# Review Article

## A Systematic Review of the Consequences of Early Extraction of First Permanent First Molar in Different Mixed Dentition Stages

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**Abstract**

**Aims and Objectives:** The aim of this study was to consider the available evidence regarding early extraction of permanent first molars (PFMs) in different mixed dentition stages that affect the integrity of occlusion and the implications for treatment planning.

**Materials and Methods:** Electronic database, including PubMed and Science Direct, searches were conducted for available evidence. Key terms used in the search were "extraction," "first permanent molar," and "mixed dentition."

**Results:** The initial search identified 56 studies to be related to the review. Although a significant number of published articles had dealt with early extraction of PFM, only three studies had fulfilled the final selection criteria to be considered for this systematic review.

**Conclusion:** Future active appliance treatment is important after extraction of PFMs with poor prognosis. 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.

**Keywords:** *Extraction, malocclusion, permanent first molar, sequelae, space closure*

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## Introduction

It has been reported that the permanent first molar (PFM) has been reported to be the most caries prone tooth in the permanent dentition.[1] More than 50% of children over the age of 11 years have some carious experience in this tooth.[2] In addition to this, the PFM has also been commonly found to be significantly hypoplastic, with approximately 6% of children having hypoplasia in one or more first permanent molars.[1-3] Deeply decayed first permanent molars in a child present a major dilemma to the pediatric dentist and to the orthodontist.[4] The dilemma occurs when the teeth are restorable, but the achievable results will leave the teeth with questionable prognosis.[4] The first permanent molar is rarely the tooth of choice for extraction for orthodontic treatment when creating spaces is required to alleviate crowding.[1] However, there are various clinical situations in which extractions of PFMs should be considered. These situations include extensively carious PFMs, hypoplastic PFMs, heavily restored PFMs where premolars are perfectly healthy, apical pathoses or endodontically treated PFMs, crowding at the distal aspects of the arches and third molars of a reasonable form and in reasonable position, skeletally divergent malocclusions, and anterior open bite malocclusion.[1] When a PFM with poor prognosis is identified, several questions needed to be considered:

1. Is the compromised PFM worth saving, especially if it requires endodontic and/or extensive restorative treatment?
2. Should the compromised PFM be extracted as soon as possible, or should it be temporarily restored and extracted later?

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3. If the prognosis of one PFM is poor, is the extraction of the other PFMs required?

The answers to these questions are not always straight forward. First, the situation varies between the maxilla and mandible. In addition to this, the extent of crowding, the presenting malocclusion, and the stage of dental development may all influence the clinical management of these cases.

To consider the problem properly, the following information is necessary:

- The long-term prognosis of the restored PFM tooth
- The dental age of the patient
- The type of malocclusion (Angle's Class I, II, or III)
- The degree of crowding present.

Up to date, there is no consensus in the literature that suggests that early extraction of badly decayed/restored PFM would lead to specific consequence in the permanent dentition. Moreover, whether early extraction of PFM would facilitate potential orthodontic treatment in the future should it be required. Hence, the aim of this systematic review was to find scientific evidence in the literature to answer these questions.

## Materials and Methods

### Sources of information

Different electronic databases were used to conduct this review: PubMed MEDLINE (from 1950 to 1st week of January 2016) and Science Direct Database. Search strategy: Terms used in the review search were "extraction," "first permanent molar," and "mixed dentition." References of relevant articles were also screened for articles. Summary of the search is presented in Table 1.

The inclusion criteria that were taken to select articles for the review:

1. Clinical trail
2. Age of the patient (5–14 years old)
3. Effect on occlusion
4. Degree of crowding.

Moreover, studies with the following criteria were excluded:

1. Time of follow-up
2. Cases with immediate orthodontic treatment
3. Review articles.

### Study selection

Based on the articles abstract, the articles that fulfill the inclusion\exclusion criteria were selected.

## Results

The initial search identified 56 studies to be related to the review. Only three actually fulfilled the final selection criteria. The remaining articles were rejected due to one or more of the following reason:

1. Absence of control
2. Review articles
3. Impaired result.

Summary of the included articles is presented in Table 2.

In the first study (Thunold 1970),[5] the purpose of the investigation was to study the long-term effects of early extractions of PFMs. The materials consisted of 52 individuals who had lost from one to four PFMs about 25 years ago, at the age of 8–14 years. The intraoral X-rays and the models were examined especially with respect to orthodontic sequelae of early loss of the first permanent molars. On the models, the following measurements were recorded:

1. Space condition in front and in missing molar quadrant
2. Overjet and overbite
3. Tipping and rotations of the teeth adjacent to the missing molar.

The results indicated that early extraction of the first molars seems to have an uprighting effect on the front teeth, expressed by a small overjet and an increased interincisal angle. The study also indicates that loss of first permanent molar in the upper jaw does not cause great problems.

The second study (Jalevik and Moller 2007)[6] observed 27 children aged 5.6–12.7 years who had one to four PFMs extracted due to severe molar-incisor hypomineralization (MIH); each case was followed upon individual indications 3.8–8.3 years after extraction. The eruption of the permanent dentition and space closure were documented by orthopantomograms, casts, photographs, and/or bite wings. This study has shown that extraction of PFMs severely affected by MIH is

**Table 1: Summary of the search**

| Search engine | Keywords | Limitation | Number of articles |
|---|---|---|---|
| PubMed | Extraction, first permanent molar, mixed dentition | English language, from 1970 to 2016 | 25 |
| Science direct | Extraction, first permanent molar, mixed dentition | English language, journals, topic, from 2001 to 2016 | 31 |
| Medline (EBSCO) | Extraction, first permanent molar, mixed dentition | English language, journals, topic, from 1950 to 2016 | 15 |

**Table 2: Summary of the included articles**

| Authors, year | Sample | Result |
|---|---|---|
| Thunold, 1970 | 25 patients<br>Age: 8-14 years<br>Lost one to four molars 25 years ago | Uprighting effect on front teeth<br>Loss in upper jaw causes no problem |
| Jalevik and Moller, 2007 | 27 children<br>Age: 5.6-12.7 years<br>One to four extracted PFM due to severe MIH | Extraction of permanent first molars severely affected by MIH is good treatment alternative |
| Richardson, 1979 | 43 patients<br>Age: 8-14 years | During the 1st year after removal of lower first molars, the overbite tends to deepen in >50% of cases, but the overjet tends to remain stable |

MIH=Molar-incisor hypomineralization, PFM=Permanent first molar

good treatment alternative. Favorable spontaneous space reduction and development of the permanent dentition positioning can be expected without any intervention in the majority of cases extracted before the eruption of the second molar.

In the third study (Richardson 1979),[7] 43 patients aged 8–14 years at the time of extraction (19 males, 24 females) were included. The changes were measured on 90° left lateral cephalometric radiographs taken before extraction and approximately 12 months later. The overjet, overbite, and axial inclination of the upper teeth were measured relative to the maxillary plane; the axial inclination of the lower incisors was measured relative to the mandibular plane. The changes in axial inclination were then measured in the conventional way. In most cases showing a previously normal overbite or overjet, the overjet after extraction remained stable. Correlation of the overbite and overjet together against the changes in overbite proved disappointing from the prognostic standpoint except that previously incomplete overbites almost invariably increased. There was spontaneous changes in overbite, overjet, and incisor inclinations during the 1st year following extraction of both lower first permanent molars. From this study, it appears that during the 1st year after removal of lower first molars, the overbite tends to deepen in >50% of cases, but the overjet tends to remain stable.

## Discussion

This systematic review was undertaken to evaluate the early extraction of first permanent molar; a significant number of selected articles came from the search. Only three of the studies fulfilled all of our selection criteria. Studies were selected only when the cases were followed up after a period to evaluate the effects of the extraction. All the three studies had shown that the extraction had a good spontaneous space reduction and favorable development of the permanent dentition if it was done before the eruption of the second permanent molar. Moreover, it shows a previously normal overbite or overjet in most cases.

The extraction does not create great problems in the upper jaw. However, in the lower jaw, the effect of loss of PFMs on occlusion depends on the age of the extraction, and the best results were found in the early age (8–10) years.

On the other hand, lower first molars can be extracted when all the following factors are present:

1. Carious lesions with pulp involvement
2. Crowding in the relevant quadrant
3. Age 8–10 years
4. No sagittal deviations
5. No other tooth missing in the same quadrant.

Moreover, the extraction in the lower jaw should be avoided in cases with distal occlusion, deep bite, and increased overjet.

Early loss of deciduous first molar is different when compared to loss of PFM. In a systematic review about the effect of early loss of primary first molars, little effect was noted.[8]

However, loss of PFMs may affect the occlusion in a great deal.[5-7] This difference could be due to the fact that PFM at ages 5–14 plays an important role in arch integrity and mastication as well. Furthermore, the locations of primary first molars and PFMs are different which would lead to different effect on occlusion.

Previous report also suggested treatment planning for the loss of first permanent molars.[9] These managements include space closure or use of the extraction space for future orthodontic treatment. Early space closure of the extracted first molars although might appear to be a feasible option, the possible downside of this approach is the relatively long time to be considered for closing such spaces. On the other hand, leaving this space to be utilized

for future orthodontic treatment should be considered with care. An appropriate space maintainer and careful evaluation of the patient's malocclusion are important in considering this treatment modality. Only 58% of PFMs extracted at the "ideal time" (SPM development at Demirjian stage E) had complete space closure.[10] Space closure occurred in 89.9% of the maxillary and 49.0% of the mandibular quadrants.[11] The use of space maintainers after premature loss of the second upper temporary molar is a last solution in preventing tridimensional lesions in the dental arch and occlusion.[12] The results of this systematic review also should be considered with caution. This is simply due to the fact that only three publications exist and more prospective randomized controlled clinical trials are required to study the effect of early loss of PFMs on occlusion in different classes of occlusion as well as in different facial types.

## Conclusion

When planning extraction of PFMs 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.

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### Conflicts of interest

There are no conflicts of interest.

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