MOLAR EXTRACTION IN SEVERE OPEN BITE TREATMENT

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ABSTRACT

Treatment of anterior open bite in adults is a great challenge to the orthodontist. When the open bite is skeletal, it increases the difficulty of its correction and stability of the results at the end of treatment. Surgical-orthodontic treatment may be an option for the correction of this malocclusion, although many patients refuse this treatment option and prefer the compensatory treatment. This work aims to report a case of severe open bite, treated with orthodontic compensation, extraction of four first molars and use of anterior intermaxillary elastics.
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KEYWORDS: Teeth extraction, Class I malocclusion, case report.

1. INTRODUCTION

Anterior open bite malocclusion represents a great challenge to orthodontist in relation to its treatment and stability. This is even more observed in the adult patient because they do not have the potential for growth modification. In these cases, orthognathic surgery is often required for the correction[1]. The etiology of anterior open bite is multifactorial[2,3], i.e., several factors interacting and operating within a potential and growth inherent to each subject cause this malocclusion, such as skeletal pattern, backward rotation of the mandible, vertical maxillary excess, abnormalities in dental eruption and tongue posture problems[4]. It is one of the most compromising esthetic and functional malocclusions, besides the dental and skeletal alterations.

In adults, the treatment of this malocclusion is very difficult, as much to the closure of anterior open bite as to the stability of the results at the end of the treatment[5-7]. In these patients, the orthopedic treatment presents a big restriction because of the lack of growth potential, suggesting this way, that the treatment is performed mainly by orthodontic camouflage (dental balance) or, in severe cases, aided by orthognathic surgery[8]. Nowadays, several authors have worried about preconizing non-surgical methods to the treatment of anterior open bite in adult patients[5,6,9-11]. However, when the skeletal factors are associated to the problem, the most suitable treatment is the surgical-orthodontic[1]. Many patients do not accept this treatment option, due to financial problems, or "horror to surgical procedures", or even for not wishing to change the facial appearance[12]. In these patients, the option is the compensatory treatment (camouflage) of the anterior open bite, and for this there are some factors described by authors which the orthodontic mechanical benefits the treatment and the final stability[1,6,10].

The present article reports a clinical case of a hyperdiverging adult patient who manifested an anterior open bite with skeletal compromising, whose first treatment option was surgical-orthodontics (maxillary impaction). However the patient was reluctant to this treatment option and chose the compensatory treatment, with the extraction of the first permanent molars and a different bonding protocol of orthodontics accessories in the maxillary and mandibular anterior teeth and in the mandibular posterior teeth.

HISTORY and DIAGNOSIS

A 19-year-old female presented to the private clinic with the main complaint of an unpleasant and anesthetic smile due to the presence of severe anterior skeletal open bite. The patient had a pleasing facial esthetics (Figure 1) and a Class I malocclusion, with the mandibular molars with mesial tipping.

Figure 1. Pretreatment extraoral photographs.

The esthetics smile was severely compromised due to the presence of severe anterior open bite of 4 mm between the maxillary and mandibular incisors (Figure 2).

Figure 2. Pretreatment intraoral photographs.

The patient had a bilateral Class I molar relationship and did not show any missing tooth (Figure 3).

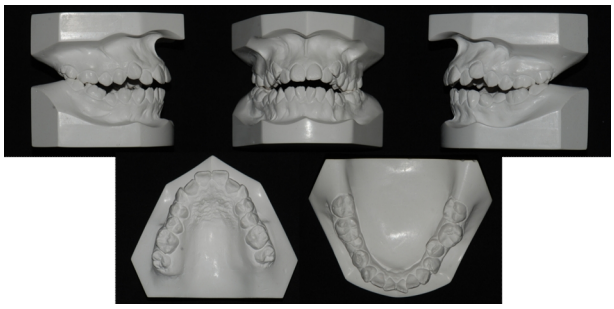

Figure 3. Pretreatment dental casts.

The bite was open from the anterior teeth to the second molars. Additionally, the maxillary and mandibular dental arches had moderate crowding. Cephalometrically, there was a mild Class II skeletal relationship. The patient had significant incisor protrusion that contributed to the skeletal Class II relationship and increased lower anterior face height. There was a bimaxillary dentoalveolar protrusion as evidenced by proclination of the maxillary and mandible incisors. There was an increase in the vertical maxillomandibular relationship in addiction to an increased mandibular plane (FMA 34.6) (Figure 4).

Figure 4. Pretreatment cephalometric radiograph.

The panoramic radiograph showed partially impacted mandibular third molars and periapical radiographs showed characteristics of normality (Figure 5).

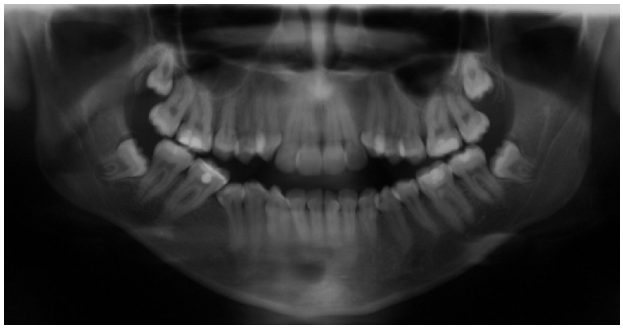

Figure 5. Pretreatment panoramic radiograph.

TREATMENT OBJECTIVES

The treatment objectives were to: 1) reduce protrusion by retraction of the anterior arch; 2) close the open bite by extrusion the maxillary and mandibular anterior teeth until an acceptable overbite-overjet relationship is achieved and 3) prevent extrusion of the posterior teeth, improving her smile esthetics.

TREATMENT ALTERNATIVES

Establishing completely different characteristics of anterior open bite types, it is extremely important to consider its nature and classification in order to choose the proper treatment. The same treatment accomplished in dentoalveolar and skeletal open bites present completely different prognosis demanding an observation of these characteristics to the correct prognosis, treatment planning and mechanotherapy to be used.

The underlying malocclusion in this woman involved dental alveolar and skeletal discrepancies. The dentoalveolar protrusion could be addressed with the four first premolar or first molars extractions. This would allow proper inclination of the maxillary and mandibular incisors, relieve periodontal pressures in the mandibular anterior area, and aid in closure of the anterior open bite. Ideal Class I molar and canine relationships could be established with this extraction pattern, but the skeletal discrepancies would not be addressed. A surgical treatment alternative could be used to correct the anterior and posterior vertical skeletal imbalances. This alternative would require extractions of the teeth to decompensate incisor angulation. Anchorage requirements in the maxillary arch would be minimal. The orthodontic anterior open bite would not be closed. The vertical discrepancy would be corrected surgically by impacting the posterior maxilla and allowing the mandible to rotate counterclockwise. A sagittal split mandibular advancement might be necessary if the rotation of the mandible was not adequate to correct the anterior and posterior discrepancy. This surgical treatment alternative would resolve the skeletal problems and produce a profile change that would be greater to the chance realized with the nonsurgical orthodontic approach.

TREATMENT PROGRESS

The patient refused the surgical-orthodontic treatment and the compensatory orthodontics treatment (camouflage) was chosen. The treatment consisted in the extraction of the maxillary and mandibular first permanent molars and different bonding protocol of the orthodontic accessories in the maxillary and mandibular anterior teeth, and in the mandibular posterior teeth to make them to present a mesiodistal verticalization during treatment and closure of the anterior open bite also with vertical intermaxillary elastic. The treatment of anterior open bite by dental compensation has the goal of promoting an acceptable occlusion, besides propitiating the esthetics of the smile to the patient. In this treatment context, the skeletal inconsistency would be camouflaged by the compensatory dental position[13,14].

The bonding of the accessories toward to the cervical in the anterior teeth was performed. As the alignment and leveling stage started, the anterior teeth suffered a greater extrusion than the posterior teeth, allowing a more efficient closure of the open bite. Considering the characteristic of the posterior teeth more mesially angulated in skeletal open bite patients, some authors defend that the treatment must be accomplished with the verticalization of these teeth related to the occlusal plan in order to promote a better function and stability of the treatment[10,15]. This may be accomplished, modifying the angle of the accessory at the orthodontic bonding moment. Initially the posterior teeth are mesially to the occlusal plan, during the alignment and leveling they would tend to distalize their crowns, rotating the occlusal plan counterclockwise, in other words, the closure of anterior open bite[10,15].

2. RESULTS

Positive facial changes were due to the incisor retraction and lack of significant increase in lower anterior face height (Figure 6, Table).

Figure 6. Posttreatment extraoral photographs.

Ideal Class I molar and canine relationships were achieved along with a good overjet and overbite. The incisors were tipped palatally to reduce the protrusion and close the bite. The posterior teeth were not extruded as the second maxillary molars moved slightly to the mesial with space closure. The mandibular incisors were lingually tipped and slightly extruded to close the open bite.

To maintain the Class I molar relationship, the molars were mesial moved without extrusion (Figures 7 and 8).

Table 1. Pretreatment and posttreatment cephalometric measurements.

Cephalometric measurements	Pretreatment	Posttreatment
SNA(º)	86.2	84.2
A-Nperp	3.2	3.6
Co-A	82.2	83.1
SNB(º)	81.5	80.7
P-Nperp	-0.6	1.2
Co-Gn	121.2	121.5
ANB(º)	4.7	3.5
FMA(º)	34.6	31.1
SN.GoGn(º)	38.1	38.4
SN.Ocl(º)	20.9	20.1
LAFH	76.9	73.2
1.NA(º)	21.9	18.2
1-NA	4.6	3.3
1.PP(º)	117.4	112.5
1-PP (mm)	30.0	31.2
1.NB(º)	31.9	27.1
IMPA(º)	88.8	86.2
1-NB (mm)	7.9	6.0
1-MP (mm)	40.3	41.2
Overjet (mm)	2.6	2.8
Overbite (mm)	-5.0	0.7
Interincisalangle(º)	121.5	131.1
LL-E (mm)	-0.5	-2.7
UL-E (mm)	-4.0	-6.5
Nasolabial angle(º)	104.3	119.0

Figure 7. Posttreatment intraoral photographs.

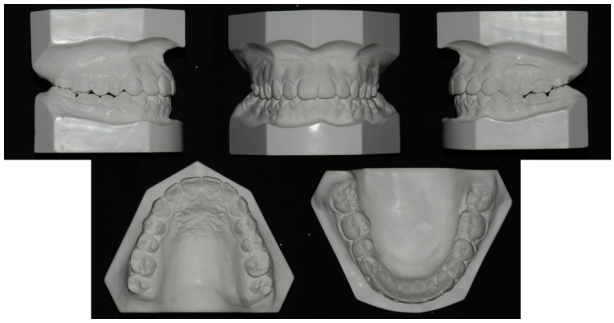

Figure 8. Posttreatment dental casts.

Cephalometric analysis at the beginning and at the end of active treatment showed that SNB angle increased from 81.5º to 80.7º, resulting in the anterior and posterior apical base relationship (ANB) to slightly decease from 4.7º to 3.5º. Both the maxillary and mandibular incisors were uprighted and the mandibular plane angle decreased from 34.6º to 31.1º (Figure 9). The posttreatment panoramic radiograph showed no caries, root resorption, periodontal bone loss, or changes in condylar form (Figure 10).

Figure 9. Posttreatment cephalometric radiograph.

Figure 10. Posttreatment panoramic radiograph.

3. DISCUSSION

The discussion will initially concentrate on the changes with treatment and later on the consequences of these changes on the dentoskeletal and soft tissue components. There was an increase in overbite of 5.7 mm, closing the bite to a positive overbite of 0.7 mm; this can be regarded as clinically significant because closure of the open bite was the primary patient concern. The results confirmed previous case reports demonstrating the efficacy of the procedure to close an open bite[6,9-11,14,16-19].

Additionally, with the cephalometric evaluation in this patient, it was found that the mandibular plane angle rotated in a counterclockwise direction. This rotation can be explained by the procedure chosen for the case in which first molar extractions were performed for correction of the anterior open bite. According to Andrade[20] the extraction of the first molars is indicated in cases in which the skeletal discrepancy is the preponderant factor in the maintenance of the open bite. The removal of dental contacts of the region of the first permanent molars, by means of dental extractions, promotes the mesial movement of the second permanent molars, which favors the change of the fulcrum of contact, providing a counterclockwise rotation of the mandible. This would result in a higher and anterior position of the mandible, reducing the hyperdivergency of the mandibular plan[20].

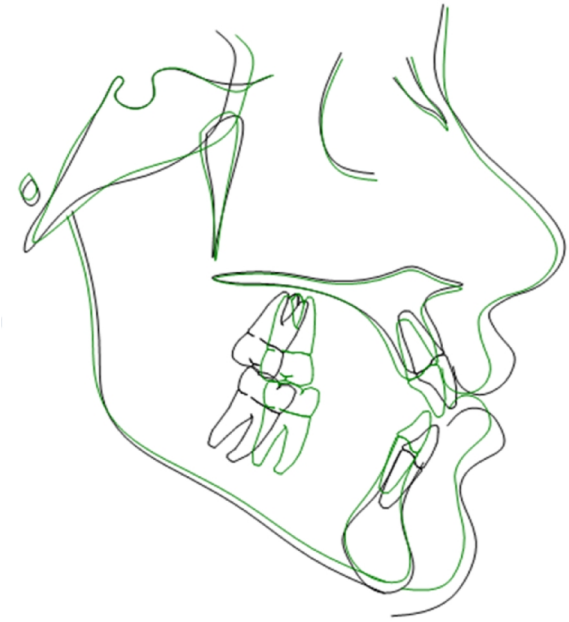

Figure 11. Initial and final cephalometric tracing superimpositions.

The extraction of four first molars was chosen in this case. The extraction of first molars is not often observed in the orthodontic literature, as a treatment alternative to this type of malocclusion. By adopting this protocol, it is speculated that the posterior segments will move mesially, aiding in the counterclockwise rotation of the mandible, thus providing a good incisal guide. Nevertheless, the removal of first molars, does not consist, obviously, in a routine orthodontic treatment procedure due, first of all, to the fact that the first maxillary molars have been considered the key elements since the times of Angle[21], and because it relates to the complexity of the mechanics to be used by the orthodontist when the first molars are extracted[22]. This treatment approach may be perfectly applied, since it is not more time-consuming than the conventional treatment with premolars extractions. The spaces of the extractions were closed with current rubber helping the closure of open bite, which also were accomplished with anterior vertical rubber inter maxilla. To Martina *et al.* (1990)[19] the response to the treatment of patients with anterior open bite becomes more efficient with the removal of the first permanent molars, because the segments would move to the mesial, resulting in a counterclockwise rotation of the mandible, thus favoring the achievement of good incisal guidance. According to the values obtained with the treatment for

the mandibular plane angle and the superposition of initial and final cephalometric tracings (Figure 11), it might be concluded that the results in this case corroborate with the authors mentioned before[19,22]. In the study by Jensen[23], it was concluded that the extraction of the four first premolars followed by the four third molars to the treatment of anterior open bite is equivalent to the loss of 25% of dental material. On the other hand, the removal of the four first molars is equivalent to the loss of 12.5%, with a more conservative form of treatment[23]. For this, it must be considered the presence of clinical or radiographic position and the size of the third molars[23,24]. In this case, it is observed in the initial panoramic radiograph the presence of third molars in excellent conditions.

The superimposition showed that there was minimal growth of the maxilla and the mandible during treatment, and profile improved significantly (Figure 11). Overlap of the maxillary structures indicated that there was palatal inclination of maxillary incisors (Figure 11). Extraction of the first premolars has been accepted by many clinicians in the management of the skeletal open bite, due to the e effect of reducing the inclination of both maxillary and mandibular incisors to increase overbite. Alternatively, molars can be extracted, to supposedly remove the wedge that opened the bite[25,26]. The orthodontic literature contains scarce reports related to the treatment of the open bite with extractions of the first molars. However, it was verified that the correction of the open bite with extraction of the first molars allow the mesial movement of the maxillary posterior segment, helping in the counterclockwise rotation of the mandible, decreasing the mandibular plane angle and the lower anterior face height, facilitating this way the achievement of an anterior positive overbite[10,17,22]. To use this treatment a correct treatment planning should be made, with detailed diagnosis, which assesses the growth pattern, hereditary factors, deleterious oral habits, functional changes, growth potential, besides the cephalometric analysis[19]. As mentioned before, the mesial movement of the second permanent molars, and therefore the fulcrum, promotes the reduction of hyperdivergency between the mandibular and palatal planes, due to the rotation of the mandible in a counterclockwise direction, favoring the closure of the anterior open bite[19].

In the present case, facial changes were due to incisor retraction and lack of significant increase in lower anterior face height (Table I). Ideal Class I molar and canine relationships were achieved along with a good overjet and overbite (Figure 06). The incisors were lingually tipped to reduce the protrusion and close the bite (Figure 06). Considering the skeletal pattern and the nonsurgical approach that was chosen, excellent occlusal and facial results were achieved (Figures 05 and 06). Ideal overbite was established, and good root uprighting into the extraction sites was achieved (Figures 08 and 10). In the panoramic radiograph, an injury on the top of the right second mandibular premolar was observed. The patient was clinically evaluated and an injury occurred as a consequence of recurrent dental caries under the large restoration that this tooth had. After this evaluation the tooth was properly treated, and the patient had no major damage.

According to the superimposition of the cephalometric tracings: initial, final and retention, it is observed that was performed a correct choice of the treatment planning to this case, because of the great facial and occlusal esthetic earnings that the patient had.

4. CONCLUSION

The molars extraction constitutes a favorable option treatment for the decreasing of vertical dimension in patients with increased lower anterior face height and moderate negative overbite. Professional must conduct the mechanics of how to close the spaces, allowing a functional harmony, occlusal and satisfactory esthetic.

Moreover, with an accurate diagnosis and treatment planning, it can be corrected the esthetic and functional problems caused by this malocclusion, performing dental compensations through the extraction of the first molars, especially in cases of adult patients who are no longer growing. However, after obtaining a stable result regardless of the applied therapy, the patient should be referred for speech evaluation to normalize some disorder of tongue posture. Only then, the orthodontist can offer a more effective treatment with less risk of relapse.

REFERENCES

[1] Ribeiro GL, *et al.* Multiloop edgewise archwire in the treatment of a patient with an anterior open bite and a long face. Am J Orthod Dentofacial Orthop, 2010; 138(1):89-95.

[2] Haydar B, Enacar A. Functional regulator therapy in treatment of skeletal open-bite. J Nihon Univ Sch Dent, 1992; 34(4):278-87.

[3] Huang GJ, *et al.* Stability of anterior openbite treated with crib therapy. Angle Orthod, 1990; 60(1):17-24; discussion 25-6.

[4] Subtelny JD, Sakude M. Open bite: diagnosis and treatment. Am J Orthod Dentofacial Orthop. 1964; 50(5):337-58.

[5] Janson G, *et al.* Stability of anterior open bite nonextraction treatment in the permanent dentition. Am J Orthod Dentofacial Orthop. 2003; 124(3):265-76; quiz 340.

[6] Kim YH, *et al.* Stability of anterior openbite correction with multiloop edgewise archwire therapy: A cephalometric follow-up study. Am J Orthod Dentofacial Orthop. 2000; 118(1):43-54.

[7] Nemeth, R.B. and R.J. Isaacson, Vertical anterior relapse. Am J Orthod. 1974; 65(6):565-85.

[8] Epker BN, Fish L. Surgical-orthodontic correction of open-bite deformity. Am J Orthod. 1977; 71(3):278-99.
[9] de Freitas MR, *et al*. Long-term stability of anterior open bite extraction treatment in the permanent dentition. Am J Orthod Dentofacial Orthop. 2004; 125(1):78-87.
[10] Enacar A, Ugur T, Toroglu S. A method for correction of open bite. J Clin Orthod. 1996; 30(1):43-8.
[11] Janson G, et al. Evaluation of anterior open-bite treatment with occlusal adjustment. Am J Orthod Dentofacial Orthop. 2008; 134(1):10-1.
[12] Beane RA Jr. Nonsurgical management of the anterior open bite: a review of the options. Semin Orthod. 1999; 5(4):275-83.
[13] Sabri R. Nonsurgical correction of a skeletal Class II, Division 1, malocclusion with bilateral crossbite and anterior open bite. Am J Orthod Dentofacial Orthop, 1998; 114(2):189-94.
[14] Sarver DM, Weissman SM. Nonsurgical treatment of open bite in nongrowing patients. Am J Orthod Dentofacial Orthop. 1995; 108(6):651-9.
[15] Kim YH. Anterior openbite and its treatment with multiloop edgewise archwire. Angle Orthod. 1987; 57(4):290-321.
[16] Gianni E. Skeletal open bite: diagnosis and orthodontic treatment. Dent Cadmos. 1976; 44(7):14-30.
[17] Goto S, Boyd RL, Iizuka T. Case report: nonsurgical treatment of an adult with severe anterior open bite. Angle Orthod. 1994; 64(4):311-8.
[18] Kucukkeles N, *et al*. Cephalometric evaluation of open bite treatment with NiTi arch wires and anterior elastics. Am J Orthod Dentofacial Orthop. 1999; 16(5):555-62.
[19] Martina R, Laino A, Michelotti A. Class I malocclusion with severe open bite skeletal pattern treatment. Am J Orthod Dentofacial Orthop. 1990; 97(5):363-73.
[20] Andrade P. Nonsurgical treatment of skeletal open bite in adult patients. , in New vision in Orthodontics-Functional Orthopedics of the Jaws2002, Ed. Santos: São Paulo. 683-90.
[21] Angle EH. Classification of malocclusion.1899, Philadelphia, Dental Cosmos.
[22] Safirstein GR. Case report SB: long-term follow-up on Class II treatment with first molar extractions. Angle Orthod. 1996; 66(2):89-94.
[23] Jensen ID. Extraction of the first molars in discrepancy cases. Am J Orthod Dentofacial Orthop. 1973; 64(2):115-36.
[24] Raleigh W. Single arch extraction - upper first molar or what to do when non-extraction treatment fails. Am J Orthod Dentofacial Orthop. 1979; 76(4):377-393.
[25] Dale J. Guidance of occlusion: serial extraction, in Orthodontics: Current Principles and Techniques, S.B.e. Graber TM, Editor 1985, MO: Mosby: St Louis. 259–366.
[26] Fränkel R, Fränkel C. Functional aspects of molar extraction in skeletal open bite, in Orthodontics: State of the Art: Essence of the Science., G.T.e. Graber LW, Editor 1986, MO: Mosby: St Louis. 184–199.