

Extractions of first permanent molars in orthodontics: Treatment planning, technical considerations and two clinical case reports

Ashok Surana^a, Siddhartha Dhar^b, SurajitChakrabarty^c, Sanjay Kumar^d

First permanent molars are not usually extracted for orthodontic purposes, but their compromised status may necessitate such a step in certain cases. This article reviews the literature, the rationale and technical considerations of orthodontic treatment with extractions of first permanent molars.

The first permanent molar has been reported to be the most caries prone tooth in the permanent dentition, and is also commonly found to display significant hypoplasia.¹⁻² Nonetheless, it has traditionally been regarded as sacred in the dentition, and has rarely been considered as a candidate for extractions, as long as restorative possibilities exist.

With greater numbers of adult patients presenting themselves for orthodontic care, the orthodontist is increasingly required to consider the presence of carious, filled or endodontically treated first permanent molars, while formulating a treatment plan. There is an ethical issue of the appropriateness of extracting healthy premolars rather than compromised molars for management of crowding or dental protrusion, since heavily restored teeth will enter the “restorative cycle” and may need to be extracted later in life.

Orthodontists have usually hesitated to extract compromised first molars rather than healthy premolars, since there is a perception that such cases are associated with more complicated treatment mechanics, significantly longer treatment time, and a poorer overall prognosis. Many operators also simply lack the experience in handling molar extraction cases.

The aim of this article is to discuss the rationale of first permanent molar extractions in orthodontic therapy, as well as its implications on treatment mechanics and retention.

Review of Literature

Wilkinson³ advised extractions of all 4 first permanent molar teeth at the age of 10.5 years, claiming that it would prevent not only malocclusion but also dental decay and pyorrhea.

Salzmann⁴ was of the opinion that such an intervention would cause significant occlusal disturbance, an increase in caries, and detrimental change in facial contour and appearance.

Mills⁵ stated that first permanent molar extractions had the effect of doubling the treatment time and halving the prognosis.

Daugaard-Jensen⁶ on the other hand suggested that first molar cases are no more time consuming than 4 premolar cases and in many cases offer distinct advantages in terms of anchorage management.

Stepovich⁷ reported that satisfactory closure of first molar extraction spaces was best achieved on children and young adults.

Compensating extractions of unopposed maxillary first permanent molars after the removal of a diseased mandibular counterpart have been a part of the British treatment philosophy.⁸

Williams and Hosila⁹ highlighted the fact that first molar extraction cases are likely to have less effect on the profile than premolar extraction cases. Also in their cases involving first molar extractions there was about a 90% chance of successful third molar eruption compared with approximately 55% chance with cases involving premolar extractions.

Indications and Contra-indications for Orthodontic Extractions of First Molars:¹⁰⁻¹¹

Indications:

1. Extensively carious first molars.
2. Hypoplastic first molars.
3. Heavily filled first molars where premolars are perfectly healthy.
4. Apical pathoses or root treated first molars.
5. Crowding at the distal part of the arches and wisdom teeth reasonably positioned.
6. High maxillary/mandibular planes angle
7. Anterior open bite cases

Contra-Indications:

1. Patients who do not present with crowding or dental protrusion.
2. Patients with decreased lower face height.
3. Orthodontic extractions of lower first molars in Class II division 2 cases should be avoided as space closure is difficult to accomplish.
4. Non-compliant patients.
5. Patients who have already undergone previous orthodontic treatment and present with root resorption and/or short roots.
6. In patients with bruxism, molar extractions should be avoided due to occlusal interferences that occur during space closure, causing an overload of forces on posterior teeth.

Treatment mechanics: Special considerations

1. Initial light leveling wires such as .012" HANT and .014" HANT should ideally not be extended beyond the second premolar, since the long inter bracket segments of wire in the molar extraction space are subject to deformation and breakage. In case there is significant anterior crowding present, early retraction of canine and premolar segment may be achieved with segmental loop wires prior to attempting comprehensive alignment.

^aPrivate practice of orthodontics, Kolkata, and Director, Indian Board of Orthodontics.

^bSpecialist Orthodontist, Al Hilal Medical Center, Bahrain.

^cPrivate practice of orthodontics, Kolkata

^dPrivate practice of orthodontics, Kolkata

2. Once a continuous archwire is placed upto the second molars, plastic or stainless steel tubing which is 1-2 mm shorter than the interbracket distance may be placed over the segment of wire traversing the molar extraction space, to prevent distortion and protect the soft tissues.
3. There is a tendency for lingual rolling of lower second molars during space closure: This can be reduced by using full size (0.019" x 0.025") stainless steel arch wires for space closure.
4. The MBT prescription which has the lowest lingual crown torque (10 degrees) is preferable over other prescriptions to prevent lingual rolling of second molars.
5. In case of the upper arch, anchorage loss occurs more readily. Therefore, anchorage may need to be reinforced with a Nance palatal arch to the maxillary second molars, or additional use of headgear. Currently, the miniscrew implant has become the gold standard for maintenance of anchorage.
6. If considerable space is required for management of crowding or for anterior retraction, extractions of compromised first molars must be delayed until eruption of the second molars. Early extraction of the first molars will lead to mesial eruption of second molars and nearly complete loss of extraction space.
7. Root paralleling: There is a tendency for molars to tip forward during space closure. Paralleling of roots may be achieved with gentle tip-back bends in the final rectangular wire, with tight figure of eight ligatures in place to hold the extraction space closed.
8. Class II elastics should not be used until full size steel wires are in place. If necessary they may be worn from lingual cleats on the lower molar bands to reduce the tendency for lingual rolling.
9. Following completion of treatment, extraction spaces should be held tightly closed for a few months to allow the gingival fibers

time to reorganize. This is especially true in case of adults.

10. Begg's wraparound retainers are preferable over Hawley's retainers as they prevent the opening of extraction spaces between the second premolar and second molar.

Case report 1:

Diagnosis:

A 20 year old woman reported with the chief complaint of protruded teeth. Extra-oral examination (Fig.1) revealed mesocephalic pattern with convex profile and incompetent lips, with excessive incisor display at rest. Intra-oral examination (Fig.2, 3) revealed grossly decayed 16, 36 and 46 and over erupted 26. There was increased overjet with Class I canine relationships, while the second molars were in a Class I relationship. Dental midlines were coincident. All the third molars were erupted in the oral cavity and in occlusion. Standard panoramic and cephalometric radiographs were obtained.(Fig.4) Cephalometric analysis (Table 1) showed the presence of bidental protrusion on a Class II skeletal base.

Treatment Planning:

The patient needed fixed orthodontic treatment with extractions to enable anterior retraction and correction of lip incompetence. Since three out of four of the patient's first molars were grossly decayed and one was over erupted, it was decided to extract them to gain the necessary space to achieve the orthodontic goals. Miniscrew implants would be utilized to prevent anchorage loss.

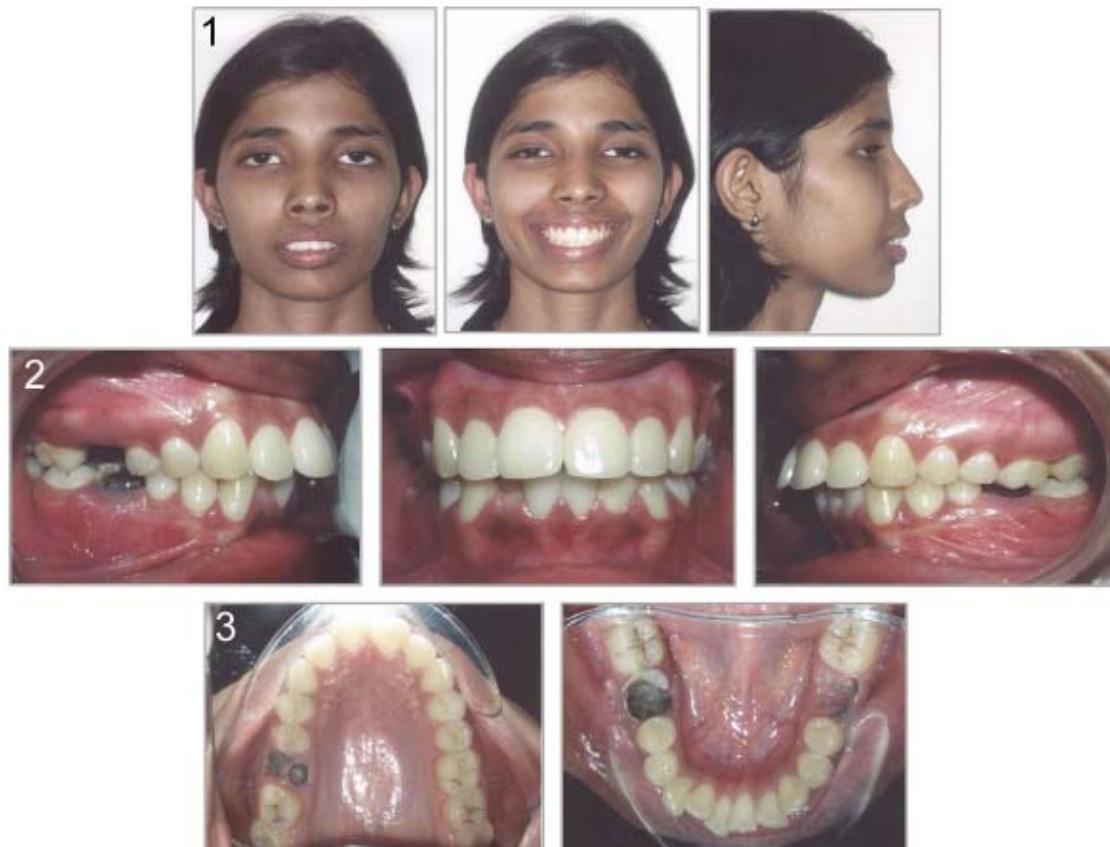


Fig 1. Pre Treatment Extraoral Photographs, 2., 3. Pre Treatment Intraoral Photographs

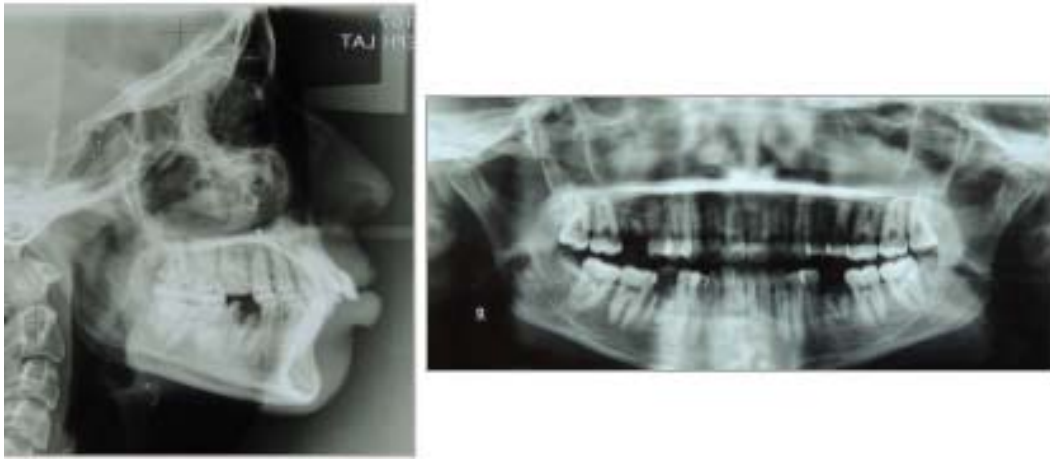


Fig 4. Pretreatment lateral cephalogram and panoramic radiograph

Table 1. PreCephalometric Measurements

Parameter	Pre-treatment
ANB	6 degrees
Upper 1 – NA	30 degrees , 5mm
Lower 1 - NB	35 degrees , 7mm
Inter incisal angle	110 degrees
Naso labial angle	98 degrees
IMPA	97 degrees
Sn – Go Gn	35 degrees



Fig 5. Mid treatment intraoral photographs

Treatment Progress:

Following extractions of all maxillary first molars, the upper and lower arches were strapped up with preadjusted edgewise appliances (MBT, 0.022' x 0.028"). The arches were leveled and aligned with a sequence of wires beginning with 0.014" HANT, progressing up to 0.019" x 0.025" HANT. One month after the placement of 0.019" x 0.025" "posted stainless steel retraction wires, miniscrew implants (1.5 mm x 9 mm) were inserted mesial to all the permanent second molars, and retraction forces applied from them via power chains. (Fig. 5) Space

closure occurred in a routine manner, following which the occlusion was settled, and fixed appliances debonded. Treatment time was 26 months. Permanent retainers were bonded in the upper and lower anterior teeth, and removable Begg's wrap-around retainers prescribed for full time wear for a year.

At the end of treatment, the patient had a well aligned dentition with tight proximal contacts between the second premolars and second molars. Canine and molar relationships were Class I, with normal overjet and overbite. (Fig. 6). Extra oral views showed significant reduction in facial profile convexity and achievement of lip competence at rest.



Fig 6. and 7. Post treatment photographs



Fig 8. Post treatment lateral cephalogram and panoramic radiograph

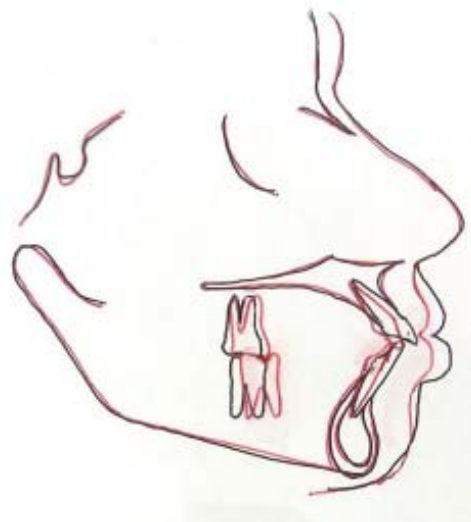


Fig 9. Cephalometric superimposition (Before and after treatment)

Table 2. Cephalometric Changes

Parameter	Pre-treatment	Finishing
ANB	6 degrees	3 degrees
Upper 1 – NA	30 degrees , 5mm	21 degrees, 4mm
Lower 1 - NB	35 degrees , 7mm	19 degrees, 4 mm
Interincisal angle	110 degrees	138 degrees
Naso labial angle	98 degrees	108 degrees
IMPA	97 degrees	90 degrees
Sn – Go Gn	35 degrees	34 degrees

The patient had a pleasing smile and dramatically improved facial esthetics (Fig. 7). Post treatment radiographs (Fig.8) showed excellent root convergence between second premolars and second molars. Cephalometric changes are summarised in Table 2 and Fig. 9.

Case report 2:

Diagnosis:

A 14 year old girl reported with the chief complaint of protruded teeth and excessive show of gums. Extra-oral examination (Fig.10) revealed dolichofacial pattern with convex profile and incompetent lips. There was excessive incisor and gingival display at rest. Intra-oral examination (Fig.11, 12) showed the presence of grossly decayed 26, 36 and 46. Molar and canine relationships were Class I. Dental midlines were coincident. Standard panoramic and cephalometric radiographs were obtained (Fig. 13). All the third molars were seen to be developing normally. Cephalometric analysis showed the presence of bidental protrusion on a Class II skeletal base with vertical growth pattern. (Table 3)

Treatment Planning:

The patient needed fixed orthodontic treatment with extractions to enable intrusion and retraction of anterior teeth, and correction of lip incompetence. Since three out of four of the patient's first molars were grossly decayed, it was decided to extract all the first molars to gain the necessary space. Miniscrew anchorage would be utilized to prevent anchorage loss, and to achieve true upper incisor intrusion.

Treatment Progress:

Following extractions of all maxillary first molars, the upper and lower arches were strapped up with preadjusted edgewise appliances (MBT, 0.022' x 0.028"). A transpalatal arch was placed on the maxillary second molars for anchorage augmentation. The arches were leveled and aligned with a sequence of wires beginning with 0.014" HANT, progressing up to 0.019" x0.025" HANT. Following placement of 0.019 " x 0.025 "posted stainless steel retraction wires, miniscrew implants (1.5 mm x 9 mm) were

inserted mesial to all the permanent second molars, and retraction forces applied from them via power chains. Two miniscrew implants were also placed distal to the maxillary lateral incisors and intrusive force exerted on maxillary anterior teeth via power chains (Fig. 14, 15.) Space closure occurred in a routine manner, following which the occlusion was settled, and fixed appliances debonded. Permanent retainers were bonded in the upper and lower anterior teeth, and removable Begg's wraparound retainers prescribed for full time wear for a year.

At the end of treatment, the patient had a well aligned dentition with tight proximal contacts between the second premolars and second molars. The lower third molars had erupted in the oral cavity. Canine and molar relationships were Class I, with normal overjet and overbite. (Fig 16).

Extra oral views (Fig. 17) showed significant reduction in facial profile convexity and achievement of lip competence at rest. Incisor and gingival display on smiling were optimal. Overall facial esthetics were greatly improved with enhanced chin projection probably as a result of auto rotation of the mandible with mini implant enabled intrusive mechanics. Radiographic views (Fig 18) showed excellent root positioning of the second molars, as well as a continuing uninhibited eruption of maxillary third molars. Active treatment time was 27 months. Cephalometric changes are summarized in Table 4 and Fig. 19.

Summary

Though permanent first molars are not the teeth of choice for orthodontic extractions, such a course of action may be dictated by caries or doubtful prognosis of these teeth. In such cases, orthodontic care can be delivered provided the specific indications and technical considerations of such treatment are kept in mind. The double opportunity to improve a patient's oral health status as well as correct the malocclusion is one that should be accepted without undue hesitation. Though such treatment may be slightly longer and more demanding on the operator's skills and patience, it would inevitably bear a highly rewarding result. With the correct mechanics and sophisticated armamentarium available, there is no reason to believe any longer in the old adage that extractions of first molars double the treatment time and halve the prognosis.



Fig 10. Pre Treatment Extraoral Photographs, **11., 12.** Pre Treatment Intraoral Photographs

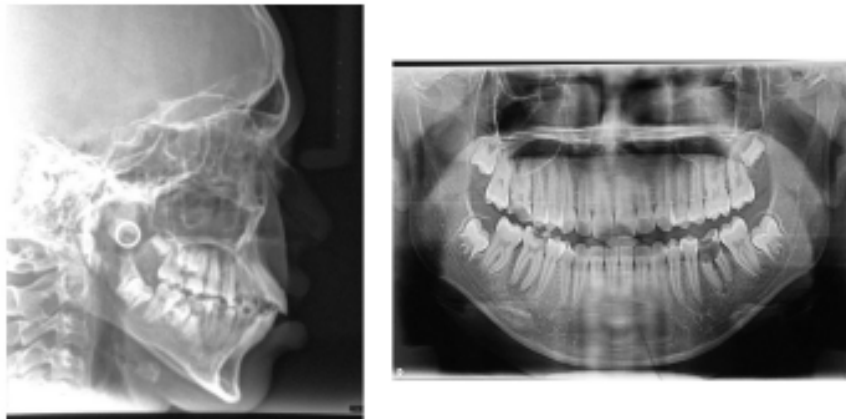


Fig 13. Pretreatment lateral cephalogram and panoramic radiograph

Table 3. PreCephalometric Measurements

Parameter	Pre-treatment
ANB	7 degrees
Upper 1 – NA	30 degrees , 8 mm
Lower 1 - NB	31 degrees , 7 mm
Inter incisal angle	92 degrees
Naso labial angle	88 degrees
IMPA	101 degrees
Sn – Go Gn	36 degrees



Fig 14. and 15. Mid treatment intraoral photographs



Fig 16. and 17. Post treatment photographs

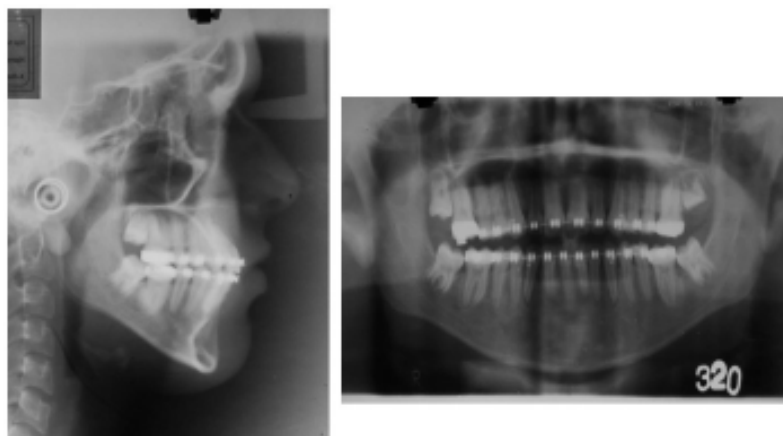


Fig 18. Post treatment lateral cephalogram and panoramic radiograph

Table 4. Cephalometric Changes

Parameter	Pre-treatment	Finishing
ANB	7 degrees	4 degrees
Upper 1 – NA	30 degrees , 8 mm	23 degrees, 4 mm
Lower 1 - NB	31 degrees , 7 mm	24 degrees, 4 mm
Inter incisal angle	92 degrees	115 degrees
Naso labial angle	88 degrees	96 degrees
IMPA	101 degrees	92 degrees
Sn – Go Gn	36 degrees	33 degrees

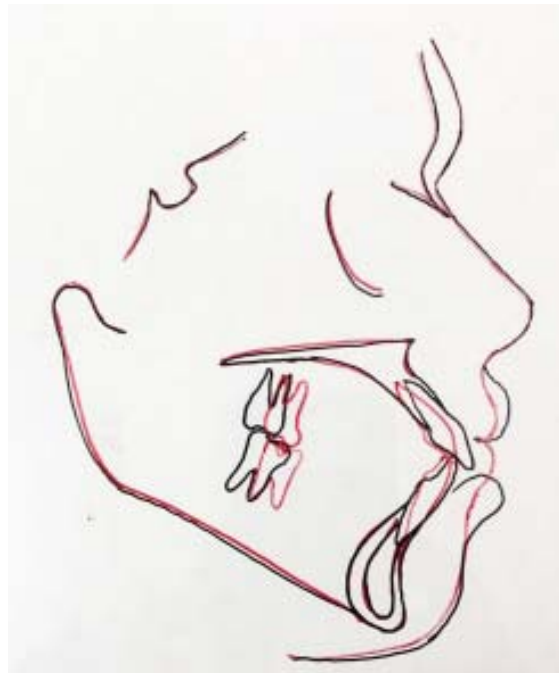


Fig 19. Cephalometric superimposition (Before and after treatment)

References

1. Todd JE, Dodd T. Children's Dental Health in the United Kingdom. London: Office of Population Censuses and Surveys, 1983.
2. Seow WK. Clinical diagnosis of enamel defects: pitfalls and practical guidelines. *Int Dent J* 1997; 47: 173-182.
3. Wilkinson AA. The first permanent molar again. *Br Dent J* 1940;8: 269-84.
4. Salzmann JA. A study of orthodontic and facial changes and effects on dentition attending the loss of first molars in five hundred adults. *J Am Dent Assoc* 1938;25: 892-905.
5. Mills JRE. Principles and practice of orthodontics, 2nd edition, New York: Churchill Livingstone; 1987. p. 123-5.
6. Daugaard-Jensen I. Extraction of first molars in discrepancy cases. *Am J Orthod* 1973;64: 115-36.
7. Stepovich ML. A clinical study on closing edentulous spaces in the mandible. *Angle Orthod* 1979; 49:227-33.
8. Mitchell L. An introduction to orthodontics, Oxford, England: Oxford University Press; 1996. p. 26-8.
9. Williams R, Hosila L. The effect of different extraction sites upon incisor retraction. *Am J Orthod* 1976; 69:388-410.
10. Sandler PJ, Atkinson R, Murray AM. For four sixes. *Am J OrthodDentofacialOrthop* 2000; 117: 418-435.
11. Ong DCV, Bleakley JE. Compromised first permanent molars: an orthodontic perspective. *Austr Dent J* 2010; 55: 2-14