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Evaluation Study

THE DIAGNOSTIC RELIABILITY OF THE FRANKFORT HORIZONTAL PLANE, EVALUATED BY 3D CEPHALOMETRY

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ABSTRACT

Many maxillofacial malformations can modify the Frankfort horizontal plan making it unusable in orthodontic clinical diagnosis. This study aims to evaluate the position of the cephalometric points that determine the Frankfort horizontal plane on individualised craniofacial CT reconstructions using the foramen occipital line (Basion-Opisthion) on the midline sagittal axis as a reference. Thirty patients (15 males and 15 females aged between 10 and 76, mean of 36.4 years) were selected among those undergoing maxillofacial CT. Three multiplanar reconstructions were performed; the first was positioned at the craniofacial midline level, and a line was drawn passing from the Basion and Opisthion craniometric points; the second and third reconstructions were positioned on the right and left side, respectively, with a postero-anterior and latero-medial inclination to observe two parasagittal planes suitably inclined on which a line was drawn between the craniometric points Porion and Orbitale of the respective hemiface. The following parameters were evaluated: 1. angles between Basion-Opisthion and right and left Frankfort horizontal plane and the difference between them; 2. the minimum vertical distance on the individualised multiplanar reconstructions between the Porion and Orbitale points on the left and the right side, and the line passing through Basion-Opisthion; 3. the difference between the minimum vertical distance of the right and left Porion and Orbitale; 4. the difference between the minimum vertical distance of the right and left Orbitale point. The difference between the left and right Frankfort horizontal plane ranged from 0° to 7° with a mean value of 2°23'. The difference between the vertical position of the right and left Porion points ranged between 0 and 12 mm, with a mean value of 3.35 mm. The difference between the vertical position of the right and left Orbitale points ranged between 0 and 7.5 mm, with a mean value of 2.35 mm. The Frankfort horizontal plane is questionable in patients with craniofacial asymmetries and malformations.

KEYWORDS: *cephalometry, orthodontics, CT, malformation, asymmetry*

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INTRODUCTION

The cephalometric analysis allows the clinician to quantify the relationships between facial and dental structures and establish how much the patient's dental and facial morphological characteristics differ from the norm.

The Frankfort horizontal plane (FhP), drawn from the highest point of the upper edge of the external acoustic meatus Porion point (Po) to the lowest point of the lower edge of the Orbit point (Or), was born as a reference plane for studying dry skulls by of anthropologists and anatomists. It was then used in orthodontics for the cephalometric study (1). A comparison of two-dimensional radiography and three-dimensional computed tomography for cephalometric measurements was made by different authors in the last years (2-11).

Many maxillofacial malformations can modify the FhP, making it unusable for orthodontic diagnosis (12-15). Due to the position of the skeletal structures that determine the cephalometric points of the FhP, the poor reliability of the FhP with respect to sella-nation as a facial reference plane was highlighted by Incisivo et al. (16).

This study aims to evaluate the position of the cephalometric points that determine the FhP on individualised craniofacial CT reconstructions using the foramen occipital Basion (Ba) and Opisthion (Op) line on the midline sagittal axis as a reference.

MATERIALS AND METHODS

Thirty patients (15 males and 15 females aged between 10 and 76, mean of 36.4 years) were selected among those undergoing maxillofacial CT. Patients with fractures, tumors and craniofacial malformations were excluded. Twenty-two patients with skeletal class I, 4 with class II and 4 with class III were detected after evaluation of the ANB angle.

The radiological examinations were performed using 64 Slices SOMATOM CT (Siemens, Erlangen - Germany) with volumetric acquisition according to the usual protocol for maxillofacial structures: fields of view (FoV) 14 cm, 120 Kv, 90 mAs, scan time about 9" with 1 mm slices. In addition, the DICOM files were analysed using the eFilm Workstation 2.0 reconstruction software (Merge Healthcare Inc., Hartland, WI - USA).

Three multiplanar reconstructions were performed. The first was positioned at the craniofacial midline level, and a line passing from the Ba and Op craniometric points was drawn; the second and third were positioned on the right and left side, with a postero-anterior and latero-medial inclination to visualise two parasagittal planes suitably inclined, on which a line was drawn between the craniometric points Porion (Po) and Orbitale (Or) of the respective hemiface (Fig. 1).

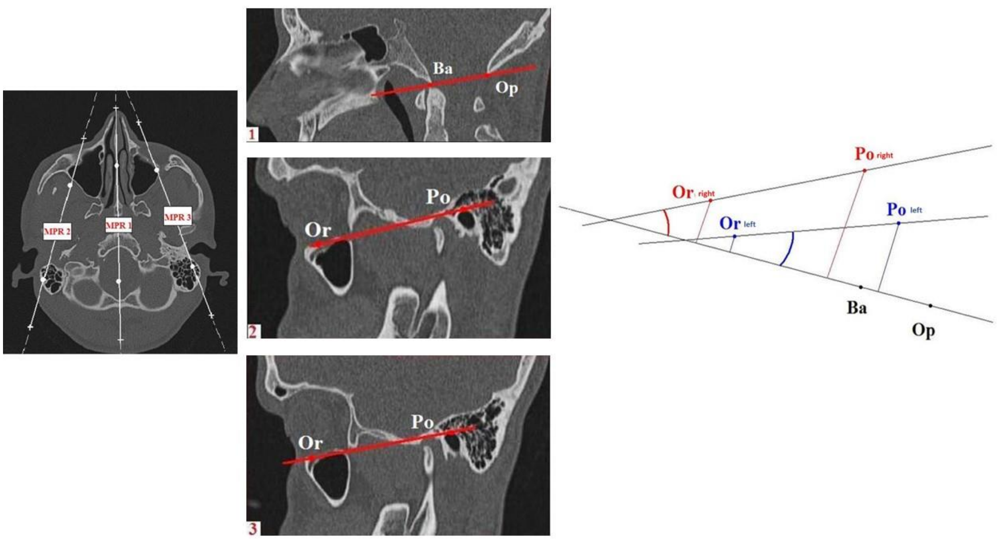

Fig. 1. *On the left the Multiplanar Reconstruction (MPR) reconstructions on axial plane; in the middle the MPR1 passing through Ba-Op, the MPR 2 passing through the right FHP, the MPR 3 passing through the left FHP; on the right the angles and distances measured.*

The following parameters were evaluated:

the angles between Ba-Op and right and left FhP and the difference between them;

the minimum vertical distance on the MPRs between the Po and Or points on the left and right side, and the line passing through Ba-Op;

the difference between the minimum vertical distance of the right and left Po;

the difference between the minimum vertical distance of the right and left Or.

RESULTS

Results are summarized in Table I.

Table I. *Summary of the results.*

Patient	Skeletric class	Left FHP^Ba-Op	Right FHP^Ba-Op	Minimum vertical distance between Left Po and Ba-Op	Minimum vertical distance between Right Po and Ba-Op	Minimum vertical distance between Left Or and Ba-Op	Minimum vertical distance between Right Or and Ba-Op
1	I	4°	4°	19 mm	17.5 mm	15 mm	13.5 mm
2	I	10°	6°	18 mm	12.5 mm	9 mm	7.5 mm
3	III	7.5°	8°	12.5 mm	18 mm	6.5 mm	11.5 mm
4	I	12.5°	13°	3 mm	10 mm	-6 mm	-1 mm
5	II	6°	5°	16.5 mm	15 mm	11 mm	10 mm
6	II	4.5°	4.5°	14 mm	14 mm	18 mm	18 mm
7	III	1°	3.5°	12.5 mm	17.5 mm	11.5 mm	14 mm
8	I	7°	4°	15 mm	13.5 mm	10 mm	9 mm
9	III	2.5°	1°	19 mm	28 mm	20 mm	26.5 mm
10	I	0°	1.5°	12 mm	16 mm	11.5 mm	19 mm
11	I	6°	4°	15 mm	18 mm	11 mm	15 mm
12	I	5°	2°	29 mm	17 mm	19 mm	15.5 mm
13	III	10°	10°	19 mm	19 mm	6.5 mm	6.5 mm
14	I	8.5°	8.5°	9 mm	9 mm	6 mm	6 mm
15	I	8°	5°	17 mm	16.5 mm	9 mm	11.5 mm
16	I	3°	4.5°	17.5 mm	23 mm	14 mm	18 mm
17	II	18.5°	15°	17 mm	12.5 mm	-1 mm	-3 mm
18	II	13°	16°	17 mm	21 mm	2.5 mm	4 mm
19	I	9°	11°	12 mm	16 mm	3 mm	6 mm
20	I	9.5°	2.5°	17 mm	13 mm	7 mm	5 mm
21	I	4°	9°	16 mm	20 mm	12 mm	10 mm
22	I	0°	0°	17.5 mm	18.5 mm	17.5 mm	18.5 mm
23	I	6.5°	5°	22 mm	18 mm	15.5 mm	13 mm
24	I	4°	1°	17.5 mm	13 mm	15 mm	13 mm
25	I	2.5°	2.5°	18 mm	18 mm	15 mm	15 mm
26	I	5°	2°	21 mm	15 mm	16 mm	13 mm
27	I	4.5°	10°	11 mm	18 mm	7 mm	9 mm
28	I	7.5°	1.5°	17.5 mm	14 mm	11 mm	12 mm
29	I	5°	6°	19 mm	21 mm	13.5 mm	14.5 mm
30	I	14°	12.5°	22 mm	21.5 mm	7 mm	9 mm

The difference between left and right FHP ranged from 0° to 7° with a mean value of 2°23'; The difference between the vertical position of the right and left Po ranged between 0 and 12 mm with a mean value of 3.35 mm; the difference between the vertical position of the right and left Or ranged between 0 and 7.5 mm with a mean value of 2.35 mm.

DISCUSSION

The diagnostic possibilities of a 3D cephalometric technique based on a volumetric acquisition in order to avoid distortions typical of a two-dimensional X-ray have been evaluated by numerous authors in recent years (2-11). Although the sample examined is not very large, the measurements performed are reliable since they are performed on the MPRs of a dedicated CT exam.

In the cephalometric analysis used in this study, discrepancies are uncorrected if reference points are more anterior or posterior in the sagittal plane than the contralateral ones.

The FhP was found to be symmetrical only in 20% of cases; in 50% of cases, the discrepancy was less or equal to 2° and in 13.3% of cases, it was greater or equal to 4°. The Po and the two Or points were symmetrical only in 4 cases (13.3%). In most cases (87%), the most significant difference in height between the right and left sides concerned the Po more than the Or point.

The difference between the right and left landmarks was so high that tracing a reliable FhP on a lateral cephalometric radiograph was impossible. Thus cephalometrics that base their analysis on FhP, particularly those of Ricketts and McNamara, cannot be performed; this cephalometric analysis would be even more inadequate in case of craniofacial asymmetries and malformations.

CONCLUSIONS

Our data showed that only in 20% of examined cases there is a symmetry in respect to the FhP.

Author contributions

DM acquired clinical and imaging data and interpreted the data; FC drafted the manuscript; MDG revised the manuscript; LB gave final approval of the version to be published.

REFERENCES

1. Lundström A, Lundström F. The Frankfort horizontal as a basis for cephalometric analysis. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1995;107(5):537-540. doi:https://doi.org/10.1016/s0889-5406(95)70121-4
2. Chien P, Parks E, Eraso F, Hartsfield J, Roberts W, Ofner S. Comparison of reliability in anatomical landmark identification using two-dimensional digital cephalometrics and three-dimensional cone beam computed tomography *in vivo*. *Dentomaxillofacial Radiology*. 2009;38(5):262-273. doi:https://doi.org/10.1259/dmfr/81889955
3. Chung Raymond-R, Lagravere Manuel-O, Flores-Mir C, Heo G, Carey JP, Major Paul-W. Analyse comparative des valeurs céphalométriques de céphalogrammes latéraux générés par CBCT versus céphalogrammes latéraux conventionnels. *International Orthodontics*. 2009;7(4):308-321. doi:https://doi.org/10.1016/s1761-7227(09)73505-3
4. Nalçaci R, Öztürk F, Sökücü O. A comparison of two-dimensional radiography and three-dimensional computed tomography in angular cephalometric measurements. *Dentomaxillofacial Radiology*. 2010;39(2):100-106. doi:https://doi.org/10.1259/dmfr/82724776
5. Cattaneo PM, Bloch CB, Calmar D, Hjortshøj M, Melsen B. Comparison between conventional and cone-beam computed tomography–generated cephalograms. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2008;134(6):798-802. doi:https://doi.org/10.1016/j.ajodo.2008.07.008
6. Berco M, Rigali PH, Miner RM, DeLuca S, Anderson NK, Will LA. Accuracy and reliability of linear cephalometric measurements from cone-beam computed tomography scans of a dry human skull. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2009;136(1):17.e1-17.e9. doi:https://doi.org/10.1016/j.ajodo.2008.08.021
7. Ludlow JB, Gubler M, Cevidanes L, Mol A. Precision of cephalometric landmark identification: Cone-beam computed tomography vs conventional cephalometric views. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2009;136(3):312.e1-312.e10. doi:https://doi.org/10.1016/j.ajodo.2008.12.018
8. Moreira CR, Sales MAO, Lopes PML, Cavalcanti MGP. Assessment of linear and angular measurements on three-dimensional

cone-beam computed tomographic images. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2009;108(3):430-436. doi:https://doi.org/10.1016/j.tripleo.2009.01.032

9. Lagravère MO, Gordon JM, Guedes IH, et al. Reliability of Traditional Cephalometric Landmarks as Seen in Three-Dimensional Analysis in Maxillary Expansion Treatments. *The Angle Orthodontist*. 2009;79(6):1047-1056. doi:https://doi.org/10.2319/010509-10r.1
10. van Vlijmen OJC, Bergé SJ, Swennen GRJ, Bronkhorst EM, Katsaros C, Kuijpers-Jagtman AM. Comparison of Cephalometric Radiographs Obtained From Cone-Beam Computed Tomography Scans and Conventional Radiographs. *Journal of Oral and Maxillofacial Surgery*. 2009;67(1):92-97. doi:https://doi.org/10.1016/j.joms.2008.04.025
11. van Vlijmen OJC, Maal T, Bergé SJ, Bronkhorst EM, Katsaros C, Kuijpers-Jagtman AM. A comparison between 2D and 3D cephalometry on CBCT scans of human skulls. *International Journal of Oral and Maxillofacial Surgery*. 2010;39(2):156-160. doi:https://doi.org/10.1016/j.ijom.2009.11.017
12. Cascone P, Cicconetti A. [Hemifacial microsomia: cephalometric evaluation]. *Mondo Ortodontico*. 1991;16(4):407-417.
13. Kreiborg S, Cohen MM. Ocular Manifestations of Apert and Crouzon Syndromes. *Journal of Craniofacial Surgery*. 2010;21(5):1354-1357. doi:https://doi.org/10.1097/scs.0b013e3181ef2b53
14. Mazza D, Primicerio P, Ambesi Impiombato F, Impara L. Studio TC e RM in un caso di fibro-displasia ossea. *Italian Oral Surgery*. Published online May 2008:21-25.
15. Mazza D, Ferraris L, Galluccio G, Cavallini C, Silvestri A. The role of MRI and CT in diagnosis and treatment planning of cherubism: a 13-year follow-up case report. *European Journal of Paediatric Dentistry*. 2013;14(1):73-76.
16. Incisivo V, Silvestri A. The Reliability and Variability of SN and PFH Reference Planes in Cephalometric Diagnosis and Therapeutic Planning of Dentomaxillofacial Malformations. *Journal Of Craniofacial Surgery*. 2000;11(1):31-38. doi:https://doi.org/10.1097/00001665-200011010-00006.

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Review

EATING DISORDERS AND ORAL HEALTH STATUS

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ABSTRACT

Eating disorders (EDs) represent a group of multiple pathological conditions defined in psychiatric classifications as “severe mental illness”, which require specialized treatments with an integrated multidisciplinary approach due to their multifactorial origin. Nutrition and EDs are divided as follows: a) anorexia nervosa; b) bulimia nervosa; c) binge-eating disorder; d) avoidant/restrictive food intake disorder; e) rumination disorder; f) pica; g) other specific disorders of nutrition; h) unspecified nutrition and EDs. The qualitative and quantitative modifications of the food introduced daily also involve manifestations affecting the oral cavity. Consequently, an individual suffering from ED with an altered diet will have insufficient nutrition and compromised overall health. This work aims to provide a general view of EDs and the effects on oral health resulting from EDs.

KEYWORDS: *food intake, weight, nutrition, eating disorders, oral health*

INTRODUCTION

Eating Disorders (Eds) are defined and classified by the American Psychiatric Association in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders as persistent EDs and/or behaviours aimed at weight control, which deteriorate physical health and psychosocial functioning and are not secondary to any known medical or psychiatric conditions. They represent a group of multiple pathological conditions defined in psychiatric classifications as “severe mental illness”, which, as such, require specialized treatments with an integrated multidisciplinary approach due to their multifactorial origin. They tend to have a prolonged course and become chronic in 20-30% of cases. These disorders frequently occur in comorbidity with other mental disorders (30-50% anxiety disorders, depression, suicide, addiction), and the risk of suicide is very high in these cases (1, 2).

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Although the typical age of onset is between 15-19 years, in some cases, it can affect subjects of younger and older ages. Studies have been conducted on the epidemiology and treatment of EDs in middle-aged and older women and men. It was found that EDs also occur in both sexes over 40 years of age. Although the occurrence of EDs (especially anorexia nervosa) is lower among older women than among young women, health professionals should consider the possibility of an ED even among older people. However, it is difficult to identify the disorder due to age-dependent symptoms, an underestimation of patients regarding the symptoms of the ED, which could be due to shame, stigmatization of psychiatric disorders even by the doctor, and the fact that the ED is often hidden behind excessive sporting activity (3, 4).

In the DSM-5, nutrition and EDs are divided as follows: a) anorexia nervosa (AN); b) bulimia nervosa (BN); c) binge-eating disorder; d) avoidant/restrictive food intake disorder; e) rumination disorder; f) pica; g) other specific disorders of nutrition and nutrition; h) unspecified nutrition and EDs (1).

The risk factors can be divided into predisposing and triggering. Both are divided into:

- Individuals: genetic, physical (discomfort for physical fitness), psychological (low self-esteem, perfectionism, anxiety, emotional difficulty, etc.), socio-cultural (pressure on thinness, dieting, etc.), and concomitant diseases.
- Family: educational styles based on beauty, bereavement, a tendency to hide problems and difficulties between family members, separations and/or conflicts and therefore alterations in the family balance.
- Cultural: the cult of the image, new ideals of beauty and thinness, and new performance styles to conform to a model proposed by social media, which propagate an unrealistic ideal of beauty, leading to dissatisfaction with one's body (2,5).

Acquiring a balanced diet is an essential prophylactic and protection tool for multiple diseases. However, the qualitative and quantitative modifications of the food introduced daily also involve manifestations affecting the oral cavity. Consequently, an individual suffering from ED with an altered diet will have insufficient nutrition, compromising the organism's overall health.

This work aims to provide a general view of EDs, deepening some particular elements and focusing on the effects on oral health resulting from EDs.

MATERIALS AND METHODS

Based on the literature, a narrative review was created that describes various aspects of EDs, particularly the alterations resulting from the wrong habits deriving from the oral cavity disorder. The research of the articles was carried out using Pubmed, WOS, and Scopus scientific databases. It was used as a search string terms related to EDs, such as "eating disorders", "eating behaviour", "epidemiology", "EDs and oral cavity", and "physical fitness".

RESULTS

The following data emerged from the epidemiological research regarding anorexia nervosa:

- The prevalence among European women is <1-4%, and the male/female ratio is 1:10.
- The incidence is equal to 8.1 cases per 100,000 inhabitants/year.
- Some studies imply that in Europe, there has been an increase in anorexia rates, probably due to better detection, while bulimia is on the decline (6).
- For bulimia nervosa, the prevalence is <1-2%, with a male-female ratio of 1:20, while the incidence is 11.4 per 100,000 inhabitants/year (2, 7).

Bulimic crises occur after the loss of balance in respecting rigid and extreme self-imposed limits, from states of dysphoric mood, conflicts, stressful events, feelings of emptiness, and loneliness (8).

DISCUSSION

Rumination syndrome is a gastrointestinal function characterized by effortless postprandial reflux. The material can be chewed and swallowed or expectorated by the patient. Generally, regurgitation is not preceded by nausea or retching. Repeated regurgitation is not caused by an associated gastrointestinal condition or another medical condition (for example, gastroesophageal reflux). They usually tend to limit their food consumption in order to prevent others from seeing them regurgitate. In 40% of cases, this is related to weight loss and/or developing nutritional deficiencies. Continuous food regurgitation must occur for at least one month to diagnose rumination disorder. Unlike vomiting, which is an energetic expulsion usually caused by an ailment, regurgitation is not an energetic expulsion and can be involuntary. The subject may report being unable to stop doing it (9, 10).

Pica is the compulsive consumption of non-nutritive substances (chalk, eraser, hair, pen, and pencil) for at least one month. The frequency is higher in pregnant women and preteens, and numerous studies in the literature report a correlation between iron deficiency and pica. However, the pathophysiology is still unknown, and the bases presumably are sought in the decrease in iron levels in the central nervous system (11, 12).

In addition to harming physical and psychosocial health, EDs also have severe consequences for oral health. Oral signs and symptoms of ED are generally caused by nutritional deficiencies and/or a long history of self-induced vomiting. However, inadequate personal hygiene, inappropriate eating habits, and medications can worsen the condition. The primary oral diseases attributable to EDs are dental erosion and dental caries. Dental erosion (the predominant oral characteristic of ED) is a pathological and chronic multifactorial process that causes irreversible enamel dissolution. It can continue until the pulp is exposed, resulting in the appearance of dental sensitivity, aesthetic impairment, and loss of vertical size.

Erosion is mainly attributable to repeated episodes of self-induced vomiting (characteristic of AN, BN, and Rumination syndrome), the persistence of the gastric acid content in the oral cavity, and changes in saliva's qualitative and quantitative characteristics (xerostomia, impaired buffering capacity, and salivary pH). Therefore, the erosive damage is due to the repeated presence of gastric juice inside the oral cavity with a pH <2, clearly lower than the critical pH of the enamel, dentin and root cement. Furthermore, the acidic environment that is created causes demineralization, i.e., the enamel is deprived of its mineral composition, which is essentially formed by calcium and phosphate, with the appearance of dental erosions aggravated by incorrect brushing in terms of time and technique. In addition, abrasive toothpaste and stiff bristles can evolve into mechanical abrasions (lesions commonly localized in the cervical areas of the enamel) with a loss of dental substance (2, 13).

It is usually clinically observed after at least two years of induced vomiting episodes. Furthermore, the severity of erosion is directly proportional to the frequency of reflux. Patients with dental erosion are more prone to have dentinal sensitivity, usually present at the cervical level due to the thinner enamel layer and, therefore, with dentin exposure.

The other important feature of ED is dental caries; as a multifactorial pathology, its development cannot be attributed exclusively to EDs. The three fundamental pillars for caries prevention are proper nutrition (the first factor responsible for biochemical and physiological changes within the oral biofilm), fluoroprophylaxis, and oral hygiene. If these three measures are lacking, and to these are added genetic predisposition, malnutrition, the intake of specific drugs, altered salivary composition and flow, they influence the differences in the prevalence of caries. The destruction of the tooth's hard tissues is the work of endogenous microorganisms (Streptococcus mutans and Lactobacillus), which metabolize fermentable carbohydrates introduced by the diet, producing organic acids that cause a drop in pH, determining demineralization of the tooth enamel. Similarly, it occurs when the oral cavity is continuously exposed to gastric acids following episodes of vomiting.

Gum recession occurs mainly in adult patients due to traumatic brushing or continuous acid attacks. In addition, vitamin C deficiency can cause marginal gingivitis. Periodontal health can be further influenced by nutritional deficits and, therefore, an insufficient response of the organism to oppose the possible development of inflammation and a more rapid loss of alveolar bone.

Angular cheilitis may develop mainly due to a chronic Candida Albicans fungus infection, although it can also occur due to a coexisting staphylococcus infection. These species are commensal organisms, usually present within the oral cavity, representing about 50% of the population. In particular situations of imbalance, such as salivary dysfunctions and nutritional deficiencies, they can proliferate and, in this case, infect the lesions of the oral mucosa. Candidiasis can be considered a wake-up call for nutritional deficiencies caused by ED.

Glossodynia, altered taste, dysgeusia, hypogeusia, burning sensation, or stomatodynia may also be present. In addition, patients report the perception of the burning of the tongue or oral cavity, despite the insignificant clinical-pathological findings.

Side effects of pica, in addition to various types of poisoning, develop abdominal problems with discomfort and pain in the intestines and, in most cases, occlusion requiring surgery. The teeth are mainly affected by wear, especially from continuous contact with hard objects. Another cause is prolonged and incorrect contact between the antagonist's teeth, as with bruxism, clenching, and malocclusion. It is a condition that depends on the involuntary contraction of the chewing muscles. It occurs mainly at night, and in addition, to wear, it can cause pain in the jaw due to excessive stress on the temporomandibular joint and headache. Clinically, the worn surface has a brown colour due to dentin exposure. Radiographically, the pulp chamber and canals may appear small (12).

CONCLUSIONS

EDs are pathologies recognized as diseases of dental relevance. In most cases, they can be successfully treated when diagnosed early, and patients with known or suspected EDs should be referred immediately to a competent psychiatrist. Numerous studies have confirmed the intense correlation between EDs and damage to the oral cavity. From this perspective, dental prevention is of fundamental importance both in the early stage of interception of the disease and in the medium and long-term management of lesions to oral tissues whose appearance is related to the ED.

Dentists and hygienists play a significant role in identifying, preventing, and treating the noticeable oral health effects of EDs. Preventive action is practised by gathering information on oral hygiene and food habits and providing advice on promoting a balanced diet by transmitting knowledge on the consequences of an altered diet.

This review underlines the strong correlation between ED and oral health and highlights the importance of the dental hygienist's role and adequate knowledge of the various pathological pictures of ED so that ED can be promptly intercepted to avoid worsening of this pathology.

REFERENCES

1. Guha M. Diagnostic and Statistical Manual of Mental Disorders: DSM-5 (5th edition). *Reference Reviews*. 2014;28(3):36-37. doi:https://doi.org/10.1108/RR-10-2013-0256
2. Smink FRE, van Hoeken D, Hoek HW. Epidemiology of Eating Disorders: Incidence, Prevalence and Mortality Rates. *Current Psychiatry Reports*. 2012;14(4):406-414. doi:https://doi.org/10.1007/s11920-012-0282-y
3. Ohrn R, Enzell K, Angmar-Mansson B. Oral status of 81 subjects with eating disorders. *European Journal of Oral Sciences*. 1999;107(3):157-163. doi:https://doi.org/10.1046/j.0909-8836.1999.eos1070301.x
4. Mangweth-Matzek B, Hoek HW. Epidemiology and treatment of eating disorders in men and women of middle and older age. *Current Opinion in Psychiatry*. 2017;30(6):446-451. doi:https://doi.org/10.1097/YCO.0000000000000356
5. Hudson JI, Hiripi E, Pope HG, Kessler RC. The Prevalence and Correlates of Eating Disorders in the National Comorbidity Survey Replication. *Biological Psychiatry*. 2007;61(3):348-358. doi:https://doi.org/10.1016/j.biopsych.2006.03.040
6. Keski-Rahkonen A, Mustelin L. Epidemiology of eating disorders in Europe: prevalence, incidence, comorbidity, course, consequences, and risk factors. *Current opinion in psychiatry*. 2016;29(6):340-345. doi:https://doi.org/10.1097/YCO.0000000000000278
7. Steinberg BJ. Medical and dental implications of eating disorders. *Journal of Dental Hygiene*. 2014;88(3):156-159.
8. Antonelli JR, Seltzer R. Oral and Physical Manifestations of Anorexia and Bulimia Nervosa. *Texas Dental Journal*. 2016;133(9):528-535.
9. Absah I, Rishi A, Talley NJ, Katzka D, Halland M. Rumination syndrome: pathophysiology, diagnosis, and treatment. *Neurogastroenterology & Motility*. 2016;29(4):e12954. doi:https://doi.org/10.1111/nmo.12954
10. Kessing BF, Smout AJPM, Bredenoord AJ. Current Diagnosis and Management of the Rumination Syndrome. *Journal of Clinical Gastroenterology*. 2014;48(6):478-483. doi:https://doi.org/10.1097/mcg.0000000000000142
11. Delaney CB, Eddy KT, Hartmann AS, Becker AE, Murray HB, Thomas JJ. Pica and rumination behavior among individuals seeking treatment for eating disorders or obesity. *International Journal of Eating Disorders*. 2014;48(2):238-248. doi:https://doi.org/10.1002/eat.22279

12. Borgna-Pignatti C, Zanella S. Pica as a manifestation of iron deficiency. *Expert Review of Hematology*. 2016;9(11):1075-1080. doi:https://doi.org/10.1080/17474086.2016.1245136
13. Uhlen MM, Tveit AB, Refsholt Stenhagen K, Mulic A. Self-induced vomiting and dental erosion – a clinical study. *BMC Oral Health*. 2014;14(1). doi:https://doi.org/10.1186/1472-6831-14-92

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Case Report

ULTRASOUND CHARACTERIZATION OF A LYMPHATIC MALFORMATION OF THE TONGUE: A CASE REPORT

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ABSTRACT

Lymphangioma is an infrequent benign lesion in the family of vascular malformations classified as lymphatic malformation (LMs). These, in most cases, have onset in the first years of life but can sometimes occur during growth. Clinical severity can range from the absence of symptoms to mild discomfort to the point of determining bone malformations of the entire head and neck area. The diagnosis can be addressed from the clinical examination, which the histopathological examination will confirm. The imaging tests used in this area are computed tomography, magnetic resonance, and ultrasounds. Ultrasounds can be used with both intraoral and extraoral approaches. The intraoral approach is best suited when the mass is on the tongue. A case report of a lymphangioma of the back of the tongue is presented. The clinical and histological characteristics of the lesion were analyzed. An ultrasound examination (US) was performed to determine the characteristics of the lesion. Information obtained in the US was useful as a diagnostic aid. Intraoral ultrasonography can be a promising diagnostic aid in the context of LMs of the tongue.

KEYWORDS: *Lymphangioma, tongue, clinical and histopathological examination, ultrasound*

INTRODUCTION

Lymphangiomas are infrequent lymphatic malformations (LMs), usually involving the head and neck region. This group of lesions has been known and described for a long time, but the pathogenesis is still unclear, and it is not easy to categorize and classify them (1). These lesions can be described as congenital malformations of the lymphatic system with different sizes of lymphatic channels and cystic spaces (2). The head and neck region is most affected (75% of cases)

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and represents about 5% of benign tumors in children (3). The skin is the most common site, but oral lesions are frequent. In particular, the dorsum of the tongue is reported as the major affected site, followed by lips, buccal mucosa, soft palate, and floor of the mouth (4). The reported incidence ranges from 1:2500 to 1:16000, with no difference in gender distribution. Morbidity and mortality are related to the size and site of the lesion (2, 5). The prognosis is generally good, and the clinical course can be asymptomatic in some cases, although larger LMs may provide airway obstruction and death in children (6).

In many cases, the early development of these masses at the lingual level and in all oral districts can cause alterations in the growth of the lower third of the face and considerable orthodontic problems (7). In addition, LMs can enlarge with an upper respiratory infection or hormone changes at puberty (8). In the past, LMs were classified according to their clinical presentation and site of onset. In 1982, histological and cellular characteristics were integrated into the clinical classification. Furthermore, this classification divided the vascular anomalies into tumors and malformations, improving the management of this category of lesions (9). In this work, LMs were classified as low-flow vascular malformations of lymphatic origin and subcategorized into macrocystic, microcystic, and mixed (10). Subsequent classifications adopted this nomenclature in 1996 and in the classification proposed and approved at the International Society for the Study of Vascular Anomalies (IVVSA) workshop in 2014 (11).

The latter intended to evolve the understanding of the biology and genetics of vascular and lymphatic malformations (12). From a histological point of view, LM consists of lymphatic channels surrounded by endothelial cells. The channels' size and shape are variable, determining the classification (13). Histopathologic features consist of lymphatic vessels with marked dilatations (7), and the vessels can infiltrate the closest soft tissues and exhibit lymphoid aggregates. The endothelium is slight, with fluid rich in proteins and lymphocytes; secondary haemorrhage may occur in the lymphatic vessels. Lymphatic fluid, red blood cells, lymphocytes, macrophages, and neutrophils characterize the lymphatic spaces. Surrounding connective tissue consists of loose fibrotic tissue and inflammatory cells (14). Usually, the tumor is superficial, shows a lobulated surface, and may appear translucent. When the lesion is deeper, it appears as a soft consistency mass with irregular edges. Superficial lesions may also have a papillary appearance, with no changes in colour in the surrounding healthy mucosa, while the deeper lesions appear as nodules without showing a significant change from the surrounding mucosa (4). The differential clinical diagnosis for LMs in the oral cavity includes all the exophytic lesions of the tongue, from granular cell tumors to lingual thyroid and mesenchymal tumors. All vascular malformations of mesenchymal origin should be considered.

Also, pyogenic granuloma should be inserted in the differential diagnosis. For these reasons, the histopathological analysis will be decisive for the final diagnosis as the listed lesions often present a clinical history similar to LMs (15). Therefore, surgical excision is the treatment of choice (13, 16). Some diagnostic tools can be used as diagnostic aid, particularly computed tomography (CT) and magnetic resonance imaging (MRI) (17). Ultrasonography (US) can be used for prenatal diagnosis of large masses in the head and neck region and other areas. However, some authors emphasize the importance of the intraoral US in managing oral LMs (16, 17). This study presents a case of tongue lymphangioma using the US for diagnostic characterization.

CASE REPORT

A thirteen-year-old male presented at the Oral Medicine and Pathology Division of the University of Campania, "Luigi Vanvitelli", for a swelling on the left dorsum of the tongue. The patient's parents reported that the lesion had appeared for about one year following infection with a fever of the upper respiratory tract. The young patient reported that he had always had discomfort in that tongue area. Intraoral examination showed harmonic growth of the bone structures with a mild Angle first-class malocclusion and crowding of the lower incisors, all teeth present in the arch (except wisdom teeth), excellent oral hygiene, and no caries. The lesion appeared as an elastic mass of about 3x1.5 cm, occupying the dorsum's entire central portion, extending posteriorly up to the left lingual tonsil. The surface appeared raised and characterized by nodules alternating with a papular appearance and micro-vesicles without any significant change in surface texture or colour.

Despite the size of the lesion, the patient denied any pain and reported being able to breathe and speak normally, with mild discomfort in swallowing. US examination was performed with an 18MHz linear hockey stick probe in B-mode. One focus was placed in correspondence with the lesion, and the harmonic mode was set. In the US, the lesion appeared hypo-iso-echoic with a thickened hyperechoic epithelium on the surface and an anechoic band that delimited it from the underlying connective tissue. The thickness measured was about 2.5 cm. In the context of the lesion, well-defined and anechoic ovoid areas were present, well delimited by a hyperechoic border to form septa. An acoustic shadow was present under those areas (Fig. 1). In power Doppler mode, it was possible to observe the flow of microvessels under the lesion. The incisional biopsy was performed. Histological analysis confirmed the clinical diagnosis of lymphangioma. The patient decided to wait for surgical therapy due to the extent of the lesion and the paucity of symptoms. An annual follow-up was scheduled.

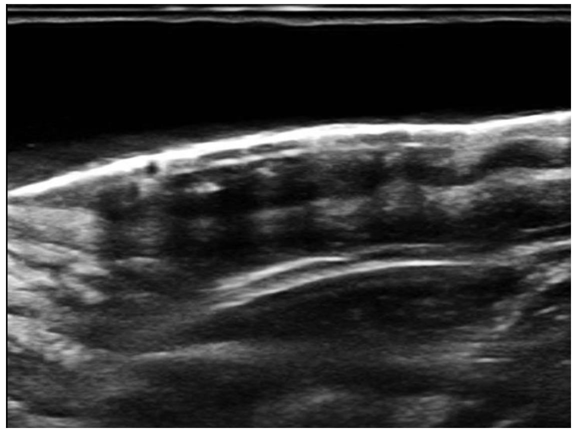

Fig. 1. *Acoustic shadow present in anechoic ovoid and hyperechoic border areas*

DISCUSSION

Despite being a benign lesion, managing intraoral LMs is challenging for the clinician. In particular, the clinical examination can address the diagnosis, but other information can be obtained with imaging tools. CT and MRI are the gold standards, especially in surgical planning; however, some information may be lost in smaller lesions. MRI imaging, for example, could be affected by metal artefacts in dentures or dental reconstructions. Furthermore, CT and MRI are less appropriate for superficial lesions without obtaining clinically relevant images with these techniques (17). US, on the other hand, is a non-invasive and reproducible technique, which allows obtaining real-time images of the scanned tissues with appropriateness comparable to the techniques mentioned above, especially in terms of size and in lesions <5mm.

Furthermore, some studies suggest that in the US, it is possible to obtain images comparable to macroscopic histopathological sections (18, 19). In the context of LMs, US is used with an extraoral approach, but in some lesions, in certain areas, such as the tongue, this may not be as effective as an intraoral approach: air spaces can attenuate acoustic waves, and the bone could represent an obstacle for the penetration of soundwaves. Therefore, the intraoral approach is preferable to diagnose tongue mass lesions (17, 20, 21). In this case report, images obtained by the intraoral US provided numerous additional information compared to the examination alone:

a) it has provided information on the thickness of the lesion and its relationship with the surrounding tissues;

b) it was possible to determine the ultrasound characteristics in terms of echogenicity and homogeneity;

c) it was possible to recognize some structures in the context of the mass, such as the presence of lobules and well-defined anechoic areas;

d) the ultrasound artefacts gave information on the density of the tissues;

e) an anechoic capsule has been identified, which separates the mass from the surrounding context and could correspond, on a histopathological level, to the thick fibrous capsule surrounding the perimeter of LMs (Fig. 1).

It is precisely this characteristic, according to Sugawara et al, that allows for distinguishing a benign lesion from a neoplastic lesion from an ultrasound point of view (17). Furthermore, even if the authors use a different ultrasound system, the US analysis returns an image with similar characteristics, such as the presence of the ovoid anechoic areas within the lesion.

CONCLUSIONS

Diagnosis and management of LMs represent a challenge for the clinician. Most of the time, the diagnosis is directed by clinical examination, but imaging tools such as the US can provide valuable additional information. Further studies are needed to establish the feasibility of using the intraoral US to manage oral LMs.

REFERENCES

1. Balakrishnan K, Perkins J. Management of Head and Neck Lymphatic Malformations. *Facial Plastic Surgery*. 2012;28(06):596-

602. doi:10.1055/s-0032-1329934

2. Rebuffini E, Zuccarino L, Grecchi E, Carinci F, Merulla VE. Picibanil (OK-432) in the treatment of head and neck lymphangiomas in children. *Dental Research Journal*. 2012;9(Suppl 2):S192-196. doi:10.4103/1735-3327.109752
3. Okazaki T, Iwatani S, Yanai T, et al. treatment of lymphangioma in children: our experience of 128 cases. *Journal of Pediatric Surgery*. 2007;42(2):386-389. doi:10.1016/j.jpedsurg.2006.10.012
4. Goswami M, Singh S, Gokkulakrishnan S, Singh A. Lymphangioma of the tongue. *National Journal of Maxillofacial Surgery*. 2011;2(1):86-88. doi:10.4103/0975-5950.85862
5. Kennedy TL, Whitaker M, Pellitteri P, Wood WE. Cystic hygroma/lymphangioma: a rational approach to management. *The Laryngoscope*. 2001;111(11):1929-1937. doi:10.1097/00005537-200111000-00011
6. Boardman SJ, Cochrane LA, Roebuck D, Elliott MJ, Hartley BEJ. Multimodality Treatment of Pediatric Lymphatic Malformations of the Head and Neck Using Surgery and Sclerotherapy. *Archives of Otolaryngology–Head & Neck Surgery*. 2010;136(3):270. doi:10.1001/archoto.2010.6
7. Chung CJ, Hwang S, Choi YJ, Kim KH. Treatment of skeletal open-bite malocclusion with lymphangioma of the tongue. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2012;141(5):627-640. doi:10.1016/j.ajodo.2010.07.029
8. Hoff SR, Rastatter JC, Richter GT. Head and neck vascular lesions. *Otolaryngologic Clinics of North America*. 2015;48(1):29-45. doi:10.1016/j.otc.2014.09.004
9. Mulliken JB, Glowacki J. Hemangiomas and Vascular Malformations in Infants and Children. *Plastic and Reconstructive Surgery*. 1982;69(3):412-420. doi:10.1097/00006534-198203000-00002
10. Renton JP, Smith RJH. Current treatment paradigms in the management of lymphatic malformations. *The Laryngoscope*. 2011;121(1):56-59. doi:10.1002/lary.20768
11. Dasgupta R, Fishman SJ. ISSVA classification. *Seminars in Pediatric Surgery*. 2014;23(4):158-161. doi:10.1053/j.sempedsurg.2014.06.016
12. Classification | International Society for the Study of Vascular Anomalies. www.issva.org. https://www.issva.org/classification
13. Balakrishnan A, Bailey CM. Lymphangioma of the tongue. A review of pathogenesis, treatment and the use of surface laser photocoagulation. *The Journal of Laryngology and Otology*. 1991;105(11):924-929. doi:10.1017/s0022215100117839
14. Sunil S, Gopakumar D, Sreenivasan B. Oral lymphangioma - Case reports and review of literature. *Contemporary Clinical Dentistry*. 2012;3(1):116. doi:10.4103/0976-237x.94561
15. Perkins JA, Manning SC, Tempero RM, et al. Lymphatic malformations: current cellular and clinical investigations. *Otolaryngology, Head and Neck Surgery*. 2010;142(6):789-794. doi:10.1016/j.otohns.2010.02.025
16. Bloom DC, Perkins JA, Manning SC. Management of lymphatic malformations. *Current Opinion in Otolaryngology & Head and Neck Surgery*. 2004;12(6):500-504. doi:10.1097/01.moo.0000143971.19992.2d
17. Sugawara C, Takahashi A, Kawano F, Kudo Y, Ishimaru N, Miyamoto Y. Intraoral ultrasonography of tongue mass lesions. *Dento Maxillo Facial Radiology*. 2016;45(5):20150362. doi:10.1259/dmfr.20150362
18. Angelelli G, Moschetta M, Limongelli L, et al. Endocavitary sonography of early oral cavity malignant tumors. *Head & Neck*. 2017;39(7):1349-1356. doi:10.1002/hed.24779
19. Shinozaki Y, Jinbu Y, Ito H, et al. Relationship between appearance of tongue carcinoma on intraoral ultrasonography and histopathologic findings. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*. 2014;117(5):634-639. doi:10.1016/j.oooo.2014.02.001
20. Natori T, Koga M, Anegawa E, et al. Usefulness of intra-oral ultrasonography to predict neck metastasis in patients with tongue carcinoma. *Oral Diseases*. 2008;14(7):591-599. doi:10.1111/j.1601-0825.2007.01423.x
21. Shintani S, Yoshihama Y, Ueyama Y, et al. The usefulness of intraoral ultrasonography in the evaluation of oral cancer. *International Journal of Oral and Maxillofacial Surgery*. 2001;30(2):139-143. doi:10.1054/ijom.2000.0035

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MANAGEMENT OF IMPACTED MAXILLARY CUSPIDS: A CASE REPORT

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ABSTRACT

The maxillary canine is the second most frequently impacted tooth after the third molar. It presents the most difficult pattern of eruption. An appropriate and timely diagnosis is mandatory to prevent potential pathological sequelae. Clinical and radiographic evaluations are indispensable to making an adequate therapeutic choice. Computer tomography cone-beam is considered the most effective radiographic exam for this purpose. In the reported case, a full-thickness vestibular gingival margin flap is mandatory when a labial impaction is suspected. An osteotomy, necessary to visualize the impacted tooth, is performed to minimize the quantity of removed bone. The impacted canine is sectioned into 2 or 3 parts to remove it successfully.

KEYWORDS: *impacted, teeth, canine, maxillary, imaging, CBCT*

INTRODUCTION

Impacted teeth are those which remain completely or incompletely embedded in the jawbone following failed eruption process for more than 2 years following physiological eruption time (1, 2). Although there are wide variations in impacted teeth, third molars remain the most prevalent impacted teeth, followed by maxillary canines (3). The impaction of maxillary canines occurs commonly, with up to 2.4% of the general population (4). Multiple factors, such as relatively long roots and eruption path, are considered responsible for higher prevalence. In contrast, mandibular canine impactions are significantly less frequent than maxillary cuspids (5).

An extensive list of etiologies causing maxillary permanent canine impaction has been reported (6-9). Local factors hindering regular eruption (e.g., overlying cysts or tumors, supernumerary teeth, loss of arch space, over-retained primary

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teeth, ankylosis, root dilacerations, trauma, reconstructive surgery for cleft lip/palate repair, thickened overlying bone or soft tissue, missing adjacent lateral incisor) are considered as common causes (6). Prevalence of maxillary cuspid impaction ranges from 1.0% to 2.5% (10-12), and from 8.0% to 10.0% (6, 12) of these cases is bilateral. Clinical evaluation of the patient with an impacted maxillary cuspid is performed by heedful inspection to evaluate arch space available and maxillary lateral incisor inclination. Also, the labial and palatal tissues are observed, and the width of keratinized gingiva in the canine area is measured. Afterwards, palpation is performed labially and palatally in search of the canine bud; this provides information regarding the potential location of the impacted canine and periodontal anatomy (13, 14). Lastly, if the primary canine is present, mobility is assessed; indeed, the presence of significant mobility may relate to the eruptive movement of the permanent canine. So, a timely diagnosis represents the first step to planning a predictable and effective treatment; however, it is often difficult to determine whether the missing canine is truly impacted or delayed eruption, especially in young patients. Hence, a detailed assessment of the impacted tooth for its location, angulation, and orientation is mandatory for orthodontic or surgical treatment planning.

A variety of radiographic assessment tools have been used for this reason in order to evaluate the impacted canines. The panoramic radiograph (orthopantomogram [OPG]) uses lower radiation dose compared to cone-beam computed tomography (CBCT) and provides comprehensive information regarding whole dentition, jaws, and the surrounding structures; therefore are frequently used for initial assessment (15). Although high radiation dose is a major concern, CBTC has the benefit of evaluating tissue dimensions more precisely and has been used for applications in general dentistry (15-17) and orthodontics (18). This clinical report describes a surgical procedure for bilateral impacted maxillary cuspids extraction.

CASE REPORT

A 15-year-old female with no significant past medical history come to our clinic to investigate the lack of eruption of both mandibular canines (1.3 and 2.3). OPT and CBCT were prescribed to the patient to investigate the reasons for the impacted teeth. The instrumental radiograph examinations showed the teeth with incorrect axial alignment for eruption, impacted in an ectopic position. According to the classification system reported by Yamamoto et al. (19) presented, all conceivable positions of maxillary canine impaction (MCI) related to their long-axis angles and the occlusal plane, both teeth were categorized as type II. That means that the crowns were mesially tipped, pressing lateral incisor teeth (Fig. 1). The therapeutic choice for this clinical case was to proceed with the surgical removal of

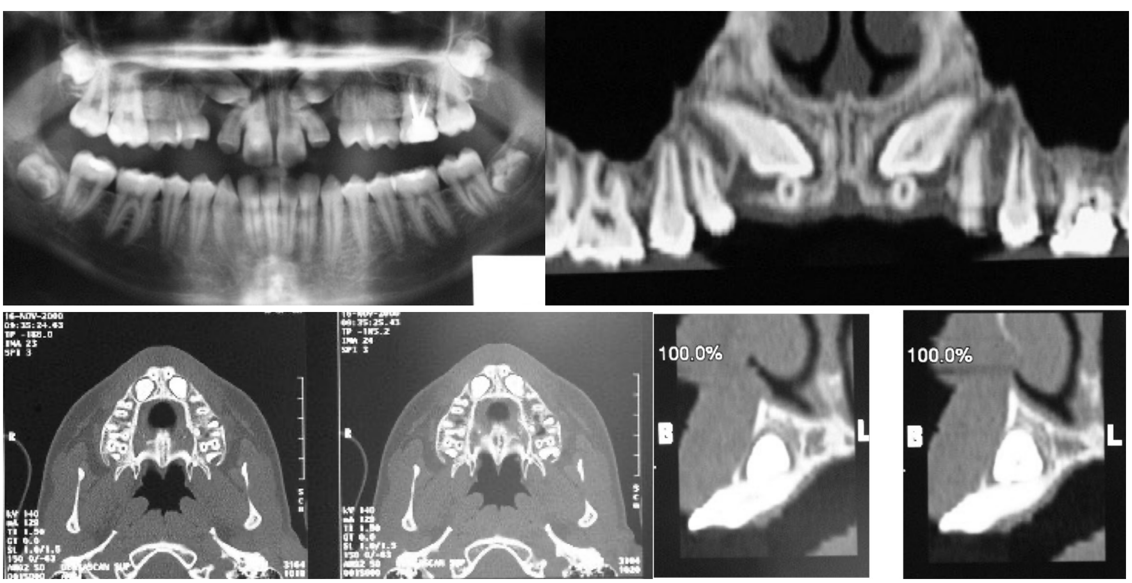

Fig. 1. ***A-D****) OPT and CBCT showing bilateral impacted maxillary canines in relation to the root of the lateral incisors and in an ectopic position with an erosion of the vestibular cortex.*

both maxillary canines, in particular, to prevent root resorption of the lateral incisors, as a consequence of the pressure exerted by the crown of the canines.

Since there was an erosion of the vestibular cortex, after local anaesthesia with adrenaline (1:100,000) to promote localized hemostasis, a paramarginal mucoperiosteal flap was elevated. A small osteotomy was made to expose the impacted teeth. After the exposure, a selective odontotomy was performed, and separated pieces were easily removed using mild torquing pressure with a straight osteotome. After extraction, wound closure was provided by a 3/0 silk suture (Fig. 2). The patient was discharged with ibuprofen, which helped reduce inflammation, and amoxicillin, to prevent superinfections sequelae. Home instructions for dental care after surgical extraction were also provided to the patient, and chlorhexidine mouthwash 0,2% was prescribed as a mouth rinse to achieve a local antiseptic effect. The follow-up period of 6 months was uneventful (Fig. 3).

DISCUSSION

Altered tooth eruption is a clinical condition characterized by failure of the tooth to emerge in the oral cavity. Impaction

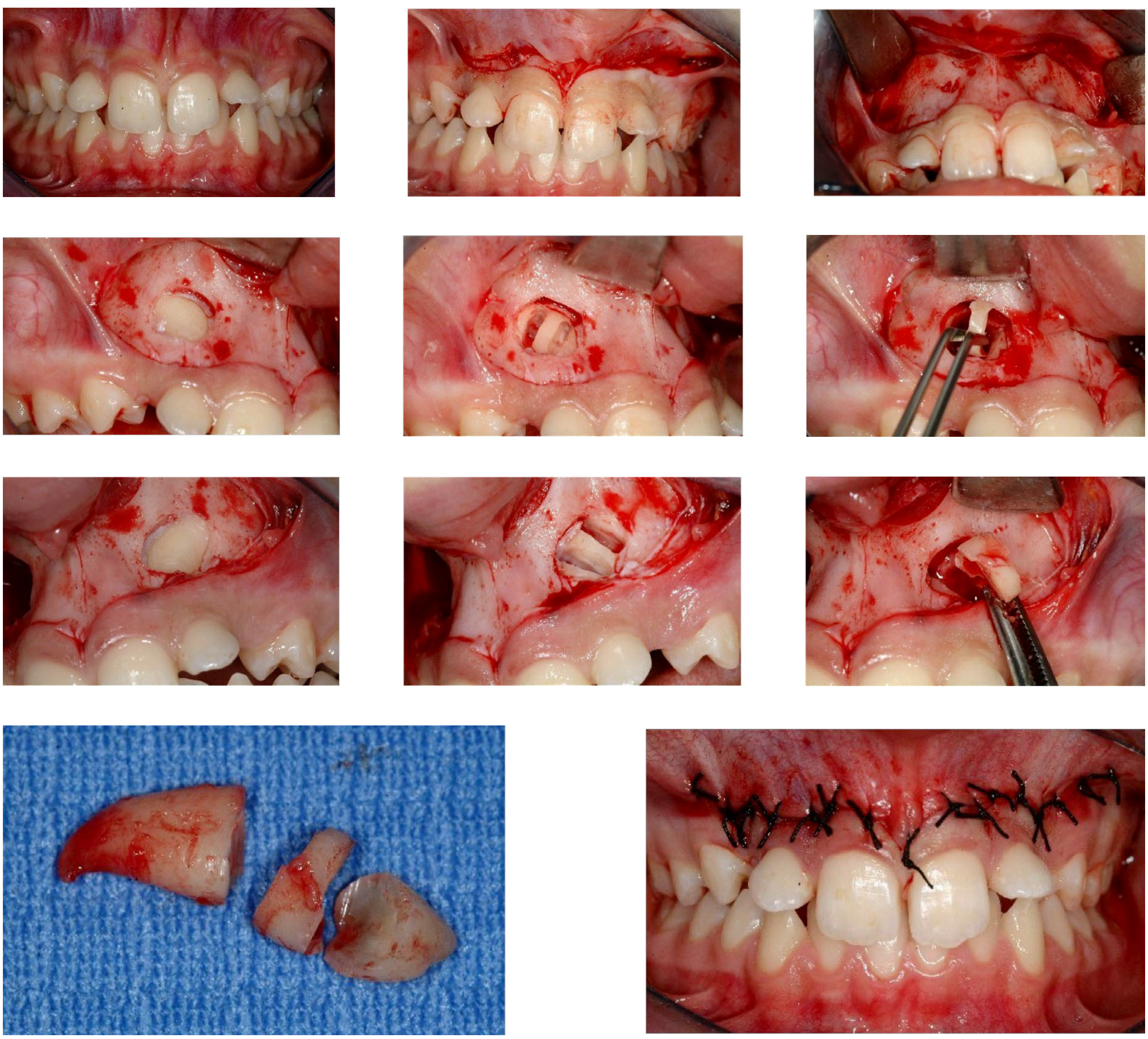

Fig. 2. *Surgical procedures: Mucoperiosteal paramarginal flap; osteotomy and odontotomy; extraction and flap suture.*

Fig. 3. *Six-month-follow-up OPT and intraoral photo.*

is the failed eruption of a permanent tooth with a completely developed root (20, 21). The canine plays important functional and esthetic roles in humans, and altered eruption of these teeth is an important patient concern. The impacted canine is a common clinical problem in dental patients. Maxillary canines are the second most frequently impacted teeth after the third molars, with a prevalence ranging from 0.9 to 5 per cent (22-25). In order to establish a diagnosis, several diagnostic methods have been adopted, which include a variety of radiographs such as intra-oral peri-apical radiographs, orthopantomogram, and cone-beam computed tomography. CBCT technology is currently the most reliable and informative diagnostic tool for impacted teeth, and it can be used for the precise evaluation of clinical strategies, although high radiation dose exposure (15-17). The available treatment options were surgical removal of the impacted canine or surgical exposure and orthodontic repositioning. Surgical removal of the impacted cuspid is indicated if there is evidence of pathology around the tooth or if there is an impingement on adjacent teeth. Commonly the impacted canine is mostly palatal in the maxilla, whereas the mandible is more frequently seen in the labial position (26). In the clinical case described, the position of both maxillary canines appeared in the buccal position, with an erosion of the vestibular cortex. The proximity to the roots of the lateral incisors and the risk of their resorption prompted the therapeutic choice of surgical removal (27).

CONCLUSION

An impacted maxillary canine poses challenging diagnoses and treatment. Therefore, the surgical management of maxillary bilateral impacted canines was adopted to avoid any pathological sequelae or problems to adjacent teeth.

REFERENCES

1. Bass TB. Observations on the misplaced upper canine tooth. *The Dental Practitioner and Dental Record*. 1967;18(1):25-33.
2. Alqerban A, Jacobs R, Lambrechts P, Loozen G, Willems G. Root resorption of the maxillary lateral incisor caused by impacted canine: a literature review. *Clinical Oral Investigations*. 2009;13(3):247-255. doi:10.1007/s00784-009-0262-8
3. Pedro FLM, Bandéca MC, Volpato LER, et al. Prevalence of Impacted Teeth in a Brazilian Subpopulation. *The Journal of Contemporary Dental Practice*. 2014;15(2):209-213. doi:10.5005/jp-journals-10024-1516
4. Sacerdoti R, Baccetti T. Dentoskeletal features associated with unilateral or bilateral palatal displacement of maxillary canines. *The Angle Orthodontist*. 2004;74(6):725-732.
5. Röhrer A. Displaced and impacted canines A radiographic research. *International Journal of Orthodontia, Oral Surgery and Radiography*. 1929;15:1003-1020. doi:10.1016/S0099-6963(29)90386-0
6. Bishara SE. Impacted maxillary canines: A review. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1992;101(2):159-171. doi:10.1016/0889-5406(92)70008-x
7. Frank CA. Treatment options for impacted teeth. *The Journal of the American Dental Association*. 2000;131(5):623-632. doi:10.14219/jada.archive.2000.0236
8. de Oliveira Ribas M, Martins WD, de Sousa MH, et al. Oral and maxillofacial manifestations of familial adenomatous polyposis

(Gardner’s syndrome): a report of two cases. *The Journal of Contemporary Dental Practice*. 2009;10(1):82-90.
9. Bayar GR, Ortakoglu K, Sencimen M. Multiple impacted teeth: report of 3 cases. *European Journal of Dentistry*. 2008;2(1):73-78.
10. Grover PS, Lorton L. The incidence of unerupted permanent teeth and related clinical cases. *Oral Surgery, Oral Medicine, Oral Pathology*. 1985;59(4):420-425. doi:10.1016/0030-4220(85)90070-2
11. Kuftinec MM, Shapira Y. The impacted maxillary canine: I. Review of concepts. *ASDC Journal of Dentistry for Children*. 1995;62(5):317-324.
12. Rayne J. The unerupted maxillary canine. *The Dental Practitioner and Dental Record*. 1969;19(6):194-204.
13. Maverna R, Gracco A. Different diagnostic tools for the localization of impacted maxillary canines: clinical considerations. *Progress in Orthodontics*. 2007;8(1):28-44.
14. Jacobs SG. Localization of the unerupted maxillary canine: How to and when to. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1999;115(3):314-322. doi:10.1016/s0889-5406(99)70335-5
15. Jung Y, Liang H, Benson B, Flint D, Cho B. The assessment of impacted maxillary canine position with panoramic radiography and cone beam CT. *Dentomaxillofacial Radiology*. 2012;41(5):356-360. doi:10.1259/dmfr/14055036
16. Zafar MS, Alrahabi M. Cone Beam Computed Tomography for Exploring Morphology of Mandibular First Molar. *British Journal of Medicine and Medical Research*. 2015;6:514-521.
17. Alrahabi M, Zafar MS. Evaluation of root canal morphology of maxillary molars using cone beam computed tomography. *Pakistan Journal of Medical Sciences*. 2015;31(2). doi:10.12669/pjms.312.6753
18. Lai CS, Bornstein MM, Mock L, Heuberger BM, Dietrich T, Katsaros C. Impacted maxillary canines and root resorptions of neighbouring teeth: a radiographic analysis using cone-beam computed tomography. *The European Journal of Orthodontics*. 2012;35(4):529-538. doi:10.1093/ejo/cjs037
19. Yamamoto G, Ohta Y, Tsuda Y, Tanaka A, Nishikawa M, Inoda H. A new classification of impacted canines and second premolars using orthopantomography. *Asian Journal Oral Maxillofacial Surgery*. 2003;15:31-37.
20. Daskalogiannakis J. *Multilingual Glossary of Orthodontic Terms*. Quintessence Publishing Co, Berlin; 2000.
21. Aktan AM, Kara S, Akgünlü F, Malkoç S. The incidence of canine transmigration and tooth impaction in a Turkish subpopulation. *European Journal of Orthodontics*. 2010;32(5):575-581. doi:10.1093/ejo/cjp151
22. Aydin U, Yilmaz HH, Yildirim D. Incidence of canine impaction and transmigration in a patient population. *Dento Maxillo Facial Radiology*. 2004;33(3):164-169. doi:10.1259/dmfr/15470658
23. Thebault B, Dutertre E. Disimpaction of maxillary canines using temporary bone anchorage and cantilever springs. *International Orthodontics*. 2015;13(1):61-80. doi:10.1016/j.ortho.2014.12.017
24. D’Amico RM, Bjerklin K, Kurol J, Falahat B. Long-term results of orthodontic treatment of impacted maxillary canines. *The Angle Orthodontist*. 2003;73(3):231-238.
25. Laffranchi L, Dalessandri D, Fontana P, Visconti L, Sapelli P. Cone beam computed tomography role in diagnosis and treatment of impacted canine patient’s: a case report. *Minerva Stomatologica*. 2010;59(6):363-376.
26. Chawla S, Goyal M, Marya K, Jhamb A, Bhatia HP. Impacted Canines: Our Clinical Experience. *International Journal of Clinical Pediatric Dentistry*. 2011;4(3):207-212. doi:10.5005/jp-journals-10005-1111
27. Cortellini P, Prato GP, Tonetti MS. The Modified Papilla Preservation Technique. A New Surgical Approach for Interproximal Regenerative Procedures. *Journal of Periodontology*. 1995;66(4):261-266. doi:10.1902/jop.1995.66.4.261

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Case report

REGENERATION OF ATROPHIC POSTERIOR MANDIBULAR RIDGES THROUGH ABSORBABLE CORTICAL CURVED LAMINAE

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ABSTRACT

Numerous techniques have been proposed to increase bone volume before implant insertion. Initially, non-resorbable biomaterials allowed a 'curtain effect' capable of isolating the site to be regenerated and preventing it from being invaded by epithelial cells were used. However, titanium-reinforced membranes allow excellent dimensional stability but require a second removal procedure and are difficult to manage in case of dehiscence. Here, a technique that uses a curved heterologous cortical lamina to cover a bone defect between two peaks is reported. The curved bone plate creates a containment space filled with pre-hydrated and collagenated granules. They will be subsequently reabsorbed and transformed into bone. The excellent vascularization of the graft combined with the integration of the lamina (which must not be removed) allows us to propose this technique as a potential alternative to those used so far.

KEYWORDS: *Bone, grafting, surgery, regeneration, osteoblast*

INTRODUCTION

Currently, the development of an increasingly predictable implantology associated with the lengthening of the life of patients makes it necessary to place dental implants for prosthetic purposes, even in areas with severe atrophy. Managing free distal saddles is particularly difficult, especially in the mandibles.

In modern implantology, the progress of biomaterial and implant techniques allows for facing complex clinical situations with highly predictable solutions. For example, placing short (1) and narrow (2) implants in edentulous ridges allows oral rehabilitation in reduced bone height and width. For example, short dental implants effectively restore function (1, 3) and can achieve acceptable long-term results even in an unfavourable crown-to-root ratio (4). However, some of

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these alternatives are not possible in cases of severe ridge atrophy. In areas with mild vertical atrophy (≤ 3mm), more conservative approaches (such as orthodontic extrusions) are often recommended. However, in case of major atrophy, it is necessary to use bone regeneration techniques (GBR) or onlay bone graft (OBG) (5). Furthermore, not only the extent of the defect but also the location of the defect could play a fundamental role in deciding which procedure is best.

In the atrophic maxilla, sinus lift has shown high reliability (6) while, in the atrophic mandible, GBR (7, 8), osteogenetic distraction (9) and block grafts (10) give less predictable results; this may be due to the mandible's different bone density and composition (11).

For example, bone microarchitecture (i.e., bone density or quality) is determined by the combination of factors associated with trabecular morphology and porosity (12). In addition, the maxilla has less dense bone than the mandible, where there is more bone (13, 14). These characteristics can have a negative impact on the vascularity of the site to be regenerated (15). Consequently, to resolve severe atrophy, a perfect evaluation of the hard and soft tissues must be made, and the most effective technique has to be chosen.

Here, a technique is proposed for the vertical and horizontal reconstructions of atrophic ridges in which a curved heterologous cortical plate is grafted (OsteoBiol® Lamina®, Tecnoss®, Giaveno, Italy). The lamina covers a bone defect between two peaks to create a containment site that can be filled with hydrated and collagenated granules of porcine origin (OsteoBiol® mp3®, Tecnoss®). They will be reabsorbed and transformed into bone (Lamina, MP3, osteobiol Roen, Italy) (16-19).

CASE REPORT

A 65-year-old man came to our clinic without teeth 45 and 46 extracted 3 years before. The site showed a posterior right mandibular bone loss in which the buccal and lingual walls were missing. Therefore, there was a reduced vertical and horizontal d dimension.

During the first surgical phase, a wide flap was prepared to extend up to the ipsilateral cuspid, in which a relief cut was made. Next, a crestal incision was made between 44 and 47. Once the site was skeletonized, the fibrous residues were removed. The bone crest showed a measure of 7 mm horizontally and a vertical deficit of 3 mm (Fig 1-4).

The requirements for applying this technique are the stability of the lamina (OsteoBiol® Lamina®) and the presence of bone peaks mesial and distal to the alveolar crest defect. A curved heterologous cortical plate was suitably shaped to cover the bone defect between the mesial peaks at 47 and distal at 44. The curved lamina creates a containment site that could be filled with pre-hydrated and collagenated granules of porcine origin (OsteoBiol® mp3®). It subsequently will

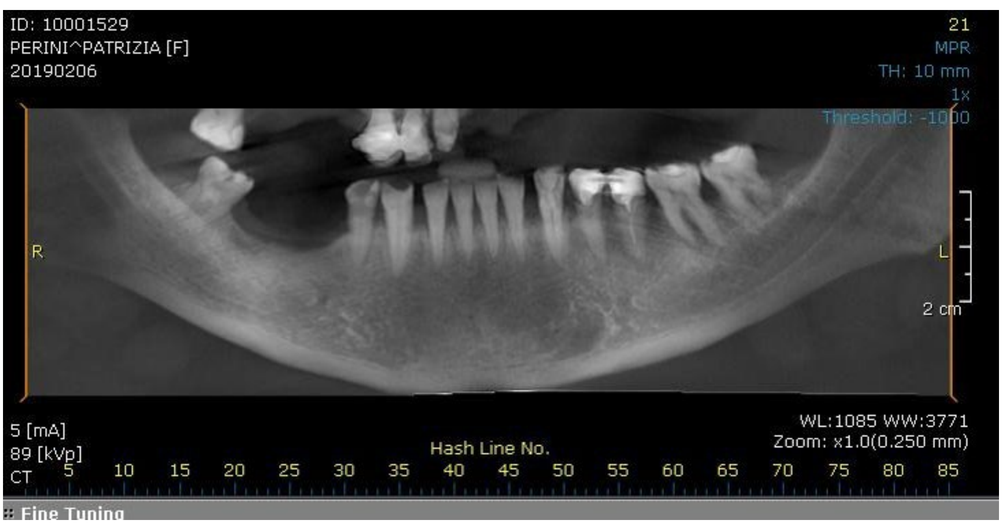

Fig. 1. *TC Cone Beam pre-surgical site, Panorex.*

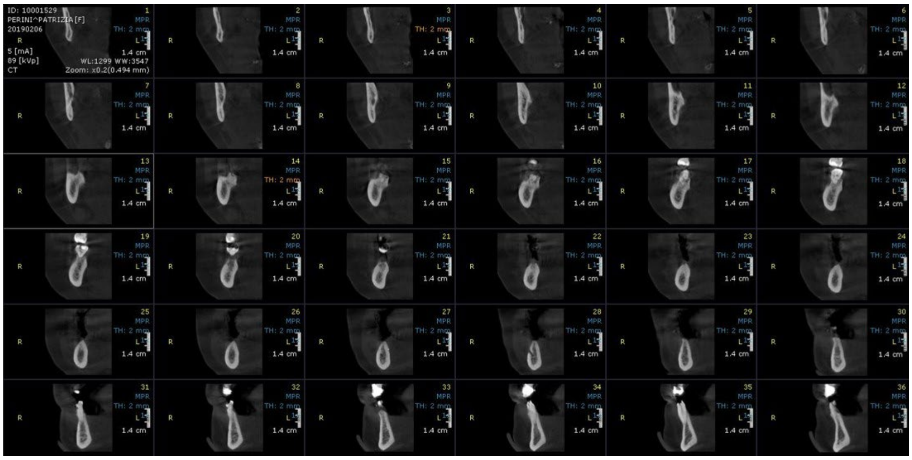

Fig. 2. *TC Cone Beam pre-surgical site, sections of the posterior mandible.*

be reabsorbed and transformed into bone. The pre-hydrated and collagenated granules cover the site and fill the curved barrier inside (Fig 5-10).

The lamina was fixed through two threaded pins (Roen, Turin, Italy) on the apical part of the crest and included the mesial and distal bone spikes to the defect (Fig 11-13).

Patients returned for a second surgical step after six months since it was the proper time for fixture insertion. Upon re-entry, it was possible to see newly formed bone and the complete integration of the inserted lamina. Then implants were inserted.

Fig. 3. *Pre-surgical site that focus deficit of bone ridge.*

DISCUSSION

Numerous techniques are proposed to increase both horizontally and vertically mandibular saddles before implant insertion. Both autologous and heterologous blocks have often been used with extreme difficulty as well as short implants (1-4).

Bone atrophy in the posterior mandible causes difficulties in the vertical, transverse, and sagittal planes, which may result in improper implant placement from a functional and aesthetic point of view (20).

Furthermore, not only the extent but also the location of the defect could play a role in deciding which procedure to choose.

There are numerous techniques proposed in order to increase the mandibular bone bases both horizontally and vertically for implant purposes, such as:

- onlay grafts in which the graft material is placed above the residual ridge to achieve horizontal and vertical augmentation. In this technique, the graft must be immobilized with dental implants or synthetic peans, screws or plates (21);
- inlay grafting, after having split the alveolar ridge horizontally, a graft material is placed between the two sections (21);
- ridge expansion, where an alveolar ridge is split vertically, and an implant is inserted into the space (22);

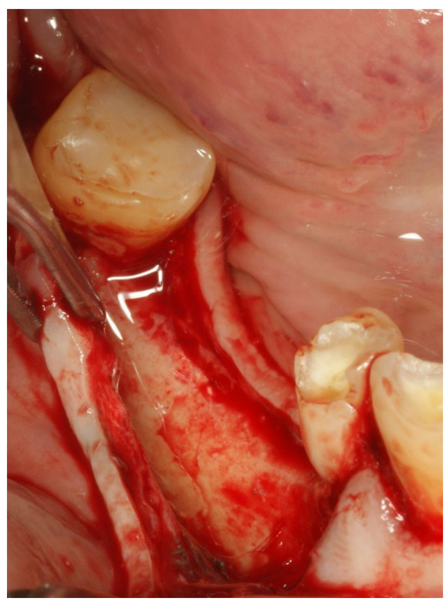

Fig. 4. *Flap elevation.*

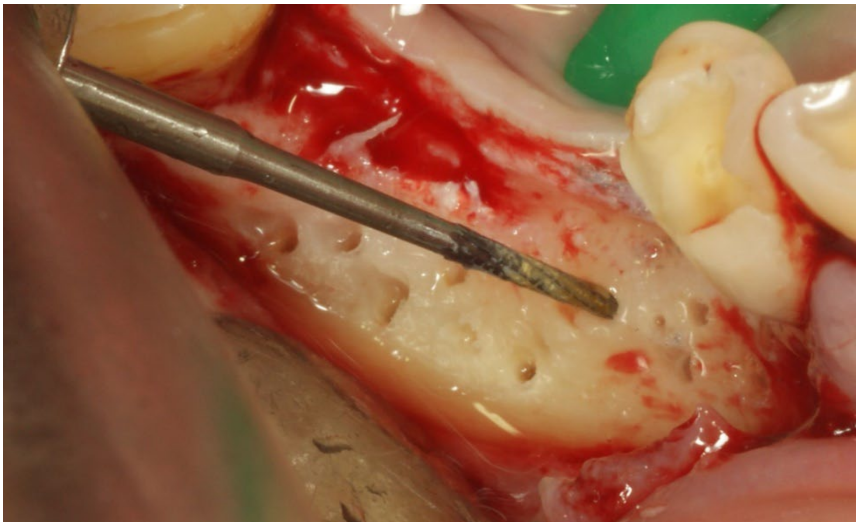

Fig. 5. *Residual alveolar crest is refreshed by doing holes to get blood from inside bone tissue.*

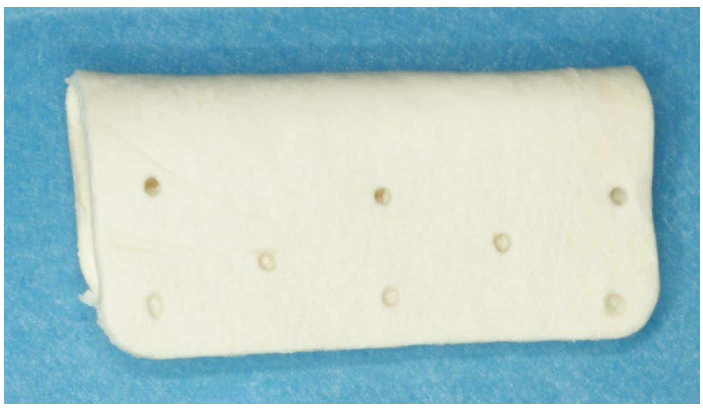

Fig. 6. *Shaped heterologous curved lamina.*

Fig. 7. *Shaped heterologous curved lamina filled with cortico-cancellous graft.*

Fig. 8. *Sh aped heterologous curved lamina placed onto the alveolar crest.*

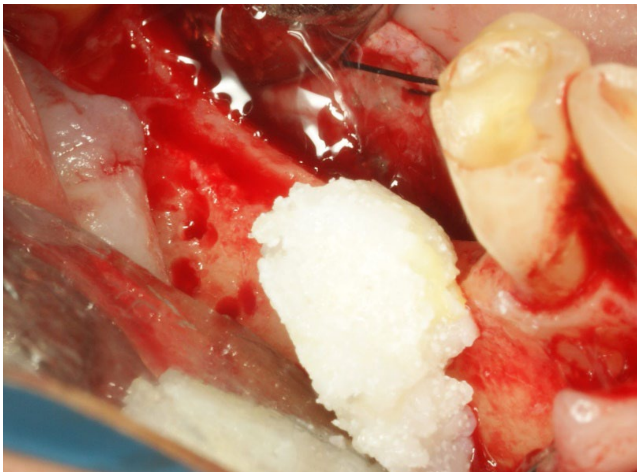

Fig. 9. *Cortico-cancellous graft onto the residual alveolar ridge.*

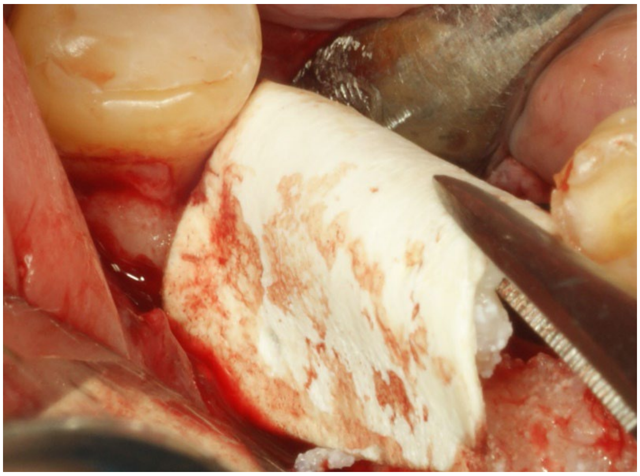

Fig. 10. *Shaped heterologous curved lamina filled with cortico-cancellous graft*

Fig. 11. *Fixation of the shaped heterologous curved lamina*

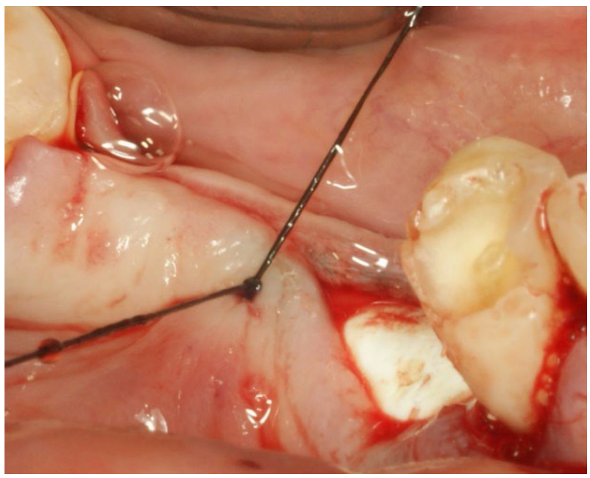

Fig. 12. *Closure of the flap*

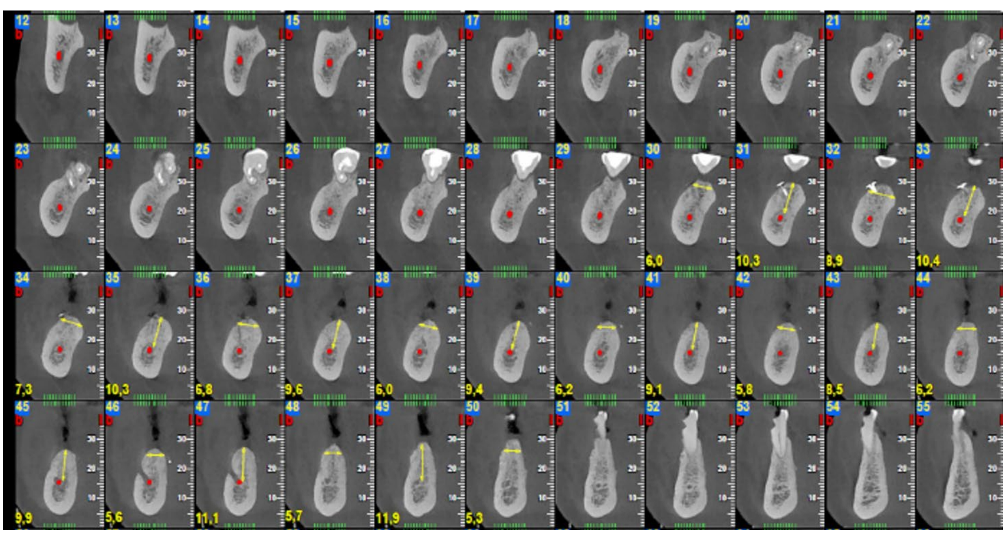

Fig. 13. *Post operative RX*

- distraction osteogenesis is a gradual and controlled displacement of a surgically prepared fracture. The two bone fragments are slowly separated, and new bone will arise in the empty space (23).
- in contrast, Guided Bone Regeneration (GBR) involves a space maintained by a barrier membrane, which will fill a graft of resorbable and transformable material with new bone (24).

Several materials can be used for augmentation:

- autogenous bone graft, biologically the "gold standard," is totally compatible and used as a scaffold for new bone formation (25);
- allografts are taken from different human donors and then frozen or demineralized and frozen (24);
- xenograft, a material derived from animals, processed in order to remove the organic component (26);
- an alloplastic graft is a synthetic bone substitute consisting of bioactive glass or calcium phosphates (27);
- osteoinductive material that can stimulate the differentiation into osteoblasts and accelerate the formation of new bone;
- the most common are bone morphogenetic proteins (BMPs), platelet-rich plasma (PRP), and leukocytes Platelet-rich fibrin (L-PRF)30.

Each type of augmentation material can be used in combination with a variety of different surgical techniques. For example, using curved heterologous cortical plates (OsteoBiol® Lamina®) covering a bone defect between two peaks creates a containment site that can be easily filled with pre-hydrated and collagenated granules of porcine origin (OsteoBiol® mp3®). Next, the grafting bed is refreshed, and holes are performed so that granules can be reached by the blood and triggers the transformation of grafted material into bone. This last will be capable of containing fixtures and supporting prosthetic crown.

Based on our experience, it is possible to propose this technique as an alternative to those previously used. However, further clinical and histological work is needed fully evaluate the technique's effectiveness.

REFERENCES

1. Monje A, Chan HL, Fu JH, Suarez F, Galindo-Moreno P, Wang HL. Are Short Dental Implants (<10 mm) Effective? A Meta-Analysis on Prospective Clinical Trials. *Journal of Periodontology*. 2013;84(7):895-904. doi:10.1902/jop.2012.120328
2. Ortega-Oller I, Suárez F, Galindo-Moreno P, et al. The Influence of Implant Diameter on Its Survival: A Meta-Analysis Based on Prospective Clinical Trials. *Journal of Periodontology*. 2014;85(4):569-580. doi:10.1902/jop.2013.130043
3. Monje A, Suarez F, Galindo-Moreno P, García-Nogales A, Fu JH, Wang HL. A systematic review on marginal bone loss around short dental implants (<10 mm) for implant-supported fixed prostheses. *Clinical Oral Implants Research*. 2013;25(10):1119-1124. doi:10.1111/clr.12236
4. Garaicoa-Pazmiño C, Suárez-López del Amo F, Monje A, et al. Influence of Crown/Implant Ratio on Marginal Bone Loss: A Systematic Review. *Journal of Periodontology*. 2014;85(9):1214-1221. doi:10.1902/jop.2014.130615
5. Wang HL, Al-Shammari K. HVC ridge deficiency classification: a therapeutically oriented classification. *The International Journal of Periodontics & Restorative Dentistry*. 2002;22(4):335-343.
6. Wallace SS, Froum SJ. Effect of Maxillary Sinus Augmentation on the Survival of Endosseous Dental Implants. A Systematic Review. *Annals of Periodontology*. 2003;8(1):328-343. doi:10.1902/annals.2003.8.1.328
7. Llambés F, Silvestre FJ, Caffesse R. Vertical guided bone regeneration with bioabsorbable barriers. *Journal of Periodontology*. 2007;78(10):2036-2042. doi:10.1902/jop.2007.070017
8. Amorfini L, Migliorati M, Signori A, Silvestrini-Biavati A, Benedicenti S. Block Allograft Technique versus Standard Guided Bone Regeneration: A Randomized Clinical Trial. *Clinical Implant Dentistry and Related Research*. 2014;16(5):655-667. doi:10.1111/cid.12040
9. Robiony M, Zorzan E, Polini F, Sembronio S, Toro C, Politi M. Osteogenesis distraction and platelet-rich plasma: combined use in restoration of severe atrophic mandible. Long-term results. *Clinical Oral Implants Research*. 2008;19(11):1202-1210. doi:10.1111/j.1600-0501.2008.01568.x
10. Pelo S, Boniello R, Moro A, Gasparini G, Amoroso PF. Augmentation of the atrophic edentulous mandible by a bilateral two-step

osteotomy with autogenous bone graft to place osseointegrated dental implants. *International Journal of Oral and Maxillofacial Surgery*. 2010;39(3):227-234. doi:10.1016/j.ijom.2009.11.004

11. Bertl K, Subotic M, Heimel P, Schwarze UY, Tangl S, Ulm C. Morphometric characteristics of cortical and trabecular bone in atrophic edentulous mandibles. *Clinical Oral Implants Research*. 2015;26(7):780-787. doi:10.1111/clr.12340
12. Ribeiro-Rotta RF, Lindh C, Rohlin M. Efficacy of clinical methods to assess jawbone tissue prior to and during endosseous dental implant placement: a systematic literature review. *The International Journal of Oral & Maxillofacial Implants*. 2007;22(2):289-300.
13. Monje A, Suarez F, Garaicoa CA, et al. Effect of Location on Primary Stability and Healing of Dental Implants. *Implant Dentistry*. 2014;23(1):69-73. doi:10.1097/id.0000000000000019
14. Monje A, Wu Y, Huang W, et al. Influence of Posterior Mandibular Dimensions on Alveolar Bone Microarchitecture. *The International Journal of Oral & Maxillofacial Implants*. 2017;32(2):423-430. doi:10.11607/jomi.5144
15. Wang HL, Boyapati L. "PASS" Principles for Predictable Bone Regeneration. *Implant Dentistry*. 2006;15(1):8-17. doi:10.1097/01.id.0000204762.39826.0f
16. Barone A, Aldini NN, Fini M, Giardino R, Calvo Guirado JL, Covani U. Xenograft Versus Extraction Alone for Ridge Preservation After Tooth Removal: A Clinical and Histomorphometric Study. *Journal of Periodontology*. 2008;79(8):1370-1377. doi:10.1902/jop.2008.070628
17. Rinna C, Ungari C, Saltarel A, Cassoni A, Reale G. Orbital Floor Restoration. *Journal of Craniofacial Surgery*. 2005;16(6):968-972. doi:10.1097/01.scs.0000186308.16795.8b
18. Grenga PL, Reale G, Cofone C, Meduri A, Ceruti P, Grenga R. Hess Area Ratio and Diplopia: Evaluation of 30 Patients Undergoing Surgical Repair for Orbital Blow-Out Fracture. *Ophthalmic Plastic & Reconstructive Surgery*. 2009;25(2):123-125. doi:10.1097/iop.0b013e31819a41d5
19. Wachtel H, Fickl S, Hinze M, Bolz W, Thalmair T. The Bone Lamina Technique: A Novel Approach for Lateral Ridge Augmentation—A Case Series. *The International Journal of Periodontics and Restorative Dentistry*. 2013;33(4):491-497. doi:10.11607/prd.1248
20. Chiapasco M, Casentini P, Zaniboni M. Bone augmentation procedures in implant dentistry. *The International Journal of Oral & Maxillofacial Implants*. 2009;24(Suppl):237-259. https://pubmed.ncbi.nlm.nih.gov/19885448/
21. Kahnberg KE, Nystrom E, Bartholdsson L. Combined use of bone grafts and Brånemark fixtures in the treatment of severely resorbed maxillae. *The International Journal of Oral & Maxillofacial Implants*. 1989;4(4):297-304.
22. Elian N, Jalbout Z, Ehrlich B, et al. A Two-Stage Full-Arch Ridge Expansion Technique: Review of the Literature and Clinical Guidelines. *Implant Dentistry*. 2008;17(1):16-23. doi:10.1097/id.0b013e318166d3a3
23. Chin M. Distraction osteogenesis for dental implants. *Atlas of the Oral and Maxillofacial Surgery Clinics of North America*. 1999;7(1):41-63.
24. Milinkovic I, Cordaro L. Are there specific indications for the different alveolar bone augmentation procedures for implant placement? A systematic review. *International Journal of Oral and Maxillofacial Surgery*. 2014;43(5):606-625. doi:10.1016/j.ijom.2013.12.004
25. Palmer P, Palmer R. Implant surgery to overcome anatomical difficulties. *British Dental Journal*. 1999;187(10):532-540. doi:10.1038/sj.bdj.4800325
26. Browaeys H, Bouvry P, De Bruyn H. A Literature Review on Biomaterials in Sinus Augmentation Procedures. *Clinical Implant Dentistry and Related Research*. 2007;9(3):166-177. doi:10.1111/j.1708-8208.2007.00050.x
27. Wheeler SL. Sinus augmentation for dental implants: The use of alloplastic materials. *Journal of Oral and Maxillofacial Surgery*. 1997;55(11):1287-1293. doi:10.1016/s0278-2391(97)90186-5