ABSTRACT
This case report describes the treatment of a teenage patient with simultaneous impaction of all three right mandibular permanent molars. The impacted first and second mandibular molars were surgically exposed and orthodontically erupted into good alignment and occlusion while the impacted third molar in the same quadrant was extracted. The unique clinical presentation, various treatment alternatives, the decision making process in finalizing the treatment plan and its clinical implementation are discussed.

Keywords: Impacted molar, Orthodontic, Eruption, Uprighting.

INTRODUCTION
Impaction is defined as failure of tooth eruption caused by a physical obstacle in the eruption path or abnormal position of the tooth germ. While impaction of third molars is a common problem, the incidence of mandibular second molar impaction is quite low and is reported to be around 0.06 to 0.3%. Impacted mandibular first molars are extremely rare, with a reported prevalence of less than 0.01%. Various treatment options for an impacted tooth include extraction with or without prosthetic replacement or orthodontic space closure, surgical repositioning, transplantation and orthodontically assisted eruption with or without surgical uncovering.

While impactions of single teeth in a quadrant are routinely encountered by most orthodontists, multiple impacted molars in the same quadrant are an unusual occurrence and are likely to present as a highly challenging clinical situation. This article reports and discusses the management of a rare case of simultaneous unilateral impaction of mandibular first, second and third molars using a combined surgical and orthodontic approach.

DIAGNOSIS
A 15-year-old boy reported to our practice with the chief complaint of ‘missing’ teeth in his right mandibular posterior area. He also complained of spacing and ‘shifted’ teeth in the lower right quadrant and desired treatment for the same. His intraoral examination confirmed that no erupted permanent molars were present on the right mandibular quadrant. The most posterior tooth clinically visible in the lower right quadrant was the second premolar, which appeared to be very distally positioned, leading to spacing. The patient’s past dental, medical and family history revealed nothing significant.

Extraorally (Figs 1A to C), the patient had a mildly convex profile. His lips were competent and their position with respect to the E-line was normal. Vertically, he had an average angle facial growth pattern and gingival display on smiling was within acceptable limits. His upper dental midline was shifted slightly to the right.

Intraorally (Figs 2A to E), both upper quadrants and the lower left quadrant had fully erupted permanent teeth till the first molars. The second permanent molars were erupting on the left side but was not seen yet on the upper right side. On the left side, molar relation was Class I and canine relation between end on and Class I. On the right side canine relation was Class I but the lower premolars appeared to have migrated distally significantly with resultant spacing. Anteriorly, the overjet and overbite was slightly greater than normal. The lower left second premolar had Turner’s hypoplasia.

The orthopantomogram (Fig. 3) revealed that all permanent teeth were present but the right mandibular first, second and third molars were severely impacted. Crowns of first and second right mandibular molars were ‘looked’ into each other with the first molar distally tipped and second
molar horizontal while the right lower third molar was displaced high in the ramus.

Lateral cephalogram (Fig. 3 and Table 1) revealed that the patient had a skeletal Class I average angle facial pattern with mildly increased labial inclination of the incisors.

**TREATMENT PLANNING**

Analysis of diagnostic records revealed that the space available was not sufficient to accommodate all three right mandibular molars properly in the arch. Hence, one molar would definitely have to be extracted and two molars could be correctly positioned in the arch.

Our preferred treatment plan involved the following steps:

a. Mesialization of lower right second premolar to create space for the molars.

b. Surgical exposure and orthodontic assisted eruption and mesialization of lower right first molar.

c. Surgical exposure and orthodontic assisted eruption and repositioning of lower right second molar.

d. Extraction of lower right third molar to be done only after ensuring good prognosis of orthodontic treatment of lower right first and second molars. This would keep alternative treatment options open.

Alternative treatment options that were considered are extraction of either the lower right first or second molar and utilizing the lower right third molar to provide satisfactory occlusion. More radical and invasive options like transplantations and surgical tooth repositioning were also considered. Lastly, the option of extracting all three molars and providing implant prosthesis with ridge preservation and if needed, bone grafting procedures was also contemplated.

Besides correction of the impacted right mandibular molars, achieving a Class I occlusion with proper alignment and leveling of the arches and good dental and facial esthetics was also part of the treatment objectives.
TREATMENT PROGRESS

Treatment was initiated in both arches with 0.022" MBT appliance. A soldered transpalatal arch was placed to control eruption of upper right molars and reinforce anchorage. Initial alignment in the lower arch was obtained using round nickel-titanium archwires which helped primarily to derotate the distally positioned right lower second premolar. Mesialization of the right lower second premolar was subsequently done using sliding mechanics on 0.018" Stainless Steel archwires (Fig. 4). After completing upper alignment, the teeth in each arch were ligated and upper and lower 0.019" × 0.025" stainless steel archwires placed. The next step was to ‘unlock’ the lower right first molar from the second molar by mesially uprighting and extruding it into its proper position (Figs 5 and 6). A minimally invasive surgical procedure was done to expose the most easily accessible mesial surface of the impacted first molar and a Begg’s bracket was bonded close to the mesiobuccal line angle. Mesial traction was initiated using chain elastics from the mandibular right first molar to the right mandibular canine. A forsus spring (3 M Unitek) was placed on the right side between the upper first molar and lower canine to reinforce anchorage for mesializing the lower first molar and also slightly intrude the upper posterior. As soon as the lower right first molar had erupted sufficiently to expose its buccal surface, the initial attachment was removed and 0.022" MBT buccal tube was bonded to move it into its correct position. Radiographs taken at this stage showed correctly positioned lower right first molar with mesially inclined impacted lower right second and third molars (Figs 7A and B). A second surgery was done to expose and bond 0.022" MBT buccal tube on the lower right second molar and simultaneously extract the lower right third molar (Figs 8A and B). Sectional 0.014" round nickel-titanium wire piggybacked on the main archwire was used to erupt the lower right second molar. The same erupting severely lingually inclined and corrective torque was applied using a series of rectangular archwires (Figs 9A and B).

After correcting the lower right second molar, finishing and detailing of the occlusion was done (Figs 10A to E). This included planning for a full ceramic crown on lower left second premolar, which had turner’s hypoplasia and its small size was contributing to an interarch tooth size discrepancy in the left posterior region. Open coil springs

**Table 1: Summary of cephalometric analysis**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pretreatment</th>
<th>Post-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA</td>
<td>81°</td>
<td>81°</td>
</tr>
<tr>
<td>SNB</td>
<td>78.5°</td>
<td>79°</td>
</tr>
<tr>
<td>ANB</td>
<td>2.5°</td>
<td>2°</td>
</tr>
<tr>
<td>Wits</td>
<td>AO &amp; BO coincident</td>
<td>BO &gt; AO by 0.5 mm</td>
</tr>
<tr>
<td>U1 to NA</td>
<td>6.5 mm, 29°</td>
<td>6 mm, 26°</td>
</tr>
<tr>
<td>U1 to SN</td>
<td>109°</td>
<td>107°</td>
</tr>
<tr>
<td>L1 to NB</td>
<td>6 mm, 30°</td>
<td>5.5 mm, 24°</td>
</tr>
<tr>
<td>IMPA</td>
<td>100°</td>
<td>94°</td>
</tr>
<tr>
<td>L1 to APog</td>
<td>2.5 mm, 29°</td>
<td>2 mm, 24°</td>
</tr>
<tr>
<td>U1 to L1</td>
<td>119°</td>
<td>127°</td>
</tr>
<tr>
<td>GoGn to SN</td>
<td>29°</td>
<td>28°</td>
</tr>
<tr>
<td>Jarabak ratio</td>
<td>64.8%</td>
<td>66.1%</td>
</tr>
<tr>
<td>U-lip to E-line</td>
<td>–1.5 mm</td>
<td>–1.5 mm</td>
</tr>
<tr>
<td>L-lip to E-line</td>
<td>0</td>
<td>0.5 mm</td>
</tr>
</tbody>
</table>
were placed to create mild spaces on the mesial and distal of the same premolar and correct the occlusion. The lower left second premolar was purposefully finished in infraocclusion to keep its reduction to a minimum while placing the full ceramic crown. Class II elastics were used for a short time to achieve and maintain Class I canine and molar relationship. Upper and lower canine to canine lingual bonded retainers were placed and the orthodontic appliance was debonded (Figs 11A to E). The total treatment time was 46 months.

Attachments were left bonded on the buccal of upper right second molar and lingual of lower right second molar for another month after the rest of the appliance was removed for use of settling elastics and to ensure stability. The patient maintained a very poor level of oral hygiene, especially in the last 2 years of the treatment. This resulted in decalcification and several carious lesions which were restored subsequent to debonding. Temporary composite restorations had been placed on mesial and distal of lower
Figs 8A and B: Surgical exposure and bonding of an attachment on lower right second molar along with extraction of lower right third molar

Figs 9A and B: Lower right second molar uprighting and erupting into oral cavity. The lingually inclined second molar was torqued using a series of rectangular wires

Figs 10A to E: Finishing wires. Patient maintained very poor oral hygiene especially in the later stages. Lower left second premolar being positioned for full ceramic crown with minimal reduction
left second premolar just prior to debonding to maintain space for the full ceramic crown, which was placed 6 weeks after completing orthodontic treatment. The impacted lower left third molar was extracted during the finishing stages of orthodontic treatment.

**TREATMENT RESULTS**

The treatment objectives as per our preferred treatment plan were achieved in this case. The right mandibular first and second molars were surgically exposed and orthodontically moved into good alignment and occlusion. A Class I molar and canine relation with normal overjet and overbite was achieved post-treatment which was stable 6 months after completing orthodontic treatment (Figs 12A to F). The patient had a pleasant profile with competent lips and good facial, dental and smile esthetics at the end of the treatment (Figs 13A to C).

Post-treatment OPG (Fig. 14) reveals that the root parallelism with respect to lower left canine and second
premolar could have been better. However, the development of decalcification areas and frank carious lesions forced us to curtail the finishing stage of the treatment. Though the upper and lower dental midlines were made coincident, slight dental midline shift to the right remained which was accepted. A comparison of pretreatment and post-treatment lateral cephalograms (Table 1) showed minor changes with improvement in labiolingual inclination of the incisors.

**DISCUSSION**

According to Andreason et al.\(^1\) three main causes of eruption disturbances are ectopic position of the tooth germ, obstacles in the eruption path and failures in the eruption mechanism. Raghoebar et al.\(^1\) have for diagnostic purposes classified eruption disturbances of teeth into the following three categories: impaction, primary retention and secondary retention.

Impaction is the cessation of the eruption of a tooth caused by a clinically or radiographically detectible physical barrier in the eruption path, or due to an abnormal position of the tooth. Radiographically, an impacted molar before emergence would show an abnormal orientation in its eruption path. It is believed that impaction of first molars is usually due to ectopic eruption while impaction of second molars is commonly due to arch length deficiency.

Primary retention is defined as cessation of eruption of a normally placed and normally developed tooth before gingival emergence without a recognizable physical barrier in the eruption path. A disturbance or abnormality in the dental follicle, which fails to initiate metabolic events for bone resorption to enable eruption is thought to be the cause of primary retention.\(^1,12\) Primary retention can be suspected when the eruption of a tooth is delayed by two or more years.\(^1\) Radiographically, a primary retained molar would mostly show a normal orientation in its eruption path.

Secondary retention refers to cessation of eruption of a tooth after gingival emergence without a physical barrier in the eruption path or ectopic position of the tooth. The most accepted reason for secondary retention is ankylosis of the tooth and infraocclusion is the most reliable clinical finding.\(^13,14\)

Another condition, although rare, that has been used in connection with unerupted teeth, most commonly molars, is primary failure of eruption.\(^15,16\) This was defined by Profitt and Vig as a condition wherein nonankylosed teeth fail to erupt fully or partially because of malfunction of
the eruption mechanism. The typical features include nonsyndromic eruption failure without mechanical obstruction, infraocclusion, significant posterior open bite, and inability to move affected teeth orthodontically. Diagnosis is difficult and mostly achieved by exclusion.

In this case the affected first, second and third molars can be classified as impacted since they were displaced from their normal positions, had improper angulations and the first and second molar crowns were ‘locked’ into each other, thus impeding eruption. The follicle and periodontal ligament of the affected teeth appeared normal on radiographs. The past dental, medical and family history elicited nothing contributory to ascertain the etiology.

With the space analysis it was evident that it would not be possible to accommodate all three molars in the arch. Our preferred treatment plan which was successfully implemented in this case was to surgically expose and orthodontically bring into position the impacted lower right first and second molars and extract the third molar. It was also contemplated to extract either of the impacted first and second molars and bring the third molar into occlusion. However, all the molars were very distally positioned and would require mesialization. If the lower right first molar was extracted, the horizontally impacted second molar would not only have to be uprighted but also require considerable mesialization to move into position of the first molar. Opting for extraction of the lower right second molar would appear to ease the uprighting of the impacted first molar. However, the issue of bringing lower right third molar into functional occlusion as the second molar would remain. In this case, the lower right third molar was displaced considerably high in the ramus with a horizontal angulation. While spontaneous improvement in the position of the lower right third molar could be expected if adequate space was created, there would be a considerable waiting period for the same and the extent to which the concerned third molar would move into position to function as the second molar could not be predicted. Most probably, this would have involved another phase of orthodontics later and considerably lengthen the treatment time. Also, till the lower right third molar could be brought into its final position, it would be necessary to prevent supraeruption of the upper right posteriors and hence, there is greater chance of preserving the blood supply to the tooth and the roots are not exposed to contamination with saliva. While this would have drastically shortened the orthodontic treatment time, there was the increased risk of complications like nonvitalization, ankylosis, root resorption, root fracture and injury to inferior alveolar neurovascular bundle. Considering the age of the patient, these procedures can at best be considered alternatives if for some reason orthodontic treatment is contraindicated, has poor prognosis or fails. The fact that the roots of the right mandibular first and second molars were completely formed further increased the chances of complications with these procedures.

The option of extracting all the three molars and planning for prosthesis was considered too aggressive and undesirable, taking into account the patient’s age and the fair prognosis of orthodontic treatment. This treatment option would keep the complexity and timing of orthodontic treatment to a minimum, but create the need of prosthetic replacement of two molars. Placement of implants would have to be delayed till growth had reduced to adult levels. Till that time, retention would need to be planned to prevent supraeruption of the upper right posteriors and distal movement of lower premolars. There would also be the need for ridge preservation and/or bone augmentation procedures to facilitate implants. The possibility of surgical complications would also be higher with this treatment approach. Moreover, no replacement works better or has better long-term prognosis than one’s own healthy natural teeth in good functional occlusion.

We decided to initially move the impacted first molar into position after creating space by mesialization of the lower right second premolar. Disimpacting the lower right first molar from the second molar by tipping it mesially into the space created would move it toward its final desirable position. Also, the impacted first molar could be exposed and bonded with a minimally invasive surgical approach. One treatment approach that was considered was to initially extract the lower right third molar and expose and bond an attachment on the second molar. However, the molars were anyway positioned distal to their final desirable position and any mechanics that would move the lower right second molar any more distal to free the lower right first molar would be considered unfavorable. This would prolong treatment time and also tax anchorage later in the treatment. Moreover, due to the uncertain etiology, it was considered prudent not to extract the lower right third molar at the beginning of the
treatment. This would keep alternative treatment options open should there be a need to revise our treatment plan.

A forsus spring (3M Unitek) was used during uprighting and mesialization of the lower right first molar. Along with the transpalatal arch, this adequately reinforced anchorage for the impacted first molar correction. Miniscrews could have been used for anchorage in this case. However, since the forsus spring also simultaneously enabled slight intrusion of the upper right posterior segment, prevented the suprabuccal root of upper right first molar till the lower first molar was corrected and helped achieve a Class I canine and molar relationship on the right side, it was our appliance of choice in this case.

Many methods have been advocated for orthodontically correcting a mesioangularly impacted mandibular second molar. Several techniques\textsuperscript{21,22} like the ‘pole arm’ spring apply an uprighting and distalizing force without the need for surgical exposure and bonded attachment by engaging the mesial surface of the second molar below the contact point. Other techniques\textsuperscript{23-28} utilize an attachment bonded on the second molar and the use of coil springs, sectional archwire, superelastic NiTi wire, different varieties of uprighting springs, and miniscrew skeletal anchorage. In the lower right quadrant, a progressive improvement in the positioning of the second molar was seen during mesialization of the second premolar and uprighting of the first molar, and we expected it to react very favorably to orthodontic force. As it was considered necessary to extract the lower right third molar for creating sufficient space for the lower right second molar, we decided to bond a buccal tube on the second molar in the same surgical procedure. A sectional round nickel titanium wire was considered a simple and comfortable method for the initial eruption of the impacted second molar into the oral cavity following which rectangular archwires were used for effective three dimensional control of tooth position.

One issue which somewhat compromised treatment results was decalcification and development of carious lesions. This was due to the lack of oral hygiene maintenance by the patient coupled with the long duration of orthodontic treatment. In retrospect, this could have been one factor in favor of considering surgical uprighting of the impacted second molar. However, repeated patient assurance toward improving hygiene and his insistence on avoiding any alternative treatment were factors which tilted our decision to achieve maximum results with orthodontic treatment.

Due to high caries index, we decided to place a crown on the hypoplastic lower left second premolar, which also corrected the interarch tooth size discrepancy and ensured good occlusion.

A cone beam CT scan was not used during the diagnosis and treatment planning in this case. However, we are of the opinion that the same can be an excellent diagnostic tool for three dimensional assessment and optimizing treatment approach in complicated impaction cases.

REFERENCES

19. Schatz JP, Joho JP. Indications of auto transplantation of teeth