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Multidisciplinary Approach to an Asymmetric Traumatic Occlusion: A Case Report

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Abstract: *The case of a 47-year-old female patient with an asymmetric traumatic occlusion, great alveolar destruction in the mandibular left central incisor, gingival recession with attachment loss and lack of keratinized tissue more accentuated in the crossbite teeth is described. This situation was caused by the traumatic position of the teeth, aggravated by a forced asymmetric anterior position of the mandible and aggravated by mandibular movements. After the extraction of the left central mandibular incisor, keratinized tissue reconstruction and alveolar bone regeneration were performed to obtain enough bone to move the adjacent teeth in this direction and allow the correct placement of an implant at the end of orthodontic treatment. The orthodontic treatment achieved general stable occlusal contacts and esthetic results that were finalized with a definitive prosthetic treatment. This interdisciplinary management was important to solve in the present case the seriously compromised function and esthetics that would never be achieved without this combination.*

Key Words: *Periodontics; orthodontics; implants; traumatic occlusion.*

Introduction

A traumatic occlusion can be a risk factor to periodontal disease in the anterior region of the mouth. This is caused by strong anterior contacts and consequently bone loss. Additionally, if the patient originally has dental and/or skeletal orthodontic problems, the severe loss of periodontal tissues worsens or adversely affects such problems.[1, 2]

One of the main objectives of the orthodontic treatment is to help the control of periodontal disease by creating a healthy physiologic typology in the alveolar bone through alterations in radicular positioning.[3]

There is no restriction to orthodontic treatment in patients with periodontal disease, as long as the disease is under control.[1, 2, 4] Nevertheless, if the bone loss is very significant around the affected tooth, the orthodontic goals and mechanics should be modified, with the help of restorative, prosthodontic and/or surgical procedures.[1, 2, 5]

Orthodontic treatment is complicated in patients with cant of the occlusal plane associated with periodontally compromised teeth.[1] When there are also severe skeletal components associated with a cant of the occlusal plane, such as a vertical growth pattern and a retruded mandible, a combined surgical approach would be the best treatment option.[6]

Diagnosis and Etiology

A 47-year-old woman complained about the unattractive appearance of her protruding mandibular teeth on the right side. Also about the high mobility of the left central incisor, asymmetric appearance of her smile showing different heights on both incisors sides, and the dysfunctional aspect of her masticatory system (Figs. 1-3).

The smile photo showed asymmetry of the lower third of the face and a shift of the mandible to the right, with an occlusal plane canted upward on the same side (Figure 3).

Intra oral photos exhibited a Class I molar and canine relationship, exception on the right cross-bite canines that presented a Class II relationship. The mandibular dental midline showed 4 mm deviation to the right shift side in relation to the maxillary dental midline. No crowding was present, however a slight narrowing arch was present on the lateral and anterior right maxilla arcade due to lingual inclination from the right central incisor to the second premolar. On the other hand on the mandibular arcade there was a labial inclination on teeth that were in a crossbite relation (from lateral incisor to second premolar) (Figure 4).

Generalized moderate chronic periodontitis was present, except on the mandibular left central incisor and on mesial face of the adjacent teeth region (mesial face of left lateral incisor and right central incisor), that presented an advanced localized chronic periodontitis with complete alveolar bone destruction on the mandibular left central incisor (Figs. 1a and 3). Due to this condition, the mandibular left central incisor was removed and alveolar bone regeneration was performed at the time of scaling and root planning (initial periodontal treatment phase) (Figure 1b, c). A free gingival graft was performed on the mandible incisor region in order to stabilize, improve periodontal inflammation and control periodontal support loss. After keratinized tissue gain, bone regeneration was preformed to improve crestal bone condition and width before orthodontic tooth movement (Figure 1d-f).

In the panoramic radiograph, we can observe that the crown of mandibular left central incisor was extracted and bonded to the adjacent teeth with composite resin. The alveolar bone destruction of the mandibular left central incisor region was also present, with a large space between the adjacent roots, more divergent on the right central incisor. The right mandibular third molar was present (Figure 5).

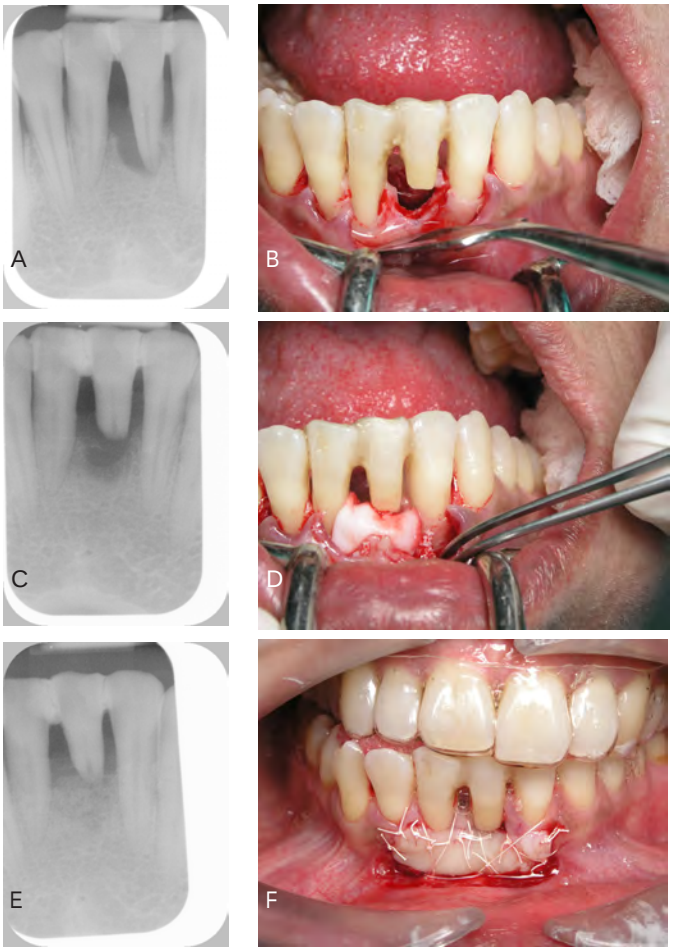

Figure 1. Periodontal treatment on the left central incisor region and periapical x-ray control; a) severe destruction of the alveolar bone; b, c) after the extraction and its crown retained in the adjacent teeth with composite resin; d, f) enamel protein derivative (EMDOGAIN®) and a hydroxiapatite (Bio-oss®) regeneration with a collagen membrane; e) after the free gingival graft.

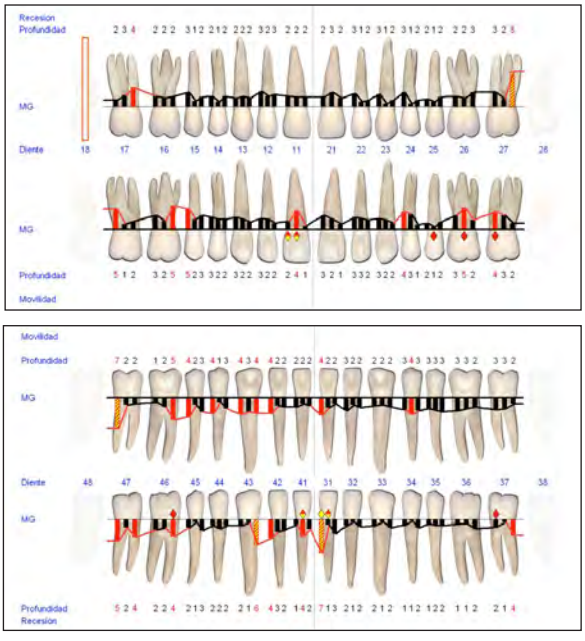

Figure 2. Initial periodontogram.

Figure 3. Pretreatment facial and intraoral photos, after the free gingival grafts and alveolar bone regeneration, with the crown of the left mandibular incisor retained in the adjacent teeth with composite resin.

Figure 4. Pretreatment dental casts.

Figure 5. Pretreatment panoramic x-ray.

On the cephalometric analysis at maximum intercuspidation (Figure 6 and Table 1), the patient presented a skeletal Class I relationship (ANB= 2.6 mm), but a Class III in the sagittal disparity between Ao and Bo (-3.7mm); hypodivergent mandibular pattern (FMA=20.7º); the mandibular incisors were proclined (IMPA= 102.8º), but the maxillary incisor was in a normal inclination, so the interincisal angle was a little low (122.4º). The overjet and the overbite were normal (1.8 and 3.1 mm respectively).

The patient complained of temporomandibular joint (TMJ) pain during mouth opening and difficulty in eating due to masticatory dysfunction.

Treatment Objectives

The treatment objectives established for this patient were:

1) extraction of mandibular left central incisor treatment to control the ongoing periodontal disease;

2) gain of keratinized tissue at mandible incisor region;

3) orthodontic treatment with occlusal plane reconstruction for levelling, extruding and correcting torque of the teeth that were in a cross-bite condition to improve the smile and occlusal trauma as well as the periodontal problem;

4) dental implant on the central mandibular left incisor, initially with a provisory crown, later replaced by a definitive fixed supported prostheses at the end of the orthodontic treatment.

Treatment Progress

Periodontal Treatment

The periodontal disease was treated by non-surgical and surgical methods (Figure 1). An hygienic phase of plaque control was initiated and full mouth scaling and root planning was performed in two separate appointments. After the extraction of the mandibular left central incisor, a surgical phase of periodontal treatment was attempted in the residual bone as well as in the mesial surface of the adjacent teeth (left lateral incisor and right central incisor). Also a free gingival graft from the palate was sutured to this area, in order to improve keratinized tissue amount. Periodontal /bone regeneration was performed applying enamel protein derivative gel (EMDOGAIN®) and a hydroxyapatite (Bio-oss®) (Figure 1d-f).

The extracted crown of mandibular left central incisor was retained in the adjacent teeth with composite resin. The right mandibular third molar was extracted. Periodontal control visits were scheduled every three months during orthodontic treatment.

Orthodontic treatment

The orthodontic treatment was initiated three months after the periodontal treatment. In the first stage, a fixed appliance 0.022" slot was applied on maxillary and mandibular arcade. For initial maxillary and mandibular teeth alignment 0.014" and 0.018" nickel titanium arches were used, later replaced by stainless arches, 0.018", 0.016 x 0.022" and 0.018 x 0.025" on the mandibular arcade (Figure 7).

In order to move the ~~left~~ mandibular teeth to a more mesial position, and to allow the mesial root movement of the right mandibular central incisor, tooth material was removed

Table 1. Cephalometric analysis before and after treatment.

Cephalometric Analyse	Norm	Before T	After T
FMIA	67º+ 3º	56.5º	60.4º
FMA	25º+ 3º	20.7º	22.9º
IMPA	88º+ 3º	102.8º	96.7º
SNA	82º+ 2º	83.2º	84.7º
SNB	80º+ 2º	80.6º	81.2º
ANB	1º- 5º	2.6º	3.5º
Ao Bo	2mm+ 2	-3.7mm	-2.4mm
UI/NA	22º+2º	20.6º	18º
Angle Z	75º+ 5º	76.2º	77.8º
Overjet	2.5mm+ 2.5	1.8mm	2.1mm
Overbite	2.5mm+ 2.5	3.1mm	2.8mm
Interincisal Angle	126º+ 10º	122.4º	130.6º

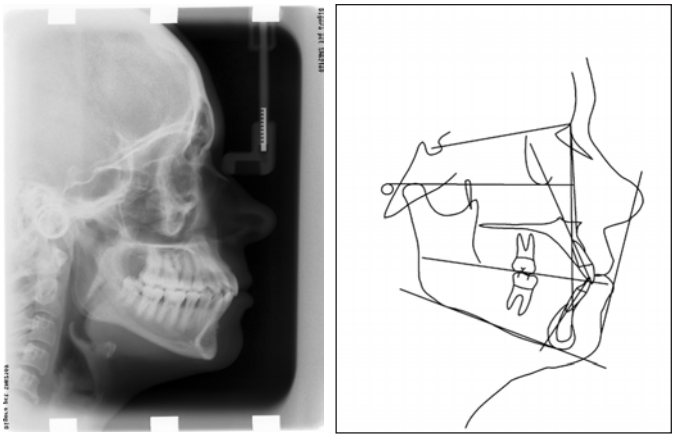

Figure 6. Pretreatment cephalometric x-ray.and tracing.

Figure 8. Intra-oral photos at the end of orthodontic treatment with a temporary acrylic tooth with normal measures adapted in the mandibular left central incisor place.

Figure 9. Extra and intra-oral photos after the orthodontic treatment.

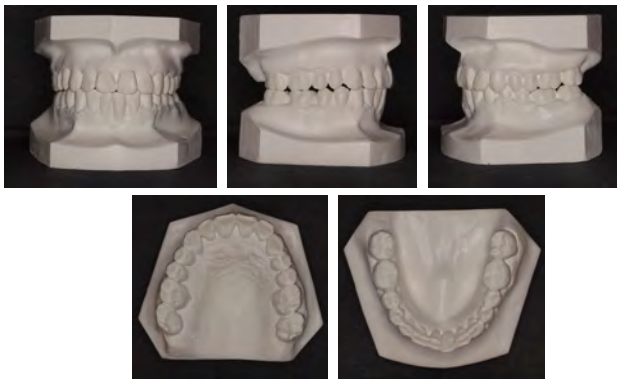

Figure 10. Posttreatment dental Casts.

on the mesial face of the crown of the left central incisor that was extracted and ligatured to the wire. On the rectangular stainless arches, the teeth that were in a crossbite position were compensated with additional torque. A positive torque was applied from the maxillary right central incisor to the second premolar. On the mandibular arch, a negative torque was applied from lateral incisor to second premolar.

One year after the beginning of the orthodontic treatment, a sectional and full multiloop edgewise arch wire (0.016 x 0.022"stainless steel) was applied respectively on the maxillary and mandibular arcade to increase the vertical dimension on the teeth that were in a crossbite position.

Class I and Class III elastics were applied on the right and left side respectively to obtain a synergetic effect during vertical compensation by extrusion of the teeth since the right central incisor to the second premolar on the maxillary arcade and intrusion from lateral incisor to second premolar on the mandibular arcade.

Figure 11. Posttreatment panoramic x-ray.

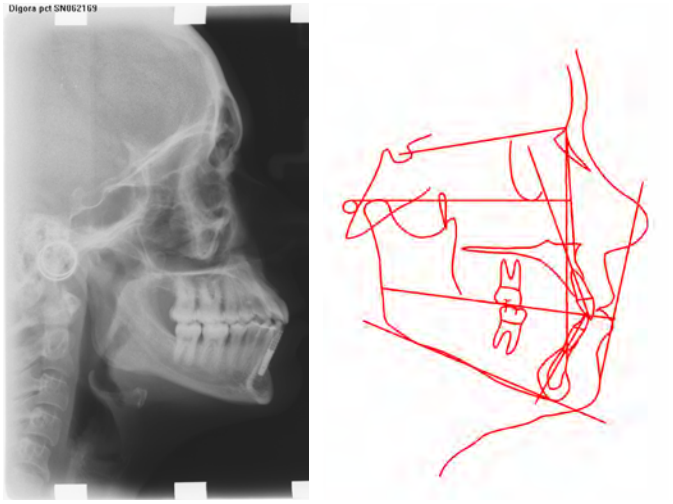

Figure 12. Posttreatment lateral cephalometric x-ray and tracing.

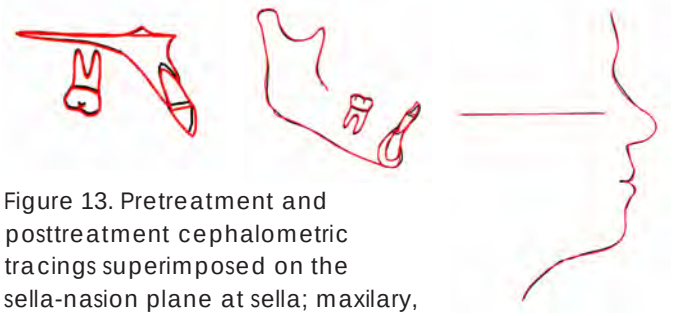

Figure 13. Pretreatment and posttreatment cephalometric tracings superimposed on the sella-nasion plane at sella; maxilary, mandibular and perfil superpositions. Red lines, posttreatment; black lines, pretreatment.

Figure 14. Intraoral photos after cervical composite restorations on the lower and upper incisors crowns.

A nitinol open coil spring was applied between the distal face of brackets on the crown on the left central incisor (that was extracted and ligatured to the wire) and the adjacent lateral central incisor. This was to increase the synergetic effect of the Class III elastic and move the mandibular left teeth to a more distal position to improve the canine Class I relation. Then a temporary acrylic tooth with normal measures was inserted in the mandibular left central incisor place. An implant was applied four months before the end of the active orthodontic treatment (Figure 8).

The active treatment took 22 months. Photographs, dental casts, panoramic and cephalometric x-rays were done at the end of the treatment and impressions were taken to elaborate a maxillary wrap-around. In the mandible a lingual bonded retainer was placed on the lingual surfaces of the lower incisors and canines. On the same day that the orthodontic appliance was removed, the temporary crown was affixed to the implant to improve the adjacent soft tissue (Figure 9).

Treatment Results

The major goal of obtaining a stable dental articulation was accomplished, partly due to compensation of teeth torque and a good patient collaboration in the use of intra-oral elastics. After-treatment photographs showed a Class I canine relation, in spite of a slightly lower dental midline deviation to the right that persisted. However, there was an acceptable overjet and overbite relation (Figs. 9 and 10). The final panoramic radiograph (Figure 11) confirmed good root positioning in general, specifically on the teeth that are near the implant. The cephalometric superimposition at the end of the treatment (Figure 12 and Table 1) allowed us to visualize the changes that occurred during the treatment (Fig.13). Frontal facial smile analysis showed that the canted occlusal plane was improved and that right and left facial height were more symmetrical (Figure 9).

Restorative treatment

The final ceramic crown restoration was done, approximately one year after the end of orthodontic treatment (Figs. 14 and 15). The significant deficiencies in the harmonious gingival scallop were not improved to a satisfactory level. So, cervical pink composite restorations were placed on the lower incisors adjacent to the implant. On the maxillary incisors the black holes were due to a triangular morphology. Then normal composite restorations were placed to improve the incisors morphology and papilla formation and also to fill the black holes for esthetic reasons (Figure 14).

Discussion

In mandibular lateral deviation, the mandible is not the only structure that is displaced. The maxilla is also affected. In the present case this confirmation was evident in the smile photograph with asymmetry of the occlusal plane, which was upward in the cross-bite side.[6]

Usually, the chin moves to the side where the maxillary height is lower just to get in occlusion.[7] The orthodontist clinician, therefore, should realize that midline discrepancy is

Figure 15. Dental Casts, after cervical composite restorations on the lower and upper incisors crowns.

only one of the various symptoms of the mandibular lateral displacement and that occlusal deviation and displacement of the mandible may be induced by craniomaxillary system dysfunction in growing children. With this in mind, we will be able to administer the best and simplest treatment to the patient by affecting skeletal improvement and help the masticatory system withstand the rigors of long-term function.[8]

The customary masticating side is usually the side that has the lower vertical dimension [9]. The torque and vertical teeth compensation on crossbite teeth, as well as the Class I elastics on the right side and short Class III elastics on the left side became essential to increase the vertical dimension on this side, thereby allowing a right Class I canine relation. In addition, for the extrusion, the loops activation was important to apply differentiated orthodontic forces on each side and use of intermaxillary elastics as an additional orthodontic force device was indispensable. In these periodontal compromised teeth, the loops allowed light orthodontic forces that should be applied to minimize further attachment loss, tipping movement and root resorption.[1, 10]

This is a periodontal patient presenting localized advanced chronic periodontitis affecting mainly the teeth that were in a cross-bite condition. The mandibular central incisor presented a challenge due to a severe periodontal bone loss in this region worsened by a high traumatic occlusion during mandibular movements. The occlusal trauma, allows increased vascularity, vascular permeability and osteoclast activity during the traumatic event.[11] Therefore, secondary trauma from occlusion (ie, premature and balance contacts) is frequently seen in periodontally compromised patients and is positively correlated with the severity of attachment loss.[12]

In the present case, one way to control traumatic movements was through disarticulation of the displaced teeth that were in a cross-bite and its compensation with additional torque in order to eliminate the traumatic occlusion.

Dentitions with reduced periodontal support show a marked tendency to return to their pretreatment position following active appliance therapy, however the correct overjet and overbite at the end of the treatment are also indispensable to stabilize the dental relation.

The vestibular gingival recession did not improve at the

end of the treatment, however no bone destruction occurred on the interproximal faces as seen in the radiograph at the end of orthodontic treatment. In the past, it was assumed by authors that when keratinized gingiva levels where less than 2 mm there was indication for a free gingival graft.[13-15] In the present case, due to advanced localized chronic periodontitis with complete alveolar bone destruction on the mandibular left central incisor region, it was necessary to apply a free gingival graft to enlarge the keratinized tissue. Also to improve the periodontal regeneration in bone defects, so as to obtain enough bone to move the adjacent teeth in this direction and allow the correct placement of an implant at the end of orthodontic treatment.

In this case the mandibular left anterior teeth before orthodontic treatment, had a particular predisposition to flare and elongate because they had no anteroposterior contacts due to a cross-bite.

Although orthodontic intrusion was planned as a beneficial treatment approach for patients with pathologic migration,[1] in the present case extrusion was done in the teeth that were in a cross-bite condition, in order to improve the open bite tendency.[16] In spite of not being the best option because pathological tooth migration involving the extrusion of teeth which already had long clinical crowns.

The collapse of the interproximal papillary dimension and the dark triangles created an unpleasant negative gingival architecture, with esthetic and functional implications. In spite of significant improvement of the gingivo-marginal condition at the end of the orthodontic therapy, black holes in gingival embrasures were present. These interproximal spaces and gingival margins were camouflaged by pink restorative composite procedures in the lower incisor teeth adjacent to the implant to replace the papillar haping that was lost due to the high gingival recession. the other hand, on the upper incisors, a white composite restoration was done to reshape normal morphology of central incisors that were slightly triangular.

This case clearly demonstrates the importance of interdisciplinary management to solve seriously compromised functional and esthetic adu ses that would never be achieved without this combination.

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