Bilateral Scissor Bite Treated by Rapid Mandibular Expansion Following Corticotomy

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Abstract

Scissor bite is defined as buccal displacement of the maxillary posterior teeth, with or without contact between the lingual surface of the maxillary lingual cusp and the buccal surface of the buccal cusp of its mandibular antagonist. Here we report treatment of bilateral scissor bite in the posterior region using rapid expansion following corticotomy. The patient was a boy aged 17 years and 11 months in whom skeletal maxillary prognathism with bilateral scissor bite was diagnosed. The distance between the tips of canines and the mesial buccal cusps of the first molars was increased by use of a bonded rapid expansion appliance following corticotomy. Appropriate occlusion and lateral profile were obtained and maintained after retention. In addition, no gingival recession, hyperesthesia, or root surface caries occurred. These results suggest that mandibular lateral expansion following corticotomy is effective in young adult patients with a narrow mandibular arch.

Key words: Bilateral scissor bite — Corticotomy — Rapid mandibular expansion — Narrowed arch — Deep bite

Introduction

Scissor bite is defined as buccal displacement of the maxillary posterior teeth, with or without contact between the lingual surface of the maxillary lingual cusp and the buccal surface of the buccal cusp of its mandibular antagonist. If left untreated, scissor bite not only adversely affects chewing function, but also impairs the normal growth and development of the mandible. Although cross-bite alone is unlikely to lead to the development of oral disease, dysfunction can arise from the resulting impairment of mastication.
Scissor bite is a comparatively rare form of malocclusion, occurring in less than 0.01% of such cases\(^1\). Moreover, because it has no effect on esthetic appearance, the patient may even be unaware that they have malocclusion at all. The rate of occurrence of scissor bite is very low, but when it does occur it is extremely difficult to correct. This is because it involves buccal tipping of the maxillary molars with over-extrusion and lingual tipping of the mandibular molars with extreme vertical overlap, making it impossible to attach orthodontic appliances to the buccal surface of the mandibular teeth and palatal surface of the maxillary teeth. Various methods have been reported in the treatment of scissor bite\(^2,5,6,8,10,11\).

Here, we report the successful treatment of bilateral scissor bite in the posterior region in an adult patient. Treatment comprised a corticotomy followed by the fitting of a bonded rapid expansion appliance to increase the distance between the mandibular canines and molars. Patient consent was obtained for publication of this report.

**Case Report**

1. **History and diagnosis**

   The patient was a boy aged 17 years and 11 months with bilateral posterior buccal cross-bite. He presented with the chief complaint of anterior protrusion of the maxillary incisors and crowding of the mandibular dentition. There was nothing remarkable in his family or medical history. Findings revealed a sym-
Class I molar relationship on the right and full Class II on the left, with overjet of +5 mm and overbite of +7 mm. The maxillary first molars showed palatal displacement. The mandibular arch was very narrow and V-shaped, with lingual tipping of the bilateral posterior teeth. Scissor bite was evident in the right maxillary first and second premolars, the left maxillary first and second premolars, and second molar (Fig. 1). A model analysis revealed that the distance between the tips of the mandibular canines and that between the mesial lingual cusps of the maxillary and mandibular first molars was more than 2 S.D. smaller than the standard values reported by Nagaoka and Kuwahara (Table 1)\textsuperscript{7}. A panoramic X-ray revealed no missing teeth or periodontal disease, but some evidence of impaction of the mandibular third molars.
Frontal cephalometric analysis showed that the midline of the maxillary dentition deviated 2 mm to the right of the facial midline (from the crista galli to the ANS); that the midline of the mandibular dentition deviated 1 mm to the left; that the left maxillary second molar was inclined buccally; and that the left mandibular second molar was tipped lingually (Fig. 3). Lateral cephalometric analysis revealed values for skeletal maxillary prognathism ($\text{ANB} = 5.5^\circ$, convexity $= 10.0^\circ$) and labial inclination of the mandibular incisors ($L1-MP = 107.0^\circ$) which were greater than the standard values reported by Iizuka and Ishikawa (Table 2). The patient had been in the habit of thumb-sucking until the age of 10 years. There was no discrepancy between centric occlusion and centric relation, and the patient had no history of temporomandibular disorder (TMD). Skeletal maxillary prognathism with bilateral scissor bite was diagnosed based on these analytical findings.

### Table 2  Cephalometric measurement values

|              | A   | B   | C   | Mean ± SD (Normative mean in Japanese male adults) |
|--------------|-----|-----|-----|--------------------------------------------------|
| Facial angle | (deg.)| 85.0 | 82.5 | 82.5 | 85.07 ± 5.76 |
| Convexity    | (deg.)| 10.0 | 8.5  | 8.5  | 5.60 ± 4.33  |
| SNA          | (deg.)| 89.0 | 88.0 | 88.0 | 81.82 ± 3.09 |
| SNB          | (deg.)| 83.5 | 83.0 | 83.0 | 78.61 ± 3.14 |
| ANB          | (deg.)| 5.5  | 5.0  | 5.0  | 3.28 ± 2.66  |
| Mandibular angle | (deg.)| 28.0 | 29.0 | 29.0 | 26.25 ± 6.34 |
| Interincisal angle | (deg.)| 118.0 | 115.0 | 113.0 | 129.66 ± 8.99 |
| U1-FH        | (deg.)| 108.0 | 111.0 | 112.0 | 108.94 ± 5.62 |
| L1-MP        | (deg.)| 107.0 | 104.0 | 106.0 | 94.67 ± 7.21 |
| Overjet      | (mm) | 5.0  | 2.5  | 3.5  |                   |
| Overbite     | (mm) | 7.0  | 3.0  | 4.0  |                   |

Standard values according to Iizuka and Ishikawa.  
(A) Pre-treatment; (B) Post-treatment; (C) Post-retention

Fig. 4  Schema and intraoral photograph during corticotomy
estimated to be 6 mm to achieve alignment along the central groove of the second premolars and second molars. Next, corticotomy followed by rapid mandibular lateral expansion was planned to correct scissor bite. The amount of expansion required in the region of the first molars was estimated to be 6 mm. The left maxillary first premolar was to be extracted after improving the scissor bite and achieving occlusal stability. For orthodontic treatment, a multi-bracket appliance would then be used to improve the maxillary protrusion and deviation to the right of the midline of the maxillary dentition and to establish individual normal occlusion. As an alternative, extraction of the four premolars and left maxillary first or second molar to improve bi-maxillary protrusion and obtain a bilateral Class I relationship was also considered. However, the final decision was to leave determining the site of extraction until after correction of the scissor bite. Distraction osteogenesis, the use of a lingual arch, and cross elastics were all considered as possible means of achieving mandibular widening.

3. Treatment progress

First, a quad-helix was used to expand the region of the maxillary first molars. Four months later, corticotomy was performed with a round bur under local anesthesia, with incisions being made in the buccal mucosa from the right mandibular canine to the second molar and the left mandibular canine to the area of the second molar according to the method of Neumann (Fig. 4). An expansion appliance, fabricated by soldering orthodontic expansion screws to orthodontic bands on

Fig. 5  Intraoral photographs before and after mandibular expansion

Fig. 6  Occlusal radiographs before and after mandibular expansion

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the right and left mandibular canines and first molars and extending a wire to the second molar, was then fixed with dental cement. Commencing on the day following the corticotomY, the screws were expanded at a rate of 0.25 mm twice daily to occlude the maxillary central groove and mandibular buccal cusp. As a result of this mandibular lateral expansion over a period of 20 days, inter-canine distance increased by 9 mm and inter-first-molar distance by 5 mm (Figs. 5 and 6). The expansion appliance was removed 3 months after expansion was completed. The left maxillary first premolar was then extracted and a multi-bracket appliance (0.018 slot standard bracket) put in place. Comprehensive orthodontic treatment was performed in both arches. The quad-helix was replaced with a Nance holding arch to reinforce anchorage of the maxillary molars. Levelling was initiated by using a 0.014-inch nickel-titanium wire. The canines were retracted by using a $0.016 \times 0.016$-inch stainless-steel wire and elastic chain. Anterior retraction of the maxillary incisors was achieved with a $0.016 \times 0.022$-inch stainless-steel wire with a double-helical closing loop and Class II elastics to reinforce anchorage in the molar region. Detailing of the occlusion was accomplished with a $0.017 \times 0.025$-inch stainless-steel arch wire with a reverse curve of Spee in the mandibular arch to raise overbite. The active treatment period eventually spanned 4 years and 7 months, much longer than anticipated, due to a total of 15 mid-treatment cancellations.
4. Treatment results

A Class I molar relationship on the right, full Class II molar relationship on the left, appropriate overjet and overbite, and tight molar intercuspation were obtained (Fig. 7). At the end of active orthodontic treatment,
the distance between the tips of the mandibular canines had increased by 7 mm and that between the mesial buccal cusps of the first molars by 7 mm compared with at pre-treatment. Lingual tipping of the tooth axes of the canines and first molars had been corrected in the process of lateral expansion (Fig. 8). Lateral cephalometric analysis showed that the mandibular plane angle had increased from 28.0 to 29.0 degrees, resulting in a slight decrease in facial angle and SNB (Table 2). Superimposition of pre-treatment and post-treatment cephalograms revealed lingual movement of the upper incisors together with intrusion into the space obtained by extraction of the left maxillary first premolar. The U1-FH increased from 108.0 to 111.0 degrees, while overjet decreased by 2.5 mm. Slight mesial movement and extrusion of the maxillary first molar were also observed. Slight mesial movement and extrusion of the molars and intrusion together with lingual tipping of the incisors in the mandibular arch resulted in overbite decreasing from 7.0 to 3.0 mm. The lip had moved posteriorly due to the increased mandibular plane angle and retraction of the maxillary arch, leading to an improvement in the lateral profile and hyperactive mentalis (Fig. 9 and Table 2). Frontal cephalometric analysis revealed that the maxillary dental midline now coincided with the facial midline; that the lingually tipped mandibular molars were uprighted buccally; and that the buccally inclined maxillary second molar had moved lingually (Fig. 10). Panoramic X-rays showed that good root parallelism had been achieved, with no evident root resorption (Fig. 11). The mandibular third molars were extracted during orthodontic treatment due to repeated pericoronitis of the wisdom tooth. No TMD symptoms, gingival recession, hyperesthesia, or root surface caries were observed. Circumferential type retainers were applied to the maxillary and mandibular arches for retention. After 2 years and 7 months of retention, the distances between the canines and first molars remained stable and a good occlusal relationship and facial profile were maintained. Overbite has slightly deepened, however, due to extrusion of the upper and lower incisors, and overjet has increased by 1 mm (Figs. 12, 13, and 14 and Table 2).

Discussion

Numerous case reports on the treatment of scissor bite have been published. The methods reported include the combined use of a mandibular expansion appliance for the mandibular dental arch with contraction of the maxillary dental arch using cross-elastics \(^{10}\); reduction of the maxillary arch and expansion of the mandibular arch using cross-elastics \(^{8}\); reduction of the maxillary arch by using a bonded constriction quad-helix appliance together with expansion of the mandibular arch using a bi-helix appliance \(^{8}\); surgical constriction of the maxilla to correct excess width \(^{11}\); mandibular expansion by posterior subapical mandibular surgery and the use of a lingual arch appliance \(^{15}\); and mandibular widening by distraction osteogenesis \(^{9}\). The basic treatment mechanisms thus comprise contraction of the width of the maxillary arch and expansion of the width of the mandibular arch. Scissor bite in the present case was caused by extreme constriction and a V-shaped mandibular arch with bilateral lingual tipping from the canines to the second molars. The treatment objectives, therefore,
were to expand and upright the mandibular arch and establish the arch form. A number of methods are available for expanding the mandibular arch, and these include the use of cross-elastics\textsuperscript{2,10}, a bi-helix\textsuperscript{8}, a lingual arch\textsuperscript{12}, and surgery\textsuperscript{5,12}. The use of cross-elastics necessitates strong patient cooperation. On the other hand, it is also difficult to achieve the

Fig. 11 Post-treatment panoramic radiograph

Fig. 12 Facial and intraoral photographs at post-retention
appropriate amount of buccal movement within a reasonable treatment period with expansion by heavy wires, such as a lingual arch or bi-helix. Therefore, we decided to aim at rapid mandibular lateral expansion, as expansion by orthodontic screws is effective and predictable. It has been reported that it is difficult to achieve stabilization with expansion of the mandibular arch, and relapse can occur\(^9\). In addition, when such an approach is adopted in adults, the stress associated with expansion is concentrated in the tooth cervix, and this is known to cause alveolar bone loss with the concomitant risk of tooth root exposure, hyperesthesia, and root surface caries\(^9\). These issues may be resolved by posterior subapical mandibular surgery\(^5\) or mandibular widening by distraction osteogenesis\(^5\). Posterior subapical mandibular surgery is known to involve risks of injury to the alveolar neurovascular bundle, however, and sufficient vascular supply to the dissected segment is crucial in achieving a good treatment outcome\(^21\). In distraction osteogenesis, new bone

![Fig. 13 Post-retention panoramic radiograph](image)

![Fig. 14 Superimposed at post-treatment (solid line) and post-retention (dotted line) cephalometric traces](image)

(A) Superimposition in SN plane at S
(B) Superimposition in palatal plane at ANS
(C) Superimposition in mandibular plane at Me
is formed and inter-molar and inter-canine distances remain stable after expansion\(^5\). This method is effective in patients with a narrow mandibular base and in eliminating crowding, as it involves lateral parallel movement of the mandibular body and the alveolar region. It may affect the temporomandibular joint (TMJ), however, and damage the tooth root\(^13\). Expansion by corticotomy eliminates the risk of gingival recession and hyperesthesia and ensures post-treatment stability\(^3\). Unlike mandibular widening by distraction osteogenesis, it has little effect on the TMJ and entails little risk of damaging the teeth while the molars are uprighted buccally. Taking these various advantages and disadvantages into consideration, mandibular lateral expansion following corticotomy was selected to enlarge the mandibular arch and correct lingual tipping of the molars in the present case. Rapid expansion can be achieved by applying orthodontic force immediately after a corticotomy\(^3\). Therefore, expansion was commenced from the day after the corticotomy was performed. As a result, the lingual inclination of the mandibular canines and molars normalized, and the distances between the canines and molars increased compared with at pre-treatment. Thus a normally shaped mandibular arch was achieved with no side effects. In addition, occlusal stability and healthy periodontal tissue were also maintained after retention. The decision on tooth extraction site was postponed until scissor bite had been corrected and change in the mandibular position confirmed. Subsequently, only the left maxillary first premolar was targeted for extraction, as removing five teeth would have meant a longer time required for recovery, in addition to which this would have been against patient wishes. Although bi-maxillary protrusion persisted, the patient was satisfied with his facial appearance, and functional and stable occlusion was achieved. Standard brackets were used. Pre-adjusted brackets incorporate in-out, angulation, and torque, and mandibular posterior brackets, in particular, have lingual crown torque, all of which pose a disadvantage in uprighting lingually tipped teeth. The posterior teeth in the present case have remained stable following retention, as they were sufficiently uprighted to achieve vertical bite force. The present results suggest that mandibular lateral expansion by means of corticotomy is effective in adult patients with a narrow mandibular arch.

**Conflict of Interest**

The authors declare that there is no conflict of interest to disclose.

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