The extraction of maxillary lateral incisors for the treatment of a Class II crowded malocclusion: a case report

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Background: The extraction of an upper lateral incisor for orthodontic purposes is rare and must be adequately justified.

Aim: The present case report describes the management of a skeletal Class II crowded malocclusion that was facilitated by the extraction of upper lateral incisors and lower first premolars.

Methods: A 14-year-old male patient presented with a skeletal Class II crowded malocclusion with associated speech and chewing difficulties. Phase I of treatment involved the extraction of the upper lateral incisors and functional appliance therapy. Phase II included the extraction of lower first premolars and mechanotherapy using full fixed appliances.

Results: An improvement in aesthetics and sagittal relations was achieved during phase I therapy as the mandible was advanced over a period of eight months. Mandibular skeletal change was 6.5 mm observed at pogonion. During phase II therapy, the maxillary canines were substituted for lateral incisors and a functional occlusion was achieved. The skeletal correction and occlusion were stable one year after debonding.

Conclusion: The present case indicated that the timely extraction of palatally-placed maxillary lateral incisors facilitated functional appliance therapy in the management of a skeletal Class II problem. The crowding of the lower anterior teeth was relieved and alignment of the upper arch was achieved with full fixed appliance therapy, resulting in improved aesthetics and a stable occlusion at one year review.

(Aust Orthod J 2015; 31: 107–115)

Received for publication: May 2014
Accepted: January 2015

Introduction

A Class II malocclusion is a common presenting complaint in orthodontic clinical practice. It is considered that most skeletal Class II malocclusions are caused by disproportions in the relationship of the maxilla and mandible largely characterised by a small or retruded mandible. A selection of functional appliances may be used to alter the condyle-glenoid fossa relationship by posturing the mandible forward to improve the attendant skeletal and occlusal disharmony. Functional appliance therapy at the appropriate time during growth has been shown to produce the most effective results in the management of retrognathic mandibular Class II patients.

Functional appliance treatment planning may be complicated if mandibular advancement is hindered by a narrow maxillary arch or tooth displacements. Obstructions to mandibular advancement may be overcome by transverse expansion of a narrowed maxillary arch in order to accommodate a postured lower arch. Similarly, tooth malposition may necessitate appliance treatment prior to the commencement of functional therapy to enable unimpeded forward repositioning of the mandible. A dental obstruction preventing full forward mandibular positioning may also be eliminated by the extraction of an offending tooth, although this is a less common occurrence.

The extraction of maxillary incisors as part of a...
treatment plan for the relief of crowding is rare due to their aesthetic importance. However, incisor extraction may be considered if teeth are affected by trauma, severe impactions, abnormal shape, resorption or extensive caries.5-9

The current case presented with a skeletal Class II, severely crowded malocclusion in association with a retrognathic mandible. The lower arch was locked behind palatally-ectopic upper lateral incisors, which were extracted prior to functional appliance treatment. A secondary phase followed and involved full-fixed appliance treatment accompanied by the extraction of the lower first premolars.

**Diagnosis**

A 14-year-old male patient presented with chief complaints of prominent upper front teeth, lip incompetence at rest and a lower lip trap. There were additional complaints of impaired speech and difficulty in eating. The patient had a convex facial profile due to a retrognathic mandible. The upper and lower arches were crowded and affected by the upper lateral incisors, which were unusually broad and ectopic. The palatally-placed lateral incisors locked the mandible in disto-occlusion and preserved the molars in a full unit Class II relationship. The overjet measured 11.5 mm. The lower incisors were retroclined, possibly due to the mandibular disto-occlusion and lip trap. There was a tooth-size – arch-length
discrepancy of 10 mm in the upper arch and 8.5 mm in the lower arch. An analysis of clinical and radiographic records led to a diagnosis of a skeletal Class II, severely crowded malocclusion, in the late CS3 stage of mandibular growth (Figure 1, Table I).10

Treatment objectives
The treatment objectives were:
1. The correction of the skeletal pattern and facial profile by forward repositioning of the mandible.
2. The alignment of the upper and lower dental arches.
3. The functional improvement of speech and mastication.

The objective of treating this case during early adolescence was to take advantage of the remaining growth for the management of the skeletal Class II malocclusion. As the palatally-ectopic upper lateral incisors appeared to contribute to the mandibular retrognathism, it was deemed important to eliminate their influence to enable maximum forward mandibular repositioning.

Table I. Measurements of cephalometric parameters.

| Parameters                        | Pretreatment | Post-functional | Post-treatment | 2 ½ years post-functional / 1 year post-debond |
|-----------------------------------|--------------|-----------------|----------------|-----------------------------------------------|
| **Maxilla**                       |              |                 |                |                                               |
| SNA                               | 80°          | 79°             | 79°            | 79°                                           |
| Pt A to Na perpendicular [mm]     | -2           | -2.5            | -2.5           | -2.5                                          |
| Maxillary base length [mm]        | 48           | 49              | 49             | 49                                            |
| **Mandible**                      |              |                 |                |                                               |
| SNB                               | 73°          | 76°             | 76.5°          | 76.5°                                         |
| Pog-Na perpendicular (mm)         | -12          | -7.5            | -5             | -5                                            |
| Facial angle                      | 83°          | 87°             | 88°            | 88°                                           |
| Mandibular base length [mm]       | 62           | 64.5            | 66             | 66                                            |
| **Maxillo-mandibular relationship**|             |                 |                |                                               |
| ANB                               | 7°           | 3°              | 2.5°           | 2.5°                                          |
| **Vertical**                      |              |                 |                |                                               |
| FMA                               | 30°          | 28°             | 29°            | 29°                                           |
| SN-GoGn                           | 35°          | 33°             | 34°            | 34°                                           |
| Anterior facial height (mm)       | 98           | 103             | 103.5          | 103.5                                         |
| Posterior facial height (mm)      | 60           | 62              | 63.5           | 64                                            |
| **Dental**                        |              |                 |                |                                               |
| UI-SN                             | 104°         | 92°             | 107.5°         | 108°                                          |
| UI-NA (linear, mm)                | 4            | 1               | 3              | 3                                             |
| UI-NA (angular)                   | 24°          | 15°             | 29°            | 30°                                           |
| LI-NB (linear, mm)                | -1           | 1               | 2.5            | 2.5                                           |
| LI-NB (angular)                   | 7°           | 15°             | 25°            | 25°                                           |
| IMPA                              | 77°          | 80°             | 91.5°          | 91.5°                                         |
| **Soft tissue**                   |              |                 |                |                                               |
| Nasolabial angle                  | 82°          | 99°             | 103°           | 103°                                          |
| Upper lip to E-line (mm)          | 1            | -2              | -2             | -2                                            |
| Lower lip to E-line (mm)          | 2            | 0               | 0              | 0                                             |

10. American Dental Association. (2010). Orthodontic Treatment: Principles and Techniques. Chicago: American Dental Association.
Treatment options

Two treatment options were discussed with the patient and his parents. The first was to commence with full fixed appliance treatment following the extraction of all first premolars. This plan was expected to create space for the alignment of the maxillary lateral incisors and resolve the mandibular crowding. Once the upper and lower arches were aligned, fixed functional appliance treatment was planned to manage the skeletal relationship. Since the upper lateral incisors were quite broad, reshaping would be necessary. It was also explained that, during the course of alignment and preparation of the arches for fixed functional appliance treatment, peak growth period may be lost resulting in little or no assistance in the management of the skeletal Class II.

The second treatment option involved the extraction of the upper lateral incisors, immediately followed by Twin Block appliance therapy. Later, in the supportive phase of the functional therapy, fixed appliance treatment with the extraction of the lower first premolars would be required for final levelling, alignment and occlusal management. The second treatment option would necessitate the cosmetic reshaping of the canines to resemble lateral incisors and first premolars to resemble canines in order to improve aesthetics and occlusal guidance.

Treatment progress

Following informed consent, the patient and his parents accepted the second treatment option and the upper lateral incisors were extracted. Twin Block therapy to advance the mandible with additional provision for maxillary expansion was initiated (Figure 2). After eight months of functional appliance treatment, an improved buccal segment, a normal overbite and overjet coupled with lip competence were achieved. The sagittal correction was retained with an upper removable appliance incorporating a reverse inclined plane (Figure 3).

During the retention phase of functional therapy, the mandibular first premolars were extracted and fixed appliances (Roth 0.022 inch slot RMO™) were bonded to the upper arch and to the lower first molars and canines only (Figure 4). Tooth alignment was initiated in the upper arch and lower canine retraction was carried out using sectional mechanics. This was followed by full bonded fixed appliance therapy and levelling alignment of both arches. The case was finished to a Class I molar relationship (Figure 5).

Because the maxillary lateral incisors were extracted, clinical procedures were undertaken for canine substitution of the lateral incisors and premolar substitution of the canines. A significant amount of crown modification and reshaping is often required to make a canine resemble the morphology of a lateral incisor. The canine reduction procedure, which aimed to remove the labial eminence, was carried out with extra thin contouring coarse grit discs (Sof-Lex™ 3M ESPE) and polishing was carried out with fine grit discs. Lateral incisor brackets were bonded onto the canines and canine brackets onto the first premolars. Mesial, distal and lingual reshaping was carried out over an interval of 3–4 weeks. At each appointment, fluoride varnish (containing 5% sodium fluoride) was applied after tooth reduction to prevent sensitivity. The palatal reduction of the canines and palatal cusp removal of the upper premolars was judged with the help of articulating paper and the identification of high spots generated during centric and eccentric movements.

The amount of in-built bracket torque of the lateral incisor was not adequate to achieve the desired labio-lingual inclination of the canine. Additional canine palatal root torque was incorporated in a 0.019 x 0.025 inch SS archwire using a torquing key. An increased amount of torque could have also been...
accomplished by the attachment of an inverted lower premolar bracket. At the same time, a canine eminence for the premolars was produced by additional buccal root torque incorporated into the wire design. The additional torque had the added effect of reducing the prominence of the premolar’s palatal cusp. The case was finished and debonded, following which a flexible spiral wire (FSW) retainer was attached to the lower arch and a Begg retainer with a reverse inclined plane was inserted in the upper arch. Regular reviews of the patient’s treated occlusion continued.

Discussion
Because the development of a permanent tooth bud is lingual to the primary tooth roots, lingual or palatal eruption frequently occurs in cases of prolonged retention of deciduous teeth. Palatally-displaced lateral incisors may also arise as a result of anterior crowding, which can lead to occlusal trauma, aesthetic concerns and, in some cases, may hamper the forward growth of the mandible.\textsuperscript{1}

Skeletal discrepancies in selected growing patients may be addressed with functional appliances. Previously published papers suggest that the optimal time to use a functional appliance for the treatment of Class II skeletal discrepancies is during or slightly after the onset of the increase in pubertal growth velocity at CS3–CS4 stage.\textsuperscript{4,10,11} A greater skeletal contribution, indicated by larger increments in total mandibular length and in ramus height, and condylar growth in a more posterior direction may be achieved through functional therapy.\textsuperscript{4} Since the present case was determined to be in late CS3 or early CS4, it was important to initiate therapy at this time to achieve the best outcome. With these benefits uppermost, the extraction of the upper lateral incisors followed by Twin Block therapy was implemented and resulted in an excellent outcome in profile and occlusion. If
the treatment alternative had been initiated with fixed appliances, a critical age of active growth would have been lost during alignment of the severely displaced lateral incisors and, subsequently, in preparation of the arches for the purpose of fixed functional appliance treatment.

A positive correlation has been found between incisor relapse and the distance of required incisor movement in cases involving palatally-placed lateral incisors. Therefore, in the present case, the likelihood of the lateral incisors partially returning to their original position during the retentive phase of management would have been high. This rationale supported the extraction of the maxillary lateral incisors. In addition, to relieve the crowding of the lower anterior teeth and harmonise the upper and lower arches, the extraction of lower premolars has been recommended in cases of upper lateral incisor extraction.

The crown reduction procedures and archwire designs followed the suggestions made by Zachrisson et al. and Ngan et al. in studies of lateral incisor/canine substitution. The aesthetic improvements included the orthodontic correction of the crown torque of the mesially-relocated canines in order to mimic optimal lateral incisor morphology and position. In addition, positional correction involving torque and rotation of the mesially-moved premolars was required. Careful crown reduction was planned to make the canine resemble the lateral incisor and eliminate likely occlusal interferences created by the canine and palatal cusp of the first premolar. Accordingly, substitutions were carried out by correcting the shape, crown torque, level of the marginal gingiva and occlusal interference of the canines and upper first premolars. The tooth reduction was performed in small increments and with great care to avoid tooth sensitivity. Occlusal equilibration was necessary, to avoid periodontal breakdown resulting from occlusal interferences. It has been suggested that the objectives of any occlusal equilibration is to eliminate interferences and premature tooth contacts in order to provide occlusal group function. Group function was achieved over a period of time, with finishing archwires and the reduction of the palatal cusps of the first premolars carried out during the finishing phase. The occlusion was stable after one year of post treatment follow-up (Figure 6). A superimposition of the lateral cephalograms at different time intervals revealed a skeletal mandibular advancement of 6.5 mm at pogonion with little change in vertical and maxillary parameters (Table I, Figures 7 and 8). The advancement remained stable 30 months after the discontinuation of functional treatment.

**Summary**

A 14-year-old male patient with a Class II molar relationship accompanied by an increased overjet and overbite, impaired oral function and anterior
crowding was treated with the extraction of upper lateral incisors. This was followed by functional appliance therapy as a first phase of treatment and later with lower first premolar extractions and fixed appliances as a second treatment phase.

1. After eight months of phase I therapy, a forward position of the mandible was achieved which produced an improved buccal segment relationship and a normal overjet and overbite. There was also substantial improvement of the profile as well as improvement in chewing and speech.

2. To relieve the crowding, first premolar extractions were carried out in the lower arch and full fixed appliance therapy was initiated.

3. The upper canines and premolars were substituted for the lateral incisors and the canines, respectively, in form and function.

4. Post-treatment group occlusal function was established and an upper inclined plane coupled with a lower bonded fixed retainer were used for retention.

5. No relapse was observed at a one year review.
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