An Innovative Treatment Approach with Atypical Orthodontic Extraction Pattern in Bimaxillary Protrusion Case

1Anil Miglani, 2Reena R Kumar, 3Ashish Chopra, 4Sangeeta Sunda

INTRODUCTION
Bimaxillary dentoalveolar protrusion is a condition characterized by proclined upper and lower incisors with increased procumbency of the lips. Hence, the goals of orthodontic treatment include the retraction of both maxillary and mandibular incisors to decrease soft tissue procumbency and facial convexity. The common treatment approach would involve extraction of first four premolars with maximum anchorage mechanics. The treatment plan becomes complicated when the patients present with extracted first molar and even more complex when third molars are congenitally missing or unfavorably positioned.

This case report describes the innovative treatment approach for the patient with bimaxillary dentoalveolar protrusion with missing mandibular first molar.

CASE REPORT
Diagnosis
A 23-year-old female patient presented with the chief complaint of forward placement of upper front teeth. The patient exhibited a convex profile with marked protrusion of lips (Figs 1A to D). Intraorally, she had a Class I canine and molar relationship with minor crowding (Figs 1E to I). The panoramic radiograph confirmed the history of prior extraction of mandibular left first molar and revealed the absence of mandibular left third molar and a need for endodontic treatment of second molar on the same side (Fig. 1J). The lateral cephalogram showed a Class I skeletal pattern with hypo-divergent jaw bases as evidenced by the ANB angle of 30° and FMA of 14°. The IMPA was 121° and L1 to NB values of 38° and 8.5 mm and U1 to NA 38° and 8 mm confirmed the proclination of the upper and lower incisors (Fig. 1K). There were no significant signs or symptoms of temporomandibular disorders.

Treatment Objectives
Treatment objectives included the following: (1) Level and align the teeth in upper and lower arch, (2) achieve ideal overjet and overbite relationships, (3) obtain a pleasing facial profile and (4) replace the mandibular left first molar.

Treatment Alternatives
The first alternative was extraction of the four first premolars and retraction of the maxillary and mandibular anterior teeth by using maximum anchorage. However, this would require the replacement of the molar by either an implant or a 3 unit conventional bridge. This adjunctive expenditure would be an additional burden to the patient.

The second alternative was extraction of mandibular first molar on the right side to create symmetric spaces and thereafter protract second molar using microimplant to end
in Class II molar relationship. Due to the absence of mandibular third molars this would have resulted in a small occlusal table with only one molar in the mandibular arch. Moreover, there will be no antagonist to the upper second molar.

The third alternative was extraction of first premolars except in the mandibular left quadrant. It was planned that in mandibular left quadrant missing molar space would be utilized for anterior retraction and as well for partial distalization of the mandibular left second premolar. The second premolar along with endodontically treated second molar could then serve as abutment for a joint first and second molar prosthesis. This would not only prevent extraction of a healthy premolar but would also negate the need of three unit bridge.

Benefits and disadvantages of each were explained to the patient and the patient choose the third treatment option.
Treatment Progress

The treatment plan involved sliding mechanics in the both arches and banding of second molar for anchorage control after the extraction of the maxillary first premolars and the mandibular right first premolar.

After the extractions, fixed preadjusted appliance with MBT Prescription (0.022 × 0.028-inch slot) was placed. After due leveling and aligning, 0.017 × 0.025-inch S-S archwire with crimpable hooks distal to lateral incisors was placed in 3 quadrants except the mandibular left quadrant where the crimpable hook was placed distal to canine, and the anterior teeth were retracted simultaneously. After space closure, it was observed that mandibular dental midline was shifted toward the right. To achieve correction of the same 0.019 × 0.025 inch S-S wire was placed in upper arch and 0.018 inch S-S wire in the lower arch along with double strength Class II elastic on right side and single strength on left side. After en masse movement, directional force control was used to retract mandibular second premolar to move in place of first molar (Figs 2A to E). After distal movement 2 mm of space was present mesial and distal to second premolar for prosthetic replacement. The treatment was completed with ideal archwires and cusp seating elastics. Lingual bonded retainer was placed in the mandibular arch and Hawley’s retainer was delivered for maxillary arch. The total treatment time was 18 months. After orthodontic treatment prosthodontic rehabilitation was done for replacement of first and second molar.

Treatment Results

The patient’s facial profile had significantly improved, and the dental occlusion was maintained with symmetric Class I molar and canine relationship on both sides with optimal overjet and overbite (Figs 3A to K). Superimposition of pre- and post-treatment cephalometric tracings (Fig. 4) confirmed the maximum retraction of the anterior teeth by controlled tipping with no positional change of the maxillary molars in any direction (Table 1).
Figs 3A to I: (A) Post-treatment profile at rest, (B) post-treatment frontal at rest, (C) post-treatment frontal dynamic smile, (D) post-treatment oblique on smile, (E) post-treatment right buccal dental photograph, (F) post-treatment frontal centered dental photograph, (G) post-treatment left buccal dental photograph, (H) post-treatment maxillary occlusal dental photograph, (I) post-treatment mandibular occlusal dental photograph

Fig. 3J: Post-treatment lateral cephalogram

Fig. 3K: Post-treatment OPG

Table 1: Pre- and post-treatment cephalometric data

<table>
<thead>
<tr>
<th></th>
<th>SNA</th>
<th>SNB</th>
<th>ANB</th>
<th>FMA</th>
<th>U1 to NA (angle)</th>
<th>U1 to NA (linear)</th>
<th>L1 to NB (angle)</th>
<th>L1 to NB (linear)</th>
<th>S-line to U/L lip</th>
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<td>78°</td>
<td>3°</td>
<td>14°</td>
<td>38°</td>
<td>8 mm</td>
<td>38°</td>
<td>8.5 mm</td>
<td>1/4 mm</td>
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<tr>
<td>Post-treatment</td>
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<td>77°</td>
<td>3°</td>
<td>14°</td>
<td>24°</td>
<td>5 mm</td>
<td>29°</td>
<td>4 mm</td>
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DISCUSSION

Bimaxillary dentoalveolar protrusion cases with missing molar are a challenge for the orthodontist. Conventional treatment plan involves extraction of premolars to achieve facial changes, but absence of molar in any quadrant creates a dilemma for the orthodontist, i.e. whether to extract the premolar of same
quadrant or to utilize the available space of the extracted molar. This case report introduces an innovative solution to the above problem by utilizing the extracted molar space for retraction and also using second premolar as an abutment for molar prosthesis to finish the case in Class I molar relation on both sides.

Though there was high anchorage demand, microimplants were not used for retraction as the patient had severe horizontal growth pattern so there were minimal chances of anchorage loss and secondly second molar were used as anchorage.4

In the maxillary arch en masse retraction was done using sliding mechanics on both sides. In the mandibular arch also sliding mechanics were used but the presence of space at asymmetric location created concerns which were resolved with changes in mechanics. The left mandibular segment required retraction of 5 units (from central incisor to second premolar) this shifted the center of resistance of these teeth distally in between canine and first premolar. Hence, the crimpable hook for retraction was placed distal to canine on left side. The mandibular midline was shifted toward right side during treatment, this could have happened because we had used same levels of force on both sides with different number of units to be retracted, i.e. 3 units on right side as compared to 5 units on left side. According to Chung et al this could have prevented by using different force levels on right and left sides.5 However, in present case midline was later matched using asymmetric Class II elastics—double on right side and single on left side.

After en masse retraction of lower anterior segment mandibular second premolar was distalized to bring it in the center of first molar space so that it can be used as abutment for first molar prosthesis. Postdistalization premolar was maintained in upright position to allow occlusal forces to pass along the long axis. Diedrich et al6 studied the distal movement of premolar to serve as posterior abutment for missing molar on 24 patients (32 premolars) for a period of average 9.6 years. All 32 distalized premolars were functioning efficiently as bridge abutment and showed minimal mobility of 0.2. They also revealed that all teeth remained vital with low measured probing depth and sulcus bleeding indices. They concluded that premolar as a posterior bridge abutment is prognostically favorable alternative to an implant.

Mandibular left second molar was endodontically treated and required crown for rehabilitation. In order to distribute the functional load and to follow Ante’s law it was decided to make a joint unit for mandibular left first and second molar.

As per Ante’s law for prosthetic rehabilitation, the abutment teeth should have a combined pericemental area equal to or greater in pericemental area than the tooth or teeth to be replaced. A ratio of abutment to pontic of 1:1 or greater would satisfy Ante’s law. The average pericemental area of second bicuspid is 207 ± 26.6 mm², for first molar is 431 ± 59.5 mm² and for second molar is 426 ± 69.7 mm².7 In the present case premolar and second molar (with average pericemental area of 207 mm² and 426 mm² respectively with a total of 633 mm²) were used as abutment for a first molar pontic (431 mm²), the above makes abutment to pontic ratio of approximately 1.46:1. Instead of a joint unit the other alternative was to place two separate units for first and second molar but that would not had sufficed Ante’s law, because that makes the abutment to pontic ratio of 0.48:1.

Even if the second molar is vital it would be prudent to include the second molar in prosthesis to match the Ante’s law ratio.

At the end of treatment, good facial esthetics and Class I molar and canine relation was achieved on both sides.

CONCLUSION

This innovative approach conserved a healthy tooth by avoiding the extraction of the sound bicuspid and an additional prosthetic replacement was prevented.

REFERENCES