CASE REPORT

Extraction of first permanent molars in the management of anterior open bite malocclusion

Sulaiman E. S. Al-Emran, BDS, MS, PhD

تعرض هذه المقالة مريضتان، أعمارهم ١٣ و ١٤ سنة، تعانيان من عضة مفتوحة أمامية. عولجت المريضتان بالأسلوب نفسه، الذي تضمن قلع الأرحاء الأولى الدائمة السفلية والعلوية، واستعمال جهاز تقويمي مؤلف من سلك مستقيم مثبت. دلت النتائج على زوال العضة الأمامية المفتوحة والتخلص من الاختلاف في طول القوس، والانغلاق الكامل لمكان القلع، كما دلت، أيضا، على تحسن في العديد من القياسات السيفالومترية، وذلك دون وجود أي تأثير خطر على شكل الوجه.

Two female patients aged 14 and 13 years with anterior open bite malocclusion are presented in this article. They were clinically managed using similar treatment approach which included the extraction of upper and lower first permanent molars and the use of orthodontic fixed straight wire appliance. The treatment results revealed elimination of anterior open bite, resolving arch length discrepancy, complete closure of extraction space and improvement of many cephalometric measurements all without jeopardizing the facial profile.

Introduction

Anterior open bite malocclusion is a condition where a space exists between the occlusal or incisal surface of maxillary and mandibular teeth when the mandible is brought into habitual or centric occlusion. This type of malocclusion is often the result of one or combination of several factors: inherited unfavorable growth pattern of the jaws, posture, excessive eruption of posterior teeth, digital habits, nasopharyngeal airway obstruction and tongue posture.[1] Skeletal anterior openbite malocclusion is usually associated with excessive anterior facial height, and is considered one of the most difficult malocclusion problems to treat by any means.

The skeletal pattern of anterior skeletal openbite is characterized by steep mandibular plane angle, obtuse gonial angle, and long lower face height. It is also sometimes associated with the palatal plane pointing downward posteriorly. The dentoalveolar characteristics include divergent upper and lower occlusal plane, mesial inclination of posterior dentition and the lack of a normal curve of spee in the lower arch.[2]

Various treatment options were proposed to resolve the problem of anterior openbite malocclusion. Some of these options could be applied during growth period, such as inhibiting the vertical maxillary growth with headgear and retarding the mandibular growth rotation with chincap. Other treatment modalities including extruding anterior teeth with vertical elastic[3] and intruding posterior teeth by bite blocks with or without magnets were also previously reported.[4] However, significant intrusion of posterior teeth in adolescents or adult is difficult to accomplish. Other methods which include tongue crib therapy[5] posterior bite blocks and functional appliance[6] were also used for treatment and retention of anterior openbite malocclusion. When extraction of permanent teeth is to be considered in anterior open bite cases it is always preferred to be carried out as posteriorly as possible including second premolars or first permanent molars as this will help in bite closure.[7] If excessive facial height is found in combination with anterior openbite malocclusion, an orthognathic surgery could be considered as an additional procedure to orthodontic therapy to correct the jaw rotation and reduce the anterior face height.

In this article, two cases with similar openbite malocclusions are presented to demonstrate a treatment plan, which included the extraction of upper and lower first permanent molars and the use of edgewise fixed orthodontic appliance to accomplish the desired correction.

Case Presentation

Two patients who were girls aged 14 (Case A) and 13 (Case B) years with anterior openbite malocclusion were clinically managed using a similar treatment approach. The first patient's (Case A) chief complaint was moderate crowding in both upper and lower jaws (3.5 mm upper and 5.5 mm lower), moderate overjet 4 mm and the inability to bite on her front teeth. Her canine and molar relationship were cuspid to cuspid Class II Angle relationship. The anterior openbite recorded was 4 mm and extended from second premolar in

Received 29 March 2001; Revised 14 May 2001
Accepted 6 June 2001
Assistant Professor, Division of Orthodontics
Dept. of Prevention Dental Science & Dean, College of Dentistry, King Saud University, Riyadh, Saudi Arabia

Address reprint request to:
Dr. Sulaiman E.S. Al-Emran
P.O. Box 60169
Riyadh, Saudi Arabia
Email: selemran@ksu.edu.sa

the right side to the second premolar in the contralateral side (Fig. 1). Radiographic examination revealed that all permanent teeth were erupted except the upper and lower third molars which showed well developed tooth germs. Three of the permanent first molars had either large carious lesions or large fillings (Fig. 2). The cephalometric radiographic data showed an orthognathic facial type, steep occlusal plane, obtuse jaw angle and decreased interincisal angle (Fig. 3).

Fig. 1. Initial intraoral photograph of Case A showing the extension of anterior open bite malocclusion.

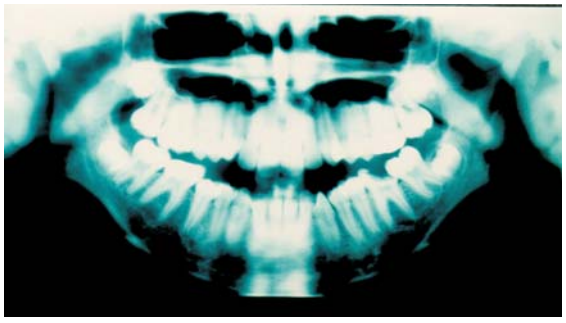

Fig. 2. Panoramic radiograph showing the status of first permanent molars and the position of third molars in Case A.

The second case (Case B) was very similar to the previous case (Case A) with the exception that in the upper and lower jaws, there was slightly more crowding (7mm upper jaw and 7.5 mm lower jaw), moderate overjet 4.5 mm and only one of the

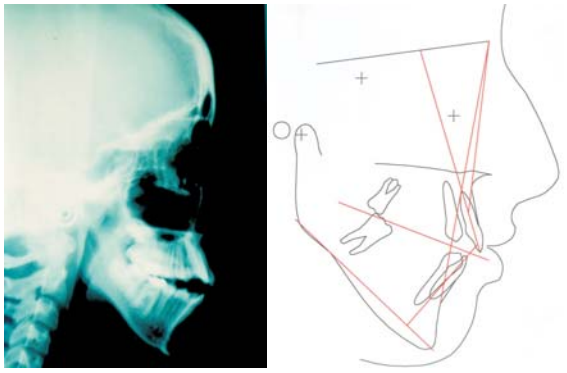

Fig. 3. Initial cephalometric radiograph, tracing and measurements of Case A.

permanent first molar had a large carious lesion (Figs. 4, 5). The cephalometric radiographic data

Fig. 4. Initial intraoral photograph of Case B showing the extension of anterior openbite malocclusion and dental crowding.

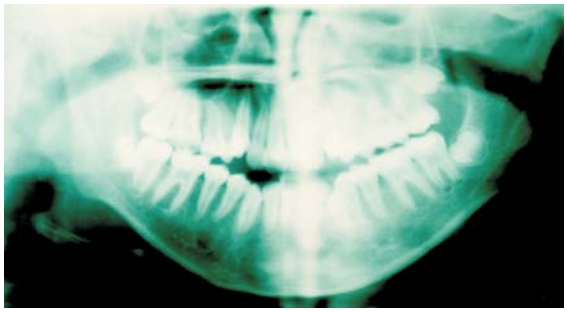

Fig. 5. Panoramic radiograph showing the status of first permanent molars and the position of third molars.

indicated prognathic facial type, steep occlusal plane, obtuse jaw angle and decreased interincisal angle mainly due to lower incisor protrusion (Fig. 6).

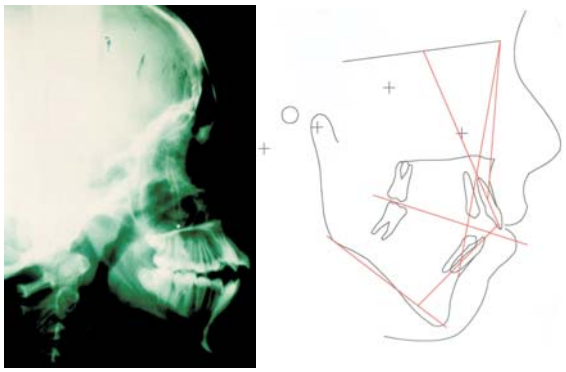

Fig. 6. Initial cephalometric radiograph, tracing and measurements of Case B.

Treatment Approach

The treatment objectives for both cases involved resolving arch length discrepancies, improvement of cephalometric measurements, eliminating anterior open, and establishing a functionally improved facial balance occlusion. The treatment approach which was implemented for both cases included the extraction of upper and lower first permanent molars and the use of orthodontic fixed straight wire appliance (slot 0.022 inch). The removal of all permanent first molars facilitated the mechanics, permitted closure of the openbite malocclusion and provided space to correct teeth malalignment. Orthodontic anchorage was only enforced in the upper jaw for both cases until proper alignment of anterior teeth was achieved, after which upper second molars were allowed to drift mesially. Modified Nance appliances were fitted on the upper second molars for anchorage. In the lower jaw no enforcement of orthodontic anchorage was applied due to the limited amount of dental crowding and the predetermined treatment plan to bring the lower second molar mesially in order to achieve bite closure.

The orthodontic mechanics involved the leveling and alignment of upper and lower teeth through a sequence of different thickness of orthodontic arch wires. After levelling and alignment were achieved, maxillary and mandibular 0.016 x 0.022 inch stainless steel arch wire were inserted and slight distalization of frontal teeth was carried out to improve overjet. Then, anchorage appliances on the upper second molars were removed and teeth located mesial to it were ligated together and the residual spaces were closed by moving the second molars mesially with elastomeric chain. The use of 0.016 x 0.022 size arch wire was to facilitate tooth movement without much tipping and with minimum wire friction during tooth sliding. In later treatment stage orthodontic vertical elastic were required for improvement of intercuspasion in all segments. After removing bands and brackets, maxillary Hawely retainer and mandibular lingual fixed retainer (3 x 3) were placed for retention.

Treatment duration for Case A was 36 months, while for Case B 25 months. The post treatment records presented in this article represents 16 months follow up period for Case A and 8 months for Case B.

Results

The post treatment results showed the correction of dental crowding and elimination of anterior open bite malocclusion in both cases (Figs.7,8). Superimposition of cephalometric tracing before and after treatment indicated that both cases responded to the treatment in a similar manner. This was manifested by minimal backward rotation of the mandible, mesialization of upper and lower second molar, minimal

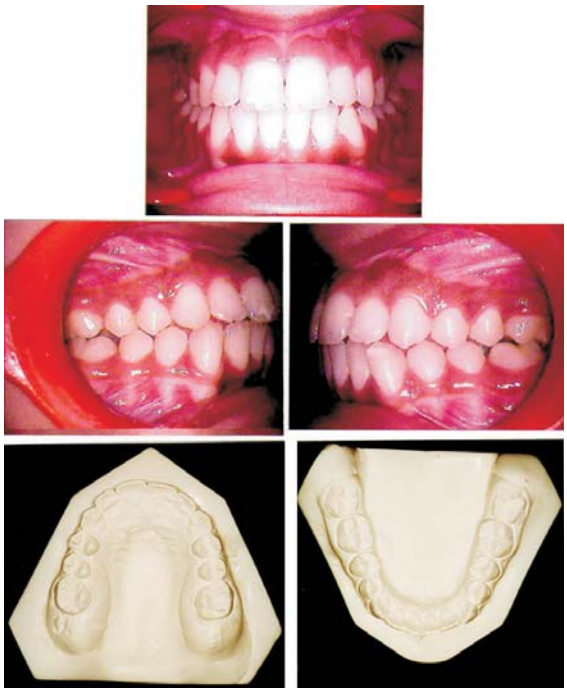

Fig. 7. Post-treatment intraoral photograph of Case A showing elimination of anterior openbite malocclusion.

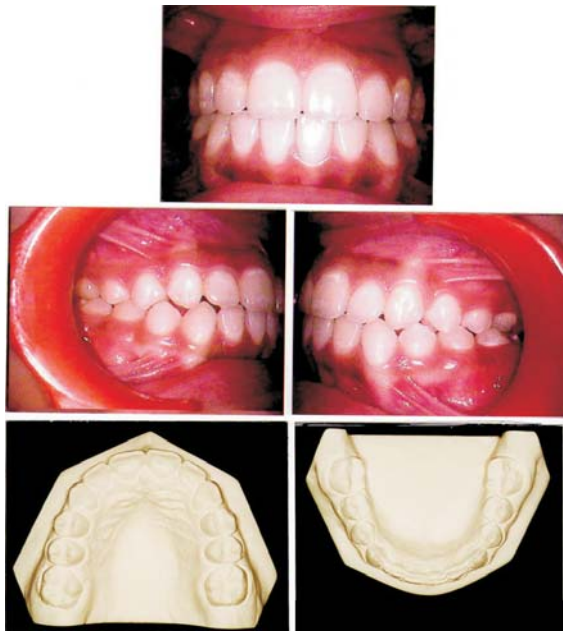

Fig. 8. Post-treatment intraoral photograph of Case B showing elimination of anterior openbite malocclusion.

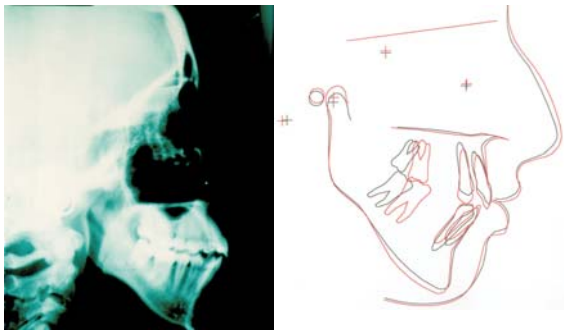

Fig. 9. Post-treatment cephalometric radiograph and superimposition of the initial (in black line) and post-treatment (in red line) cephalometric tracing showing the mesial draft of second molars, minimum retraction of upper frontal segment in Case A.

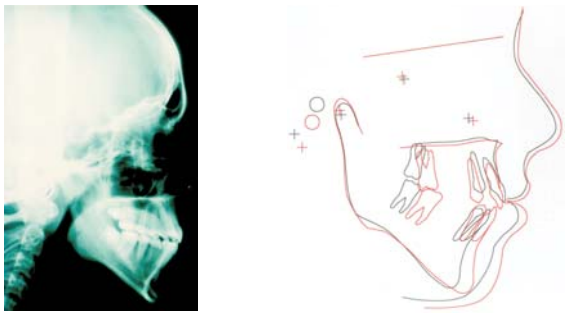

Fig. 10. Post-treatment of cephalometric radiograph and super-imposition of initial (in black line) and post-treatment (in red line) cephalometric tracing showing mesial draft of second molars, minimum retraction of frontal segment and favorable mandibular growth in Case B.

retraction of upper incisors, and anterior open bite closure (Figs. 9,10). The mandibular plane angle showed a decrease from 44.5^0 to 41.1^0 in Case (B), while Case (A) indicated an increase of one degree. The occlusal plane angle changed from 25.1^0 to. 23.1^0 in Case (B) and almost no improvement in Case (A), whereas, interincisal angle showed an improvement in both cases with better manifestation in Case (B) (Table 1). Teeth extrusion in the anterior segment were generally controlled during treatment, nevertheless it was manifested mainly in the lower anterior teeth with limited amount in both Cases (Figs. 11, 12). This action maintained the maxilarry incisor relationship with

Table 1. Initial and post-treatment cephalometric measurements

Steiner Analysis	Case A		Case B		Norms
	Per	Post	Per	Post	
SNA	75.6	76.0	78.0	77.9	81.4
SNB	71.9	71.4	72.3	74.5	77.7
ANB	3.7	4.6	5.7	3.4	3.7
Upper 1 to NA	23.7	15.6	28.4	19.9	24.2
Upper 1 to NA m	6.9	3.5	6.6	4.2	4.3
Lower 1 to NB	30.8	35.7	34.7	27.5	26.5
Lower 1 to NB m	7.4	9.7	8.4	7.1	5.0
Pogonion to NB	0.8	1.6	-1.0	0.6	1.3
Interincisal	121.8	122.7	111.3	129.2	125.5
SN to OP	28.2	28.9	25.1	23.1	16.3
SN to GoGn	50.6	51.7	44.5	41.1	34.0

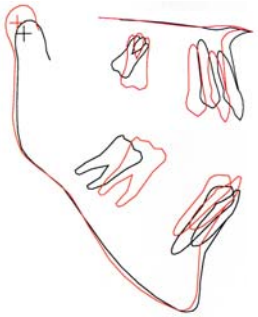

Fig. 11. Superimposition of the initial (black line) and post-treatment (red line) for case (A) using maxillary and mandible plane independently. Note: Second molars were superimposed in both tracings.

the upper lip within an acceptable range and prevented the appearance of an increase in gummy smile. Improvement of ANB angle was noted more in Case B compared to Case A (5.7 to 3.4 degree).

Evaluation of post treatment panoramic

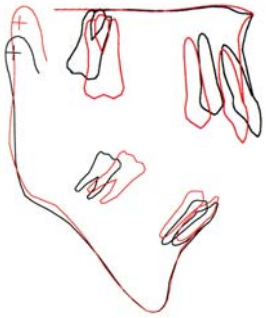

Fig. 12. Superimposition of the initial (black line) and post-treatment (red line) for Case B using maxillary and mandible plane independently. Note: Second molars were superimposed in both tracings.

radiographs reflected normal structure in the periodontium, in the root and in surrounding tissue of the upper and lower second molars (Fig. 13,14). During the first year of retention for Case A it was found beneficial to carry out slight occlusal adjustment in order to remove high spots in the posterior segment for better occlusal settling.

Although no signs of recognized orthodontic relapse was recorded during the previous post-treatment follow up period, it is believed that both cases should be followed up for a minimum two years retention period.

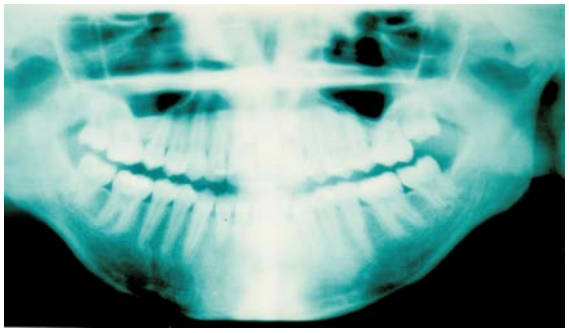

Fig. 13. Post-treatment panoramic radiograph showing complete closure of extraction sites and the start of third molar eruption in Case A.

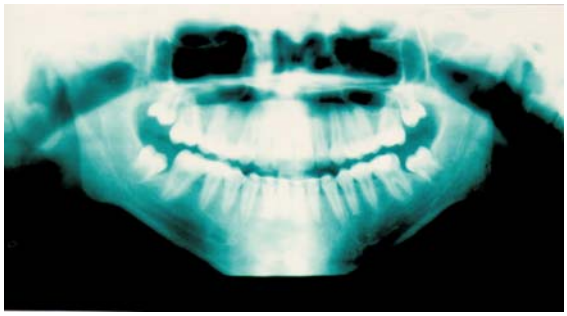

Fig. 14. Post-treatment panoramic radiograph showing complete closure of extraction sites and the sufficient space available for the eruption of third molars Case B.

Discussion

Considering the facial esthetics in the two cases presented, it was very important to correct the open bite malocclusion, eliminate arch length deficiency, prevent an increased gummy smile, all without jeopardizing the facial balance and a pleasant smile. The extraction of permanent first molars for orthodontic purposes was reported in previous literature.[8] In the two cases presented here, it was decided to extract all four first permanent molars because of their doubtful long-term prognoses and because the two cases expressed anterior open bite malocclusion where posterior extraction is preferred.[9] The avoidance of first molar extraction in the field of orthodontics is mainly due to operator's comfort with premolar extraction cases and the lack of experience in handling molar extraction cases.[9]

Mills[10] earlier statement of first permanent molar extraction doubling the treatment time and halving the prognosis may not be applicable now especially with the great advancement in the field of orthodontic mechanics and in orthodontic fixed appliances.

Williams and Hosila[11] highlighted the fact that the first molar extraction cases are likely to have less effect on the profile than premolar extraction cases. In the two cases presented in this article, the facial profiles were within acceptable range due to a minimum amount of increased overjet which existed at the starting point. However, the challenge during treatment remains to eliminate the anterior open bite without jeopardizing the facial profile. The most prominent indications are doubtful long-term prognosis of these teeth, crowding at the distal part of the arches with reasonably positioned wisdom teeth, high maxillary/mandibular plane angle and anterior open bite cases.[9] The two cases presented in this article met almost all these criteria. The most challenging aspect of first molar extraction cases could be the space closure especially in the lower arch. When the lower second molars are subjected to mesially directed force, there is always a tendency for them to tilt mesially and roll lingually. This tendency was reduced by the use of almost full size arch wire during tooth drifting and lingual root torquing at a later stage of the treatment. Whereas closure of upper first molar extraction spaces is rarely time consuming, in fact, it may occur so readily. In these two cases presented, where reasonable amount of the extraction spaces were required to relieve anterior crowding and to

improve the slight increased overjet, provisional anchorage reinforcement was applied.

Although comparison of cephalometric measurements before and after treatment in Case A were almost similar for many variables, Case B has demonstrated a counterclockwise rotation of the mandible and an improvement in different cephalometric variables following orthodontic treatment. This could be attributed to the one year difference in age for Case B which in turn might reflect the effect of our treatment approach on her remaining growth.

In addition to the effect of first permanent molars extraction on bite closure, it has also been reported that it increased the chance of a third molar eruption to about 90% compared to 55% when premolar teeth are extracted.[11] In the two cases presented here, post treatment radiograph (OPG) indicated enough space available for the eruption of third molar compared to the space deficiency shown in the initial radiograph. Although longer period of retention is beneficial, the two cases have been observed for a reasonable period of post-treatment time. In addition, both cases had passed their critical growth period (growth spurt) by a minimum of three years for case A and a minimum of two years for case B before the presented orthodontic records were obtained.

References

1. Proffit WR, Phillips C, Dann C IV. Who seeks surgical-orthodontic treatment? Int J Adult Orthod Orthognath Surg 1990;5:153-160.
2. Kim YH. Anterior open bite malocclusion: nature, diagnosis and treatment by means of multiloop edgewise arch wire technique. Angle Orthod 1987;57:290-321.
3. Gehring D, Greeseman M, Frazier M, Southard K. Extraction treatment of a Class II, Division 1 malocclusion with anterior open bite with head gear and vertical elastics. Am J Orthod Dentofacial Orthop 1998;113:431-436.
4. Woods MB, Nanda RS. Intrusion of posterior teeth with magnets. Angle Orthod 1988;58:136-150.
5. Huang GJ, Justus R, Kennedy DB, Kokich VG. Stability of anterior open bite treatment with crib therapy. Angle Orthod 1990;60:17-24.
6. Frankel R, Frankel C. A functional approach to treatment of skeletal open bite. Am J Orthod 1983;83:54-68.
7. Thilander B, Ronning O. Introduction to orthodontics C VI 135-184 Tandlakarforlaget, Stockholm 1985.
8. Hom BM, Turley PK. The effect of space closure of the mandibular first molar area in adults. Am J Orthod 1984;4:457-469.
9. Sandler PJ, Atkinson R, Murray AM. For four sixes. Am J Orthod Dentofacial Orthop 2000; 117:418-434.
10. Mill JRE. Principles and practice of orthodontics, 2nd edition, New York: Churchill Livingston, 1987: pp.123-125.
11. Williams R, Hosila L. The effect of different extraction sites upon incisor retraction. Am J Orthod 1976;69:388-410.