Case Report

Nonsurgical Treatment of Adult Open Bite Using Edgewise Appliance Combined with High-Pull Headgear and Class III Elastics

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Abstract: This case report describes the effect of a combination of high-pull headgear and Class III elastics on the nonsurgical treatment of an adult open bite. The 19-year 1-month-old Japanese female presented with the anterior open bite of 4.0 mm and mild crowding. She had a skeletal Class II but a Class III molar relationship due to a severe proclination of the mandibular dental arch. Unilateral congenital missing premolars caused a discrepancy between the facial and dental midline. After extraction of two premolars and the impacted mandibular third molars, nonsurgical therapy was performed using the standard edgewise appliance combined with a high-pull headgear and Class III elastics. The successful treatment outcome and stability of the final occlusion indicates that a combination of high-pull headgear and Class III elastics is one of the effective devices in the nonsurgical treatment of open bite and, is especially helpful in uprighting the mandibular dental arch. (*Angle Orthod* 2005;75:277–283.)

Key Words: Adult open bite; Nonsurgical treatment; High-pull headgear; Class III elastics

INTRODUCTION

Japanese orthodontists are often faced with various types of open bite malocclusion in adult patients. Open bite correction is a very challenging opportunity for orthodontists because many factors such as heredity, parafunctional habits, and unfavorable growth pattern can be associated with the establishment of the open bite malocclusion. However, by the time adolescence is reached, environmental causes of anterior open bite are less important than skeletal factors.[1]

The morphological indications of open bite include a steep mandibular plane and increased anterior facial height, both of which reflect mainly downward and backward rotation of the mandible and vertical overgrowth of the maxilla.[2] In most of the adult open bite cases that show neither severe skeletal problems nor remarkable facial disharmony, nonsurgical treatment usually has been indicated.

Studies of the long-term stability of open bite correction after orthodontic treatment have reported that 35% of the patients have significant relapse of the open bite.[3] Therefore, the causative factors in individual cases should be determined as clearly as possible at diagnosis, and then suitable treatment mechanics should be chosen for efficient treatment and long-term stability.

This case report illustrates the nonsurgical treatment of the adult open bite having a slight Class II jaw relationship with Class III molar relationship and a steep lower occlusal plane. The mechanics used for nonsurgical open-bite correction, a combination of high-pull headgear and Class III elastics, contributed to efficient uprighting of the mandibular dental arch without excessive extrusion of the posterior region nor a remarkable increase in anterior lower facial height.

CASE REPORT

History and diagnosis

The patient was 19-year 1-month-old Japanese female with chief complaints of crowding and lack of incisal contact. The patient reported that the open bite seemed to have begun in her junior high school days. She was in good health and possessed no contraindications to dental treatment. No symptoms of temporomandibular disorders were noted.

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FIGURE 1. Pretreatment (A) facial and (B) intraoral photographs at 19 year one month of age.

Her total facial height was comparatively long along with protrusion of the lower lip but the anterior lower facial height was not very large (Figure 1A). She presented with an anterior open bite of 4.0 mm and mild crowding in the anterior region (Figure 1B). The patient's occlusion showed a Class III molar relationship with lingual inclination of the mandibular right second premolar, extrusion of the maxillary right first premolar and congenital absence of the maxillary and mandibular left second premolars (Figures 1B and 3). Four impacted third molars existed (Figure 3). The upper dental midline almost coincided with the lower, but the dental midline shifted to the left of the facial midline (Figure 1A,B). The patient was judged to have no severe tongue thrust swallowing because tongue thrust was not observed while speaking or while the intraoral pictures were taken.

Lateral cephalometric analysis revealed a slight Class II skeletal relationship (ANB = 5.0°), a high mandibular plane angle (FMA = 33.0°), a large gonial angle (Go angle = 129.0°) and a steep mandibular occlusal plane (19.0°). A small interincisal angle (119.0°) showed a tendency toward a protruding dual dentition (Figure 2). The impacted mandibular third molars resulted in severe posterior discrepancy and proclination of the mandibular first and second molars (Figure 3).

The diagnosis for this patient was anterior open bite along with unilateral absence of the upper and lower second premolars due to severe proclination of the mandibular dental arch and labial inclination of the maxillary and mandibular incisors.

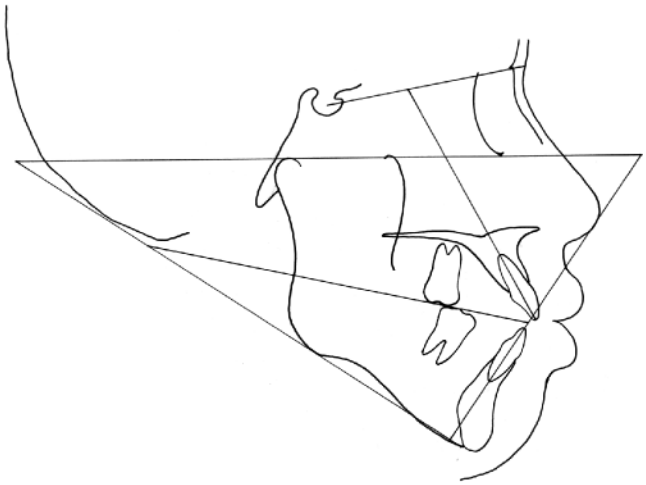

FIGURE 2. Pretreatment cephalometric tracing at 19 year one month of age.

FIGURE 3. Panoramic radiograph before treatment showing congenital absence of both upper and lower left second premolars, proclination of lower molars and four impacted third molars.

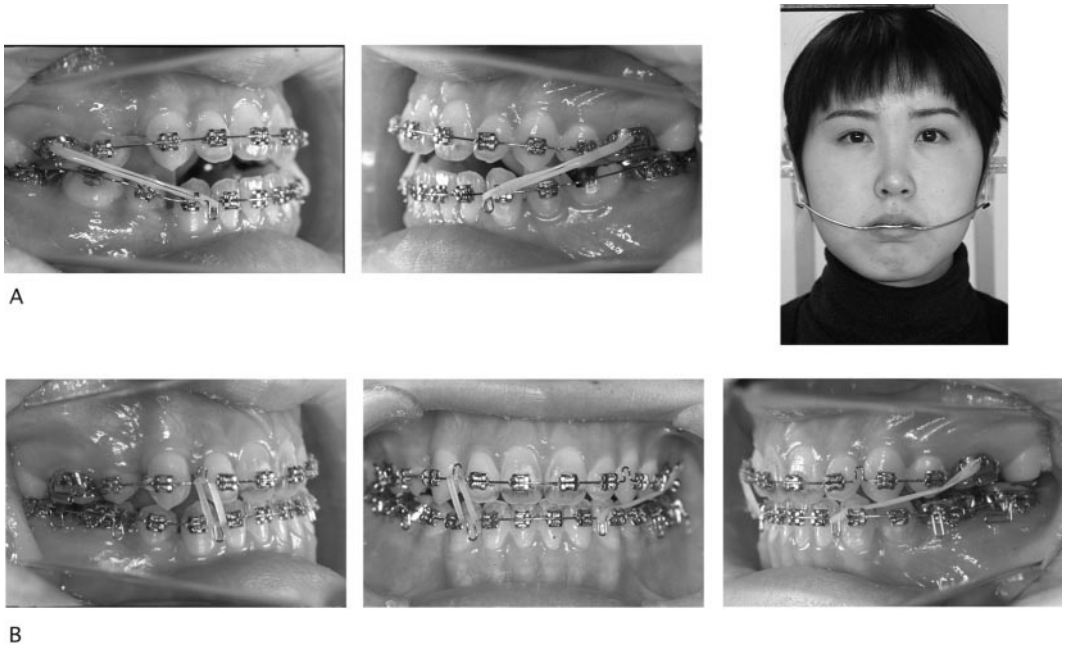

FIGURE 4. Photographs taken during active treatment; (A) intraoral pictures and frontal facial photograph five months after treatment, at the onset of Class III intermaxillary elastics along with high-pull headgear; (B) intraoral pictures nine months after treatment, at the cessation of high-pull headgear.

Treatment objectives

The treatment objectives were as follows: (1) correction of the anterior open bite and establishment of ideal overbite and overjet by retracting and tipping the maxillary and mandibular incisors lingually, (2) establishment of the Class I occlusal relationship by upright of the mandibular occlusal plane, (3) inhibition of the mandibular clockwise rotation and increment of anterior lower face height due to remarkable extrusion of the posterior teeth, (4) correction of a discrepancy between the facial and dental midlines, and (5) reduction of the protruding lower lip by incisor retraction and bite closure.

Treatment progress

The treatment objectives were explained to the patient and informed consent was obtained. Then, maxillary and mandibular right first premolars along with the impacted mandibular third molars were extracted. Although no remarkable tongue thrust was observed, the patient learned correct tongue position at rest and swallowing, and the patient was monitored thereafter. The 0.018- $\times$ 0.025-inch standard edgewise appliances were placed on both the maxillary and mandibular dental arches except for the maxillary second molars and the mandibular first molars. After five months of treatment, the patient was instructed to wear a high-pull headgear and Class III intermaxillary elastics for eight hours every night (Figure 4A). Class III elastics were used along with high-pull headgear for efficient uprighting of the mandibular second molars. Four months after the onset of the high-pull headgear and Class III elastics, bands were placed on the mandibular first molars because overbite had changed for the better with uprighting of the mandibular second molars (Figure 4B).

Closing loops (0.018- $\times$ 0.025-inch stainless steel wire for the upper, 0.17- $\times$ 0.25-inch for the lower) were used to retract both incisors and advance consolidation. The high-pull headgear and Class III elastics were stopped at one year into active treatment. Vertical elastics were used for six months to obtain suitable interdigitation by ideal arch wires (0.018- $\times$ 0.025-inch for both dental arches). The patient maintained good motivation for the use headgear and elastics during active treatment.

RESULTS

Edgewise appliances were removed after 23 months of active treatment. The anterior open bite was completely corrected and suitable interdigitation was achieved with Class I molar and canine relationships (Figure 5B). Post-treatment facial photographs revealed a positive change in lip balance and a lack of significant increase in the anterior lower facial height (Figure 5A). The dental midline was almost coincident with the facial midline (Figures 1 and 5). Both the maxillary and mandibular incisors were sufficiently retracted to close the anterior open bite (Figure 10). The mandibular molars showed enough uprighting to obtain a Class III molar and dental relationship (Figures 6 and 10). Very slight extrusion of the molars resulted in a little backward rotation of the mandible but no remarkably negative

FIGURE 5. Posttreatment (A) facial and (B) intraoral photographs taken at 23 months after the onset of active treatment (at 21 year two month old).

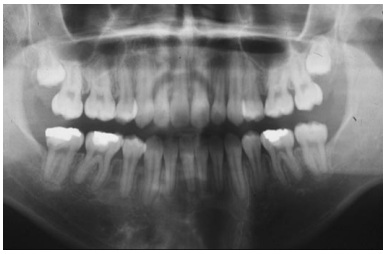

FIGURE 6. Panoramic radiograph at the finish of active treatment.

changes in the facial height or soft tissue profile (Figures 5A and 9).

At the finish of active treatment, removable plate retainers were placed in both dental arches. Removable retainers were to be worn all day long for one year and then only at night. Proper occlusion and a balanced facial profile were maintained after retention (Figure 7A,B). The maxillary third molars were extracted during retention to avoid vertical changes of the maxillary second molars (Figure 8).

DISCUSSION

The nonsurgical treatment mechanics applied to this adult open bite consisted of the 0.018- × 0.025-inch standard edgewise appliances combined with a high-pull headgear and Class III elastics. The characteristics of these mechanics include efficient uprighting of the mandibular molars, proper correction of the steep lower occlusal plane and vertical control of both the maxillary and mandibular molars (Figure 11). At the onset of treatment, standard edgewise appliances were placed on both dental arches except for the mandibular first molars. This is likely to have been advantageous in affecting uprighting of the mandibular second molars without an unfavorable reaction moving the teeth forward. Although the cooperation of the patient was essential for successful treatment results, the patient in this case was instructed to wear these auxiliaries only at night and only for seven months in total.

This case displayed a Class III molar relation due to severe proclination of the mandibular dental arch and a slight Class II skeletal relationship (ANB = 5.0°) without remarkable facial disharmony. Therefore, the uprighting of the mandibular dental arch was essential for achieving a Class I molar relationship. The duration of active treatment was a comparatively short period (23 months), and the treatment outcome including the improved occlusal interdigitation as well as the correction of the anterior open bite was maintained, indicating that the mechanics used for orthodontic treatment was suitable for this case. It has been reported that the degree of success for open-bite correction with conventional orthodontic procedures is inversely proportional to the facial dysplasia such as an unfavorable ratio of the upper anterior face height to lower face height.[4] This case showed a tendency toward a long face, but the ratio of anterior facial height was not so small, which probably contributed to the efficient treatment progress without deterioration in facial balance.

The most important factors in prediction or prognosis are the etiology of the open bite and the dentofacial configuration. When the causative factor is identified obviously at diagnosis, open-bite correction is expected to be easier to accomplish. In this case, protrusion of both the maxillary

FIGURE 7. (A) Facial and (B) intraoral photographs after retention (at 23 year two month old).

FIGURE 8. Panoramic radiograph after retention.

FIGURE 9. Superimposed cephalometric tracing on Sella-Nasion at Sella for overall change with treatment. Solid line = before treatment, dotted line = after treatment, broken line = after retention.

and mandibular incisors with severe proclination of the molars obviously caused the anterior open bite. In Japanese cases, a habit of tongue thrusting or the large volume of the tongue may cause the open bite or bimaxillary dentoalveolar protrusion (or both).[5] A previous report has suggested that the tongue tends to have difficulty adapting to the altered position after orthodontic treatment in such cases.[6] However, in this case, parafunction of the tongue probably was not related to establishing the open bite because tongue thrusting was not identified while speaking and during exposure of intraoral pictures. Therefore, the maintenance of an increase in overbite by nonsurgical treatment could be expected so long as sufficient retraction of the incisors with the premolar extraction was attained.

On the other hand, the unilaterally congenital missing left second premolars resulted in a discrepancy between the dental and facial midlines. A web-based study on the public's preference for anterior tooth variation has shown that almost 80% of laypersons preferred the images without the midline discrepancy.[7] Accordingly, we also attempted to correct this case nonsurgically with extraction of the right maxillary and mandibular first premolars. In addition, the impacted mandibular third molars resulted in a posterior discrepancy and a severe inclination of the second molars, and these were extracted to obtain enough space for efficient uprighting of the lower molars.

Aras[8] has indicated that no mandibular rotation change was observed after orthodontic treatment with first premolar extractions in subjects with a skeletal open bite. In the present case, the correction of the anterior open bite was achieved with no remarkable rotation of the mandible and no significant increase in the lower facial height (Figure 9). However, cephalometric superimposition (Figure 10) showed very slight extrusion of the molars. Long-face individuals commonly display excessive eruption of the pos-

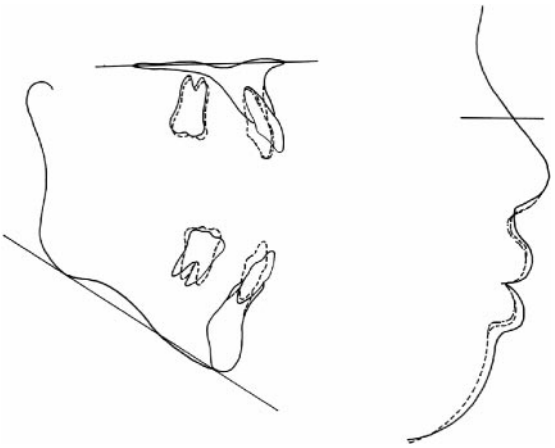

FIGURE 10. Superimposed cephalometric tracings for maxillary, mandibular and profile changes. Solid line = before treatment, dotted line = after treatment, broken line = after retention.

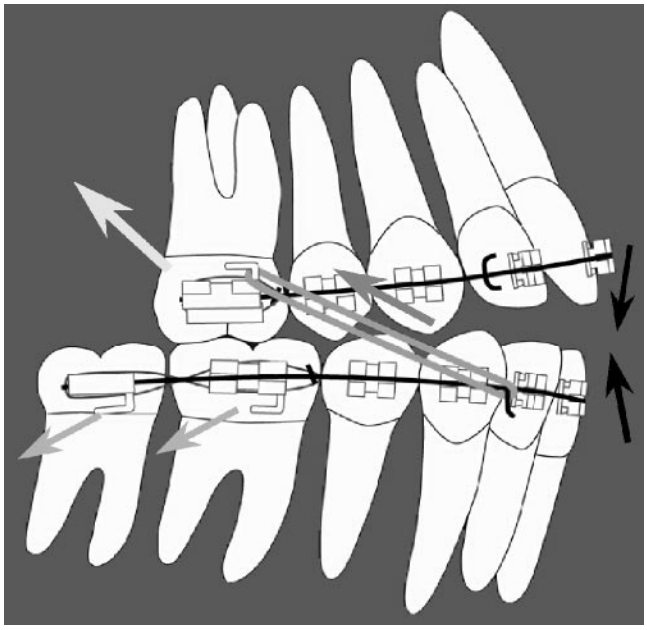

FIGURE 11. Scheme of open bite correction with Class III intermaxillary elastics and high-pull headgear (thick arrows). This mechanics is helpful in the upright of mandibular molars without remarkable extrusion of the maxillary molars as well as increase in overbite (thin arrows).

terior teeth and have significantly less occlusal force.[9] According to the patient's history, the anterior open bite developed with the eruption of the mandibular second molars, suggesting that the patient had insufficient occlusal force in nature to inhibit unfavorable eruption of the molars. Forces from occlusion have been reported to play a role in the vertical position of the teeth by affecting eruption.[10] Therefore, in spite of the use of these effective mechanics for open bite correction, it was probably difficult to completely prevent molar extrusion in this case.

Stability of the corrected tooth positions and the final occlusion depend on control of the possible factors related to relapse of the anterior open bite. As reported previously, the major primary factors in the dental equilibrium appear to be the resting tongue and lip pressures.[10] In this case, a corrected tooth position was obtained by sufficient and careful correction of the occlusal plane including uprighting of the molars and incisors. As a result of this, the anterior teeth are likely to have been placed in a balanced position between the tongue and lip. Furthermore, Beckman and Segner[11] have reported that a successful treatment outcome of open-bite patients with a long face divergent pattern may be enhanced by using a removable retainer capable of closing the bite through retrusion of the upper incisors. Therefore, removable retainers were selected in both dental arches to allow more adjustment capabilities posttreatment as a result of the pretreatment open bite. Neither relapse nor remarkable change in the corrected occlusion occurred during retention.

In the present case, a combination of Class III elastics and headgear was one of the effective devices in nonsurgical treatment of the open bite. However, it is essential for orthodontists to analyze the individual open-bite cases precisely and then to choose adequate mechanics for each case with a view to attaining good treatment outcomes.

CONCLUSIONS

In this case report, a combination of high-pull headgear and Class III elastics proved to be effective mechanics for the treatment of the adult open bite. The patient showed a Class III molar relationship and a steep lower occlusal plane due to a severe proclination of the mandibular dental arch. Proper uprighting of the molars obtained by nonsurgical treatment using these mechanics seems to have contributed to successful stability of the final occlusion.

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