

Treatment Planning for the Loss of First Permanent Molars

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Abstract: During the mixed-dentition stage of dental development, dentists may encounter patients with first permanent molars considered to have a poor long-term prognosis. In this situation, extraction of the tooth and space closure or use of the extraction space for future orthodontic treatment should be considered. The aim of this article is to give guidelines about treatment planning for patients who have first molars with a poor prognosis during the mixed-dentition stage.

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Clinical Relevance: Patients may present with carious or severely hypoplastic first permanent molars during the mixed-dentition period of dental development. Extraction should be considered when encountering teeth with a poor long-term prognosis.

The first permanent molar (FPM) has been quoted as being the most caries-prone tooth in the permanent dentition, probably as a result of its early exposure to the oral environment. More than 50% of children over 11 years have some experience of caries in such teeth.¹ With a decline in the caries rate, improvements in restorative techniques and high parental expectations, dentists may consider restoration of FPMs with extensive caries and pulpal symptoms during the mixed-dentition stage. However, heavily restored teeth will enter the restorative cycle and may need to be extracted in later life. Late extraction has restorative implications and may lead to unfavourable occlusal changes if spaces are left unrestored. In such cases,

consideration should be given to the extraction of these teeth during the mixed-dentition stage.

It is commonly quoted that the FPM is not the ideal tooth to be extracted for orthodontic reasons as space is provided away from the labial segments. Although technically demanding, it is possible to use the extraction space orthodontically for the relief of crowding and overjet reduction with favourable results.²

The aim of this article is to review the consequences following extraction of FPMs and to give guidelines about treatment planning when extracting these teeth.

CONSEQUENCES OF THE LOSS OF MANDIBULAR FIRST PERMANENT MOLARS

The ideal time for the loss of the mandibular FPM is before the eruption of the second permanent molar, usually at a chronological age of 8–9 years.³ The second molar may erupt early and a good contact area relationship can eventually

be established with the second premolar. Some distal drift of the premolars can also be expected at this stage, particularly if there is crowding in this region.

Richardson⁴ reported a tendency for lower incisor crowding to diminish in the first year following the extraction of mandibular FPMs. The overbite also tended to increase in the majority of subjects studied, and this was associated with retroclination of the lower incisors. These changes were found particularly in patients who started with proclined lower incisors and increased overjets. In contrast, Thunold⁵ found no increase in overbite in a group of patients who had had four FPMs extracted 25 years previously.

Further back in the dental arch, it cannot be said with certainty that loss of the FPMs will relieve posterior crowding with subsequent eruption of third molars in all cases. However, Williams and Hosila⁵ found a 90% chance of successful third molar eruption (compared with a 55% chance following extraction of premolars). Similarly, Plint⁶ found that most third molars erupted following the loss of the FPMs (with a tendency to early eruption), and most established a good contact area relationship with the second molars.

Early Extraction

Extraction of FPMs before the age of 8 years may result in distal drifting, tilting and rotation of the unerupted second premolar, especially in an uncrowded dentition (Figure 1).⁷ Significant distal drifting occurs during this stage of development, because the second premolar lies in an unrestrained position

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Figure 1. Early extraction of FPMs in combination with an uncrowded dentition has resulted in significant distal drift of the second premolars.

apical to the roots of the second deciduous molar. The socket of the FPM may provide a less resistant path to eruption than the bone immediately overlying the second premolar. There is also a risk that the second premolar may become impacted against the second permanent molar if it has a distal angulation radiographically or if the second premolar escapes from the guiding influence of the distal root of the second deciduous molar.

Consideration should be given to the relationship of the lower second premolar to the second deciduous molar in all cases: it may be appropriate to remove the second deciduous molar at the same time as the FPM to encourage the second premolar to take a more vertical path of eruption.

Extraction During or After Eruption of the Second Permanent Molars

If FPMs are extracted during or after eruption of the second permanent molars, space closure is usually unsatisfactory. Occlusal consequences may include:

- Mesial tilting and lingual rolling of the second permanent molar. Occlusal forces encourage mesial tilting and the molar tilts lingually because the lingual plate is thinner than the buccal plate of alveolar bone. Lingual rolling may result in the development of a scissor bite and non-working side interferences.
- Over-eruption of the opposing FPM. The occlusal interference created will

prevent the lower second molar drifting mesially, increase its mesial tipping and may predispose to later temporomandibular joint dysfunction.

- Incomplete space closure or formation of a poor mesial contact area relation with plaque stagnation and consequent dental disease.
- Distal drifting and tilting of the second premolar.
- Atrophy of the alveolar bone if space closure is incomplete.

CONSEQUENCES OF THE LOSS OF MAXILLARY FIRST PERMANENT MOLARS

The maxillary molars develop with a distal angulation which favours spontaneous space closure (Figure 2). Extraction of the FPM from as early as 8 years can result in favourable space closure. Good approximation between the second molar and second premolar may even be achieved if FPMs are extracted soon after the eruption of second molars. In such cases, the second molar will tilt mesially and rotate mesiopalatally around the palatal root. If a class 1 buccal segment relationship exists, the mandibular first molar will rarely overerupt because its mesial cusp will occlude with the

maxillary second deciduous molar or permanent second premolar. Even if such an occlusal stop does not exist, space closure in the maxillary arch occurs before the mandibular FPM has sufficient time to overerupt and prevent mesial migration of the maxillary second molar.

With regards to the labial segment, Thunold's study of patients who had had FPMs extracted 25 years previously³ suggested that there may be less upper labial segment crowding in such cases than in untreated individuals. Plint⁶ found that, in common with mandibular teeth, most maxillary third molars erupt following the loss of FPMs.

FACTORS TO CONSIDER WHEN PLANNING EXTRACTION OF FIRST PERMANENT MOLARS

It is important to consider the following factors when planning extraction of FPMs:

- the restorative state of the tooth;
- dental age of the patient;
- degree of crowding in the buccal and labial segments;
- the occlusal relationship;
- presence and condition of the other teeth.



Figure 2. Distal development angulation of the maxillary second permanent molars. This aids spontaneous space closure in the maxilla following FPM extraction. Note how the mandibular second molars develop more vertically. As a matter of interest, this patient suffers from amelogenesis imperfecta and has severe toothwear affecting the maxillary FPMs. Clinicians should consider removal of these teeth at this stage of development.

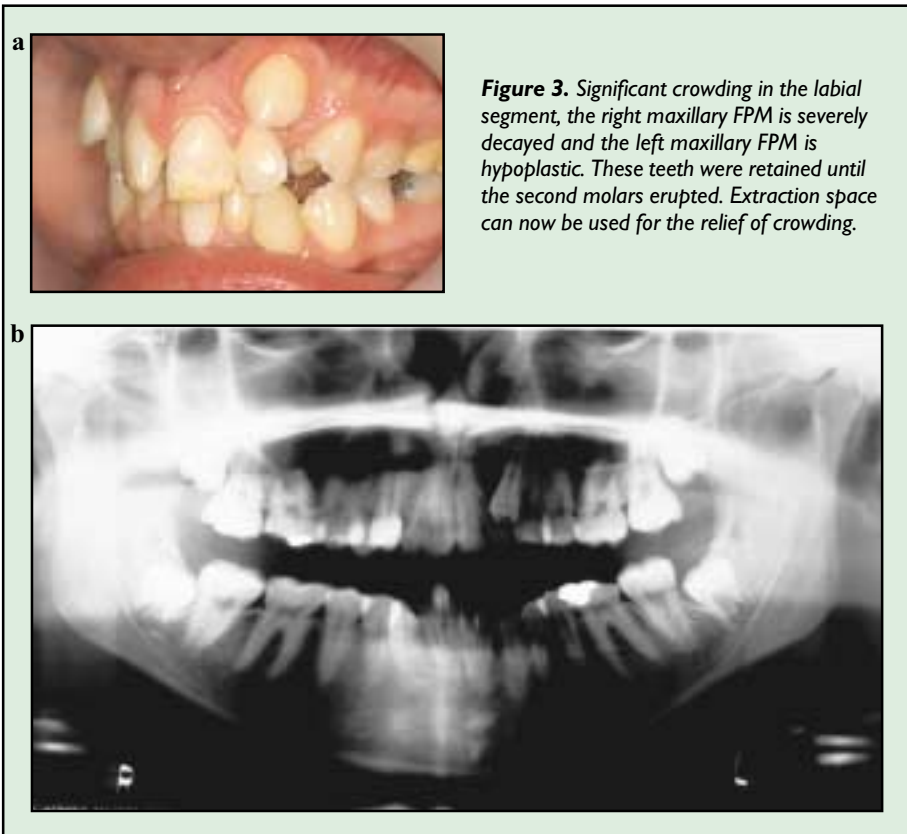


Figure 3. Significant crowding in the labial segment, the right maxillary FPM is severely decayed and the left maxillary FPM is hypoplastic. These teeth were retained until the second molars erupted. Extraction space can now be used for the relief of crowding.

Restorative State of the First Molar

Extraction of a FPM during the mixed-dentition should be considered when these teeth have, or are affected by:

- large occlusal or approximal restorations;
- irreversible pulpitis;
- periradicular infection;
- severe hypoplasia. In well kept mouths, where restorative treatment may have a good long-term prognosis, conservation of hypoplastic molars may be a more appropriate form of treatment. However, hypoplastic molars should always be considered as candidates for extraction if space is required for the correction of malocclusion.

Dental Age of the Patient

To achieve spontaneous space closure, the ideal time for the extraction of FPMs is before the eruption of the second molars. Timing is more critical in the

mandible than in the maxilla. Delayed extractions result in incomplete space closure and establishment of poor contact point relationships. The results of delayed extraction in the mandible are enhanced if mild crowding exists in the premolar region as distal drift of the premolars reduces the amount the second molar must migrate mesially.

The Presence of Crowding

The presence of crowding has been shown to be one of the most important factors for the establishment of a satisfactory occlusal result following the extraction of FPMs.⁷

Crowding in the premolar region is commonly encountered when there has been early loss of the second deciduous molar. Mesial migration of the FPM uses space required for premolar eruption and the extraction of FPMs may result in spontaneous resolution of buccal segment crowding in such cases.

The extraction of FPMs cannot be expected to resolve significant crowding

in the labial segments spontaneously. In such cases, the FPM may be retained until the second permanent molar erupts. Following this, the tooth can be extracted and the space used to correct labial segment crowding orthodontically (Figure 3). Alternatively, if maxillary FPMs are extracted to compensate for the loss of mandibular FPMs, the clinician has three options for creating space for the relief of crowding and/or overjet reduction:

1. Space lost can be regained with molar distalization therapy. This may involve the use of headgear or a transpalatal arch which will distalize the second molars in addition to derotating these teeth.
2. Extraction of two premolar units. Loss of the FPM space can be viewed as providing space for the third molars to erupt.
3. A functional appliance can be used to reduce the overjet and overbite. This will substantially reduce the anchorage requirements during any subsequent fixed appliance treatment. Functional appliance treatment will also help to support the lower labial segment if the mandibular FPMs have been extracted.

In spaced dentitions little space closure can be expected to occur, and the extraction of FPMs should be avoided. Restorative methods should be used to retain such teeth within the dental arch.

The Occlusal Relationship

In class I cases with labial segment crowding, the first molar may be retained



Figure 4. A palatal arch. This device restricts mesial migration of the second molars, allowing the extraction space to be used for relief of anterior crowding.

Tooth requiring extraction	Acceptable overjet and dental alignment	Acceptable overjet and crowding in buccal segments only	Unacceptable overjet and/or space required for labial segment crowding	Reverse overjet
6̄ and/or 6̅	Compensate to aid mandibular space closure. Balancing unnecessary as centreline shift is unlikely in an uncrowded arch.	Compensation and balancing required, assuming the crowding is symmetrical.	Seek specialist orthodontic opinion. Options regarding maxillary FPM include: <ul style="list-style-type: none"> ● Retain FPM until second molars erupt. A maxillary holding appliance can be used to prevent overeruption of the maxillary FPM. ● Compensate. Later distalization therapy can be used to regain space, or two premolar units can be extracted if the third molars are developing. Balance to prevent centreline shift. 	Refer for a specialist opinion regarding necessity to compensate. Balance if crowding exists.
6̄ and/or 6̅	Compensation and balancing unnecessary.	Balance only.	Retain FPMs until second molars erupt. Balance to prevent centreline shift.	Refer to specialist.

Table 1. Summary of cases requiring balancing and compensating extractions.

for space maintenance until the second molar erupts. If crowding exists only in the buccal segments, loss of the first molar at the ideal dental age may result in spontaneous resolution of crowding and good space closure.

In class II division 1 malocclusion cases, an increased overjet (>3 mm) increases the risk of trauma to the upper central incisors and can confer a poor dental appearance. For each millimetre of overjet reduction required, approximately 2 mm of space is required from the dental arch.⁸ To meet these space requirements for overjet reduction, poor-prognosis maxillary FPMs may be retained until the second permanent molar erupts – although this may prejudice the mesial movement of the lower second molar. Once these teeth have been removed, mesial migration of the second molar can be restricted using a palatal arch (Figure 4) or J-hook headgear to the upper arch wire. Functional appliances can be used to reduce the overjet and substantially reduce anchorage requirements in later fixed appliance therapy where FPMs are electively removed.

In class II division II malocclusion cases, overbite control may present a difficult problem during orthodontic treatment. Lower arch extractions make it more difficult to control the position of the lower labial segment and can make overbite control problematical. For this reason, extractions in the lower arch should be avoided if at all possible in deep bite cases.

In class III cases it is wise to seek a specialist orthodontic opinion before extraction.

Presence and Condition of the Other Teeth

A clinical and radiographic examination should be carried out to check the presence and condition of the remaining teeth. In some cases it may be more appropriate to balance the loss of a FPM with the extraction of a poor prognosis contralateral tooth other than the FPM. For example, radiographic examination may show that a contralateral developing premolar has a hypoplastic crown. It may be more appropriate to balance loss of a FPM with this tooth.

The absence of third molars does not generally contraindicate the extraction of FPMs. However, the presence of mesially directed forces from developing third molars may aid space closure.

BALANCING AND COMPENSATING EXTRACTIONS

Compensating involves extraction of an antagonistic molar to prevent its overeruption. As discussed earlier, overeruption of the upper FPM can prevent mesial migration of the mandibular second permanent molar. *Balancing* involves removal of a contralateral tooth, which needn't necessarily be a FPM, to preserve the

dental midline. Balancing and compensating extractions should be considered during the mixed-dentition stage if no active appliance treatment is to be undertaken. In the permanent dentition, balancing extractions are not appropriate although removal of an upper molar should be considered if the lower molar is not being replaced.

The following scenarios aim to illustrate when balancing and compensating should be considered. These are summarized in Table 1.

Acceptable Overjet and Dental Alignment

Removal of a lower FPM should be compensated by removal of the maxillary FPM to prevent overeruption. There is no need to compensate for extraction of a maxillary FPM. It is unlikely that a significant centreline shift will result from removal of a FPM in an uncrowded dentition, and balancing extractions are unnecessary.

Acceptable Overjet and Crowding in Buccal Segments

Removal of a mandibular FPM should be balanced at the ideal age to provide spontaneous improvement of premolar crowding and maintenance of the dental midline. Extraction of a mandibular FPM should be compensated by removal of the opposing FPM.

Extraction of one maxillary FPM should

be balanced by extraction of the contralateral tooth if crowding exists. Compensating extractions are not beneficial.

Unacceptable Overjet and/or Space Required for Labial Segment Alignment

Upper Molars

Maxillary FPMs with poor prognosis can be stabilized until the second permanent molars have erupted. Space obtained by removing an FPM can be used for reduction of overjet and dental alignment. Compensating extractions are not necessary.

Lower Molars

If there is no significant crowding in the lower arch, the FPM should be extracted at the ideal time for spontaneous space closure. If a maxillary FPM also has a poor prognosis it may be retained until the second permanent molar erupts. In a class II molar relationship the maxillary FPM may not overerupt as its mesial surface occludes with the distal surface of the mandibular second deciduous molar. If it is likely that the maxillary FPM may overerupt and prevent the mandibular second molar from moving mesially, extraction of the maxillary FPM should be considered: space can be regained later by molar distalization. If the maxillary FPM is disease free it may be possible to remove premolar units later to

create space for alignment and reduction of overjet. A maxillary holding appliance may be used to prevent overeruption of the maxillary FPM until the mandibular second permanent molar is in a good position.

In uncrowded arches it may still be better to balance molar extractions to allow symmetrical orthodontic arch mechanics. The opinion of an orthodontic specialist should be sought in such cases.

Reverse Overjet

Orthodontic advice should be sought before carrying out any extractions.

CONCLUSION

When planning extraction of FPMs with poor prognosis it is important to consider whether future active appliance treatment will be necessary. If such therapy is not needed, consideration should be given to extraction at the ideal developmental age to achieve spontaneous space closure. Each case should be assessed for the need of balancing or compensating extractions to preserve the dental midline and prevent overeruption, respectively. If future appliance treatment is likely to be necessary, it is important to seek specialist advice, and it may be more appropriate to stabilize the FPMs until the second molars erupt so that extraction space can be used to relieve

crowding and reduce overjet.

Most patients will not accept the extraction of several FPMs under local anaesthesia. For patients referred for extraction under general anaesthesia it is important, for ethical reasons, that both referring and receiving dentists ensure that a specialist orthodontic opinion has been gained to be sure that the treatment plan is appropriate for the patient in question.

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FURTHER READING

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ABSTRACT

TOOTHPASTE FORMULATION IMPROVED AGAIN?

A Study to Assess the Plaque Inhibitory Action of a New Zinc Citrate Toothpaste Formulation. J. Moran, M. Addy, D. Corry, R.G. Newcombe and J. Haywood. *Journal of Clinical Periodontology* 2001; **28**: 157–161.

It has previously been suggested that toothpastes containing zinc citrate may inhibit plaque and gingival inflammation. One agent contained in

these pastes has been triclosan, which is thought to contribute antibacterial and antiplaque effects.

This study examined a new formulation containing bromochlorophene and triglyceride oil, in either a 1% or 8% concentration. Volunteers avoided all oral hygiene aids except for a toothpaste slurry rinse for varying periods in a double-blind trial. Although after 24 and 48 hours there was no significant difference, after 96 hours the 1% concentration test group had a significant reduction in both plaque score (10.6%) and plaque area (24.2%),

compared to the controls. The more concentrated 8% test group showed significantly less reduction in both scores. The authors suggest reasons for the beneficial effects, and also why the more concentrated material may not have been so effective.

Since the vast majority of the population suffer from plaque-related gingivitis and other dental problems, further investigation is required into the potential value of the zinc citrate/bromochlorophene/triglyceride formulation.

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