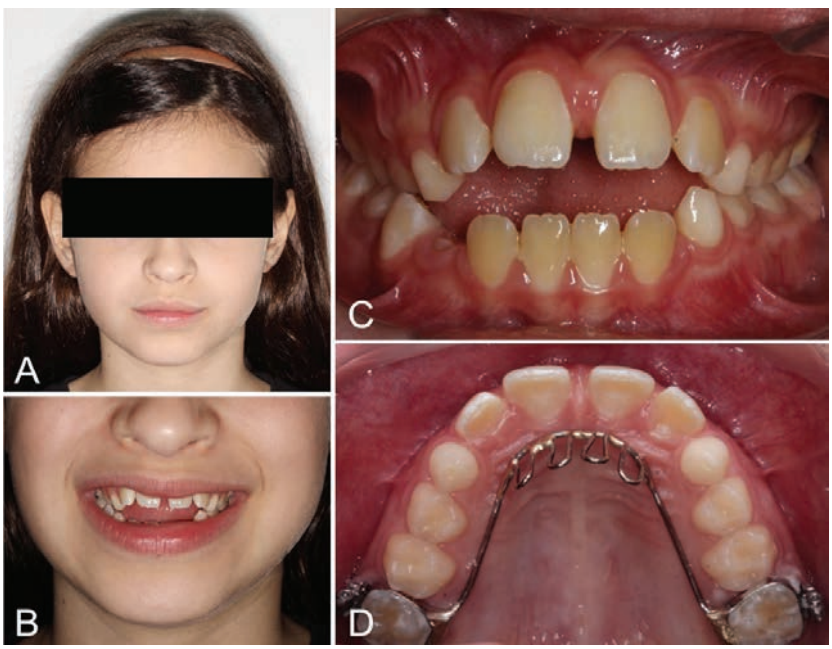

***Figure 1**: Facial initial aspect (A and B), malocclusion (C) and the palatal grid installed to interrupt parafunctional habit (D).*

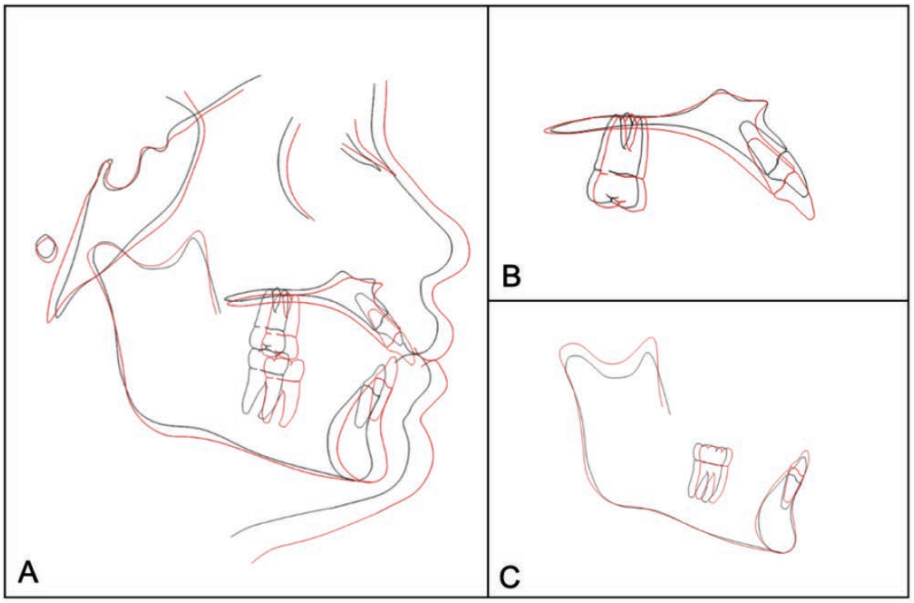

***Figure 2**: Superimposition of the initial cephalometric tracings (black) and one year after malocclusion correction (red). It is possible to observe the bite closure and facial growth (A), and, the dental effects of extrusion caused by the interruption of the habit on the upper (B) and lower (C) incisors.*

***Figure 3**: Extraoral and intraoral characteristics immediately after malocclusion correction (A.1, A.2 and A.3) and one year after removing the fixed palatal grid (B.1, B.2 and B.3).*

Treatment Plan

The treatment plan was: 1) To help interrupt lingual interposition and digital suctioning habits a fixed palatal grid was installed in the upper arch made with 0.8 wire (Morelli, Sorocaba, SP, Brazil) fixed in bands (American Orthodontics, USA) in the first permanent molars. This stage lasted six months until the overbite was positive in both patients. 3) The fixed palatal grid was removed after three months under clinical evaluation since it was found that the treatment results were stable. 4) One year after the retention stage the patient returned for follow-up (Figure 3) and new radiographic, electromyography and speech examinations were performed. It is important to mention the multidisciplinary approach of this case, the patient underwent regular speech therapy in a private office before, during and after all orthodontic treatment.

***Table 1**: Frequencies means (M) and standard deviations (SD) of the first and second portuguese formants (F_1 and F_2) in three moments of evaluation (M0, M1 and M2).*

Parameters		Initial Evaluation (M0)		Evaluation after the appliance installation (M1)		Evaluation after appliance removal (M2)	
		Frequencies (Hz)	(±SD)	Frequencies (Hz)	(±SD)	Frequencies (Hz)	(±SD)
[a]	F1 (Hz)	786	53.74	993	11.58	933	9.83
	F2 (Hz)	1589	58.53	1780	115.00	1813	35.32
[ɛ]	F1 (Hz)	716	21.65	664	28.56	732	33.40
	F2 (Hz)	2240	127.74	2560	27.32	2583	101.23
[e]	F1 Hz)	400	29.71	342	15.10	496	14.08
	F2 (Hz)	2821	79.88	2618	96.93	2755	29.40
[i]	F1 (Hz)	414	21.69	513	44.00	332	3.00
	F2 (Hz)	3083	105.64	2323	230.76	3268	23.47
[ɔ]	F1 (Hz)	739	34.63	737	12.69	787	51.49
	F2 (Hz)	1085	26.80	1176	27.08	1043	50.83
[o]	F1 (Hz)	578	26.11	436	39.76	467	46.38
	F2 (Hz)	1214	104.81	781	11.27	995	97.40
[u]	F1 (Hz)	488	47.23	633	22.37	340	33.12
	F2 (Hz)	927	72.00	891	34.29	854	77.91

***Table 2**: Electromyographic results before and after treatment.*

	SMILING				**BLOWING**				**SUCKING**			
	***SO**		***IO**		**SO**		**IO**		**SO**		**IO**	
	I	**F**	**I**	**F**	**I**	**F**	**I**	**F**	**I**	**F**	**I**	**F**
***RMS**	50.3	30.6	94.5	132	54.2	78.3	78.9	116	108	64.8	79.4	38.6
Max. Value	233	209	802	788	233	551	336	556	690	380	690	189
Min. Value	-192	-197	-648	-653	-206	-431	-429	-563	-648	-326	-648	-238

*Note: * RMS: root mean square; SO: superior orbicular muscle; IO: inferior orbicular muscle; I: inicial; F: final.*

***Table 3**: Cephalometric angle measurements before and after treatment.*

CEPHALOMETRIC MEASUREMENTS	NORMAL VALUE	INICIAL VALUE	FINAL VALUE
1:NA	22°	39.3°	36.2°
1:NB	25°	34.2°	32.8°
1:1	131°	105.7°	123°
GoGn:SN	32°	30.5°	27.7°

Orthodontic documentation and complementary exams

Cephalometric Analysis

Cephalograms were requested to verify if there were skeletal factors involved with the AOP. To analyse this, the GoGN-SN angle was evaluated to verify the vertical and horizontal growth pattern of the patient. It was found that the patient presented a horizontal growth pattern (GoGn-SN angle near the normal value of 32°), thus, the open bite was caused only by the habit of digital suction, atypical phonation and lingual interposition. Through the cephalograms it was also possible to observe the influence of dental positioning on the establishment of the AOB since angular values (1NA, 1NB and 1: 1) were accentuated showing an exaggerated buccal tipping.

Electromyographic Evaluation

To complement the clinical examination, myoelectric activity evaluation of the perioral muscles during the smile, blowing and sucking (upper and lower orbicularis) was performed to verify the influence of muscle activity on this malocclusion. EMG System® electromyography EMG 500 model with 4 channels for EMG was used. To standardize the capture of EMG data, the patient was asked to make the movements of smiling and blowing for 10 seconds, and, for the suction movement, the patient sucked 100ml of water using a straw. The electromyography was connected to a portable computer that provided the graphic image of the EMG signal being possible analysis the RMS value (root mean square value or root mean square value, which corresponds to a measure derived from the amplitude of the EMG signal).

Speech Analysis

The acoustic evaluation of formats frequencies was performed to infer the tongue position and it was based on methodology described by Viegas.[9] Phonatory samples were recorded in a quiet room using the open-source software Praat, version 6.0.16 (P. Boresma and D. Weenink, University of Amsterdam, Netherlands, available at http://www.fon.hum.uva.nl/praat/), in mono channel, with a sampling rate of 22.050 Hz and in "wav" format. An HP notebook computer (Hewlett-Packard, USA) with a Windows 10 operating system and a Shure microphone, model SM 58 (Shure, USA), placed at a distance of 10cm from the lips of the patient, were used for the recordings.

To record the speech signals, the patient was asked to say a carrier phrase ("Say ___ for me") that was filled with the words "pápa", "pépe", "pêpe", "pípi", "pópo", "pôpo", and "púpu". Then, segments of the seven tonic vowels were selected from the broadband spectrograms, choosing the best-defined sections of the formant spectrograms and extracting 10ms of the intermediate section of each vowel. Two measurements of each parameter were estimated and the mean of these values was extracted at the end.

Treatment Results

The results between the initial and final exams (clinical examination, cephalograms, electromyography and speech) can be observed on Figures 1, 2, 3 and Tables 1, 2 and 3. The use of the fixed palatal grid in this treatment was effective and provided the correct tongue positioning, causing correct repositioning of the upper and lower incisors, leading to the correction of the AOB. The correct tongue position also provided the correction of the posterior crossbite as it was slight unilateral crossbite (top-to-top bite).

DISCUSSION

A comparative study using cephalograms of the patients with and without AOB shows that the inclination angles of the upper and lower incisors (1.1, 1.NA and 1.NB) differ statistically between patients with AOB and patients with normal occlusion[12] and these results are in agreement with the findings obtained in this case report (Table 3).

The AOB can be classified as dental or skeletal, and it requires the correct diagnosis so the treatment plan may be effective and successful [13] shows the importance of cephalograms as a tool for the correct diagnosis of open bite. In the cephalometric measures of the patient (Table 3) it was possible to observe the improvement in the positioning of the upper and lower incisors, reducing buccal tipping (1.1, 1.NA and 1.NB) comparing to the beginning of the treatment.

The lingual interposition may cause, among other problems, changes in speech. Researchers found alterations in several types of phonemes, but did not investigate the frequencies of the formants, so it makes impossible to compare with the present results.[14,15] In AOB cases it is also expected that the tongue tonicity reduce, since there is a tendency to lingual interposition in the anterior area where there is no occlusal contact.

The speech corresponds to the articulation of the voice sounds that are produced in the larynx and modified by the resonance cavities, such as the larynx, pharynx, mouth and nose. These cavities act as a filter, amplifying some frequency bands and damping others. The amplified bands are called frequencies of the formants, and the first two formants (F1 and F2) are the most studied. The frequency of the first formant (F1) is related to the posterior cavity (pharynx) behind the point of maximum lingual constriction, and is influenced by the vertical position of the tongue and

degree of mouth opening. This measure is inversely proportional to the height of the tongue position. The frequency of the second formant (F2) is associated to the anterior cavity (oral), lingual constriction and is influenced by the anteroposterior displacement of the tongue. The higher the frequency of F2, the more anterior will be the constriction of the tongue and the lower this value, the more posterior will be the positioning of the tongue during speech.[16,17]

When is compared the moment that the patient had the appliance installed (M1) with the initial (M0) it was possible to observe that the frequencies of the first formant (F1) were higher in the vowels [a], [i] and [u] (Table 1), and it allows to infer that after the installation of the orthodontic appliance, the tongue presented a lower position, the mandible more opened and there was more constriction of the pharynx when these vowels were spoken[16,17]. However, the vowels [ɛ], [e], [o] presented lower F1 frequencies in M1 (Table 1) than in the initial evaluation, demonstrating a higher tongue position, with a more closed mandible and less pharyngeal constriction.[16,17]The vowel [ɔ] in the two moments (Table 1) of evaluation presented close averages. In the frequencies of F2 (Table 1), higher values were observed for the three vowels [a], [ɛ] e [ɔ] when the appliance was installed (M1) when compared to the initial period (M0), demonstrating an anteriorization of the tongue. These opposite directions at the height of the tongue measured by F1 and anteriorization of the tongue in most vowels measured by F2 (Table 1) can be attributed to the difficulty of adapting the tongue to a new position shortly after the installation of the palatine crib.

When comparing the moments of installation (M1) and the removal of the orthodontic appliance (M2), it was observed that after removal, the tongue presented a lower position in the low and high medium vowels [ɛ], [e], [ɔ] and [o] (Table 1), demonstrated by the increase of F1,[16,17] which can be attributed to the removal of the mechanical barrier. In the anteroposterior direction, when the crib was removed (M2) the frequencies of F2 increased in five vowels [a],[ɛ],[e], [i] e [o] when compared to the moment of installation of the palatal grid (M1) (Table 1). It demonstrated that after removal of the appliance, the tongue presented an anterior posture during the moment of articulation of those vowels.[16,17]

When analysing the data of the initial moments (M0) and final (M2) it was noted that after removal of the palatine grid, four vowels ([a], [ɛ], [e], [ɔ]) presented a lower tongue position, demonstrated by an increase of frequencies of F1 (Table 1). In the horizontal direction, after removal of the crib (M2), posteriorization of the tongue was observed in the vowels [e], [T], [o] and [u] demonstrated by F2 lower values (Table 1).[16,17] The other vowels presented more anterior position of the tongue, which evidenced the need for speech therapy to adapt the tonicity and tongue posture to prevent alterations in dental occlusion after removal of the mechanical barrier.

With the data presented, the importance of the association of orthodontists and speech therapists is essential especially in malocclusions associated with deleterious habits, given that the function of orthodontic appliances is to change the shape of dental arches and prevent lingual interposition, while speech therapy will correct the position of the tongue and lips during swallowing, speech, chewing and usual position.[14]

Changes in the formants' frequencies were also reported in a longitudinal study in which the patients used upper and lower Hawley plaques. The authors observed distortions of the phonemes [s] and [z] in addition to increase of F1 and reduction of F2 in the vowel [i]. These changes were more evident after installation and especially after one week of use. After one month, and especially after the third month, the data were normal in most of the patients.[8] The data in the present study after installation of crib (M1), the tongue presented lower position (higher F1) and posteriorization of the tongue (lower F2) demonstrating, therefore, the same trend during the vowel emission of the vowel [i].

Electromyography is a very useful tool in the study of neuromuscular aspects of the masticatory system; however, in order to obtain a faithful electromyography record, it is imperative to use an adequate technique in order to minimize interference from the external environment.[18,19]

In the processing of the collected signal, the RMS was chosen. This form of analysis presents outstanding advantages, since it quantitatively expresses muscular electrical activity, with the realization of this calculation in a simplified way, through specific software.[19]

The present study demonstrated (Table 2) that the patient showed difference in electromyographic activity as a result of the palatine grid treatment and of the open bite correction, with lower electrical activity of the orbicular muscles after the bite closure during the smile and suction movements. This fact is probably related to the characteristics of this malocclusion, where vestibuloinfraversion of the incisors and negative vertical trespass are observed, which hamper the performance of the basic functions of the orbicularis muscles, generating the need for adaptations. The results obtained were in agreement with previous studies, where the authors observed that individuals with anterior open bite, expend greater effort of the perioral muscles to effect several movements, as well as presented smaller potentials of orbicularis muscle action of the mouth compared to those with occlusion normal.[20,21,22] Also, the correct tongue position also provided the correction of the posterior crossbite as it

was slight unilateral crossbite (top-to-top bite) Some studies[14,23] says that in some of these cases the interceptive approach solves, without the need for orthodontic treatment, if the habit is removed before the alveolar atresia occurs in the maxilla. Otherwise, the rapid expansion of the maxilla (REM), should be performed to correct transverse discrepancies of the upper arch of severe skeletal or dental origin. In our case report the slight unilateral crossbite (top-to-top bite) was solved only with de interceptive treatment which indicated that there wasn't any severe skeletal or dental transverse discrepancies.

The persistence of perioral muscle dysfunction pattern after orthodontic treatment may lead to recurrence. The imbalance of the perioral muscles represents an important factor of alteration of the morphology of the arches and the position of the teeth.[24]

CONCLUSION

Based on the results, it can be inferred that by the change in the upper and lower incisors inclination results in a tendency to improve the perioral musculature tone, the tongue positioning and, consequently, the improvement of speech.

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MULTIDISCIPLINARY CONSERVATIVE MANAGEMENT OF DENTAL FRACTURE IN YOUNG PATIENT: CASE REPORT

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Palavras-chave: Fraturas dos Dentes. Traumatismos Dentários. Tratamento Conservador. Restauração Dentária Permanente.

RESUMO

Introdução: O manejo de dentes permanentes fraturados por traumatismo dentário em pacientes jovens é desafiador e requer uma abordagem eficiente. **Objetivo:** Descrever o tratamento conservador e multidisciplinar em um caso de traumatismo dentário de um menino de 13 anos de idade. **Relato do caso:** Ao exame clínico foi verificada uma fratura de esmalte e dentina no incisivo central superior esquerdo e uma fratura complicada no incisivo lateral superior direito, com extensão subgengival da margem na face palatina, e não foram observados edema ou deslocamento dentário. Ao exame radiográfico, não foram verificadas alterações pulpares ou perirradiculares. Foi proposta realização de aumento da coroa clínica do incisivo lateral superior direito para posterior realização do tratamento endodôntico. Para os dois dentes traumatizados foi proposta a realização de restauração direta com resina composta, proporcionando um tratamento menos invasivo ao incisivo lateral superior direito, ao invés de submetê-lo a um tratamento protético, como a colocação de uma coroa total cerâmica, principalmente devido à pouca idade do paciente. Na visita de dois anos de acompanhamento, observou-se a manutenção da saúde dos tecidos periapicais e ausência de alterações clínicas. **Conclusão:** As restaurações se mantiveram em boas condições e a estética foi considerada satisfatória pelos profissionais, paciente e pais.

Keywords: Tooth Fractures. Tooth Injuries. Conservative Treatment. Dental Restoration Permanent.

ABSTRACT

Introduction: The management of fractured permanent teeth due to dental trauma in young patients is a challenge that requires an efficient approach. **Objective**: Describe a conservative and multidisciplinary treatment of a case of dental trauma in a 13 years-old boy. **Case report:** At clinical examination was verified enamel and dentin fracture in the left upper central incisor and a fracture with pulp exposure in the right upper lateral incisor, with subgingival extension of its margin at lingual surface, and no swelling or tooth displacement was observed. At radiographic evaluation, no pulp or periradicular disturbances were verified. It was proposed the surgical lengthening of the clinical crown of the right upper lateral incisor for later performing endodontic treatment. It was decided to make direct composite resin restorations in both fractured teeth, instead of doing a prosthetic treatment in the affected lateral incisor, such as the placement of a full ceramic crown, in an attempt to perform a less invasive treatment, mainly due to the age of the patient. At a two years follow-up visit was observed the maintenance of the health of periapical tissues and the absence of clinical alterations. **Conclusion:** The restorations were kept in good conditions and aesthetics was considered satisfactory by professionals, patient and parents.

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INTRODUCTION

Traumatic dental injuries are a public dental health problem worldwide and its prevalence among schoolchildren with 12 to 15 years old varies between 14.4% to 33.8%.[1] It is more prevalent in the permanent dentition[1] and the coronal fracture of maxillary anterior teeth can represent up to 22% of injuries to hard tissues, negatively affecting the health-related quality of life (OHRQoL) of children and adolescents,[2] while the restorative treatment of these injuries has a positive impact on the OHRQoL of these individuals.[3] This is mainly due to its anatomical characteristics and position in the dental arch.[4] Sport activities are the major cause related to its occurrence in the age group between 7 to 15 years[1] and children in mixed dentition period are considered a group at risk.[5]

The management of dental fractures is challenging, since the procedures should be directed to minimize undesired consequences,[1] requiring at least two treatment options. It is necessary not only the reconstruction of the tooth form, but also the perfect mimic of its color, besides considering the age and behavior of the patient.[6]

There are different types of operative procedures, including direct and indirect techniques, and this may influence aesthetic results and longevity of restoration. In cases of severe loss of coronary structure in anterior teeth, it is common to perform crown or fragment reattachment, in order to ensure a satisfactory aesthetically result through a simpler and faster technique. In cases in which the fractured tooth fragments are not available, the most indicated treatments consist of making indirect restorations, such as full ceramic crown. However, following a current trend of minimal intervention, direct placement with composite resins have been performed, because it is more conservative, repairable, predictable and less expensive option. [6,7]

The purpose of this manuscript is to report the unusual multidisciplinary conservative approach of a case of a 13 years-old boy with extensive permanent maxillary lateral incisor fracture and its successful two years follow-up.

CASE REPORT

A 13-years-old boy was referred to the Centro de Vigilância e Monitoramento de Traumatismos Dentoalveolares da Universidade Federal do Rio de Janeiro, Brazil (CVMT FO-UFRJ), with chief complain of two anterior teeth fractured. According to him and his mother, he had fallen and hit his mouth on the sidewalk. His first appointment was in an emergency public service one hour after the trauma, where it was done the endodontic access in the right upper lateral incisor and were given diet and oral hygiene instructions. Analgesics and an antimicrobial solution (Chlorhexidine 0,12%) for local application for one week were prescribed.

Patient medical history was not relevant and there was no history of previous dental trauma in both dentitions. The patient reported having the deleterious habit of onychophagia. Patient was in mixed dentition; no caries lesions were observed, and the oral hygiene was satisfactory.

After completing the Term of Free and Informed Consent, data from clinical examination were collected, combined with mother's report, allowed the diagnosis of concussion, as the type of injury that affected the supporting tissues of maxillary anterior tooth. In relation to hard tissues, the left maxillary central incisor presents an uncomplicated enamel and dentin fracture and the right upper lateral incisor, enamel and dentin fracture with pulp exposure, with temporary filling present, and subgingival extension of the fracture margin at lingual surface. Radiographic evaluation showed no signs of periapical neither pulp changes in left maxillary central incisor, but right upper lateral incisor showed a suggestive periapical lesion (Figure 1).

Patient was instructed to maintaining the hygiene of the affected area with soft toothbrush. All the possible treatments were explained to patient and his mother. To perform the full exposure of the fractured margins of lateral incisor, the following options were given: orthodontic extrusion of this element or surgical lengthening of the clinical crown. Regarding the restorative procedure to be used for this same tooth, the options were making a crown full of porcelain or a direct light-cured composite resin restoration.

After discussing about the advantages and disadvantages of each of the proposed procedures, choice was to perform a more conservative approach. The surgical lengthening of the clinical crown and the endodontic treatment of the right upper lateral incisor was performed (Figure 2). After these first steps, direct restorations were realized in right lateral and left central maxillary incisors with direct composite resins (Filtek™ Z350 XT®; 3M ESPE; Brazil) (Figure 3). All clinical procedures were done under local anesthesia (ALPHACAINE® 1:100.000; DFL; Brazil) and with rubber dam isolation.

At a two-years follow-up visit, clinical and radiographic evaluation was performed, and oral hygiene instructions were reinforced. Direct restorations showed up intact and their aesthetics were considered satisfactory for both the professional and the patient and his mother. The importance of maintaining the follow-up visits was explained to them. We could observe the success of the unusual conservative technique that was employed in this case, with no clinic or radiographic abnormality symptoms (Figure 4).

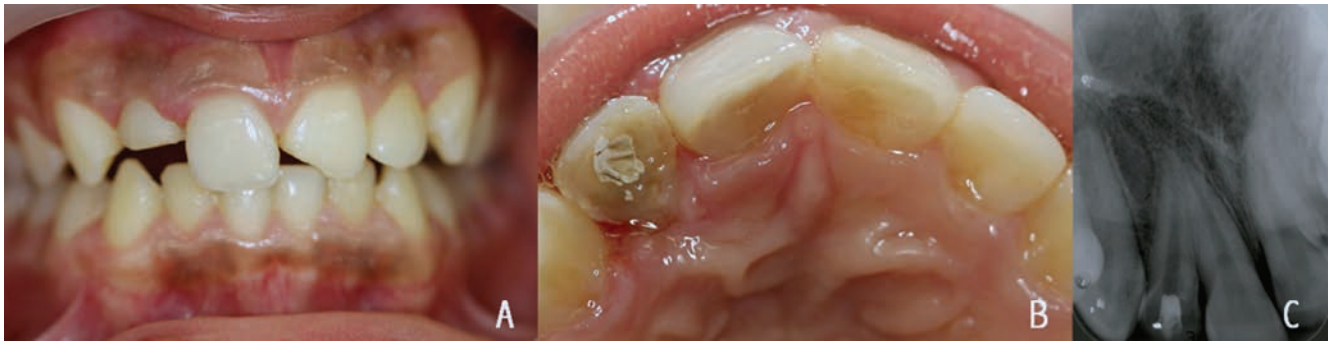

***Figure 1**:* (A) Initial frontal view showing the enamel and dentin fracture in the left upper central incisor and enamel and dentin fracture with pulp exposure in the right upper lateral incisor; (B) the occlusal photography and (C) the periapical radiography of the right upper lateral incisor.

***Figure 2**:* (A) Periapical radiography of the right upper lateral incisor after endodontic treatment and (B) the clinical aspect just after the endodontic treatment.

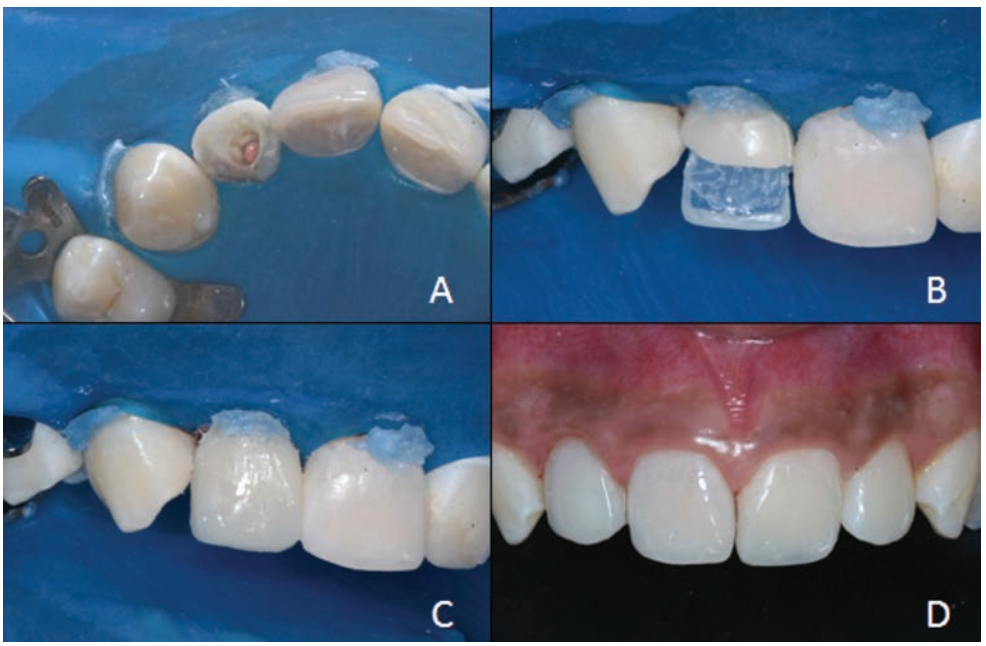

***Figure 3**:* (A) Occlusal view after rubber dam isolation; (B) reconstruction of the palatine surface; (C) aspect after direct restoration and (D) final image just after the restorative treatment of the left upper central incisor and the right upper lateral incisor.

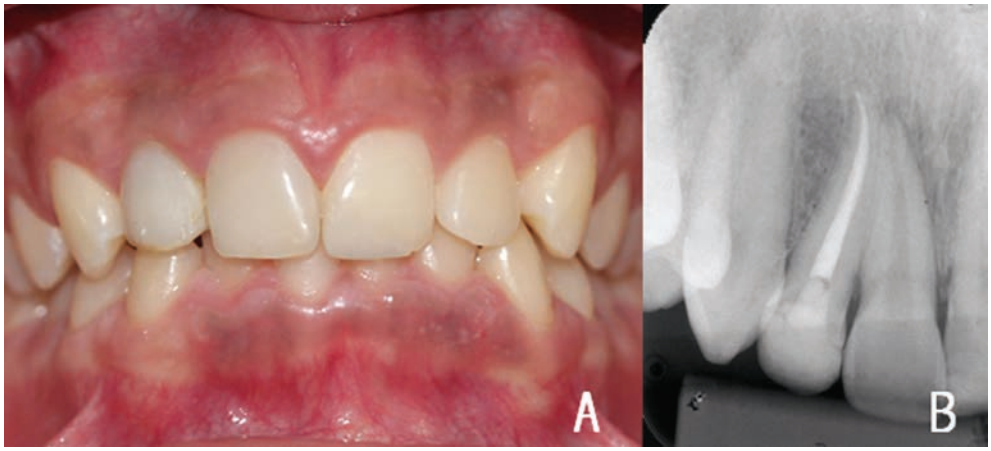

Figure 4: (A) Clinical view and (B) periapical radiographic after a two-year follow-up.

DISCUSSION

Cases of coronary dental fracture require a multidisciplinary approach, which allows a more complete, efficient and safe treatment.[8] Furthermore, management of patients at mixed dentition are a challenge, because they often require a pediatric dental approach to behavior, but also need of care on other dental areas. In the present case, the proposed treatment, based on the guideline of International Association of Dental Traumatology (IADT),[9] covered different dental specialties: pediatric dentistry, periodontics, endodontics and operative dentistry. It was fundamental for the success observed in this case.

It is important to note the role of the pediatric dentists in cases of dental trauma, since in most cases they will make the first contact with the newly injured patients. Therefore, these professionals should be prepared to make a quick and accurate diagnosis and formulate an appropriate treatment plan.[10] When necessary, it is crucial to referral the patient to other professionals to carry out the specific interventions, as was done in the present case.

It has been demonstrated that untreated dental fracture of permanent teeth in children may impact their quality of life.[2] Therefore, demands of patient and parents need to be considered and discussed with the dentist to choose the best treatment to be employed, in order to restore function and aesthetics of affected teeth.[11] Different treatment options were proposed to the patient and her mother in this case; advantages and disadvantages of each of them were explained and discussed with the professional. It was chosen a conservative approach, although the aesthetic desires of the patient were achieved.

Furthermore, it is important to note that treatment for injured teeth should be performed as early as possible, since the consequences are most frequently observed in a period of 3 months after trauma, and the most common complications are pulp necrosis and progressive inflammatory resorption.[12]

In the view of minimally invasive dentistry, injuries resulting from dental trauma have received an increasingly conservative approach, both in primary and permanent dentition.[12] Extensive coronary fractures, as in this case, has been treated with direct composite resin restorations, instead of conducting indirect techniques, such as total crowns. This is because this is a simple, fast and cheaper alternative and ensure a good aesthetic quality and predictability of results [7,8,11,13], being excellent in cases of young patients [7], as in the present case.

Absence of clinical and radiographic changes were verified at two-years follow-up visit. Patient and professional considered the aesthetics of the restorations as satisfactory. It was not observed marginal leakage or color change, which are, after secondary caries, the main causes for replacement of restorations [14].

CONCLUSION

The treatment proposed in the present case was a successful conservative approach for management of a complicated tooth fracture in a young patient.

ACKNOWLEDGMENT

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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).

The Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal) publishes original articles, clinical case reports, protocols, reviews, letters to the editor and editorials/comments. Researches involving animals and/or human beings must be accompanied by the Certificate of Approval of a Research Ethics Committee. All articles are published in PDF format, in American English and must be submitted in this language. An abstract in Portuguese is demanded at the time of submitting and sending the final version.

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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.

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The Revista Científica do CRO-RJ (Rio de Janeiro Dental Journal) accepts the spontaneous submission of original articles, clinical case reports, protocols, 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
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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).

Protocols aim to guide clinical practices in the different specialties of dentistry. Description: Structured Summary (150 words); introduction; step-by-step presentation of the adopted protocol with textual description and images/figures/tables; discussion, conclusions and references.

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.

Abstract of Protocols

Inform the reader about the topic to be addressed and state the aim of the protocol.

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:

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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.

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

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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.

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The revised manuscripts must be sent within 2 months after notifying the authors about the conditional acceptance (minor or major adjustments). All the revisions must be accompanied by a letter of response to the reviewers, in which each question or suggestion made by the reviewers must be answered in sequential order. The letter must a) detail the author's reply, point by point, to each of the reviewers' comments, and b) a revised manuscript, highlighting in color, exactly what has been changed in the manuscript after revision. In addition to this, any need for adjustment or correction of the manuscript is the sole responsibility of the authors.

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