Interceptive extractions for first permanent molars: a clinical protocol

Paul Ashley*[1] and Joe Noar[2]

Key points

- Highlights the importance of an interceptive approach when faced with compromised first permanent molars.
- Demonstrates the need to look for the presence of the third permanent molar when planning these cases.
- Provides a flowchart to help simplify the planning process.

Abstract

Treatment planning for compromised first permanent molars (FPM) can be difficult. In this paper, we present a clinical protocol to support decision-making. Interceptive loss of an FPM should be considered: where the restoration required to repair the compromised FPM is likely to be large; if the FPM is compromised because of molar-incisor hypomineralisation (MIH); where orthodontics requiring loss of tooth units is planned; or if third permanent molars (TPM) are present. Planning requires careful assessment of the prognosis of the FPM and 8–10 years is the ideal age to do this. If the prognosis is uncertain, the decision of whether or not to extract can be influenced by the presence or absence of the TPM. If the decision to extract the FPM is made, timing is dependent on whether or not extractions will be required as part of orthodontic treatment.

Introduction

Decisions made in the developing child can have far-reaching consequences on occlusal development and oral health. Management of the compromised first permanent molar (FPM) is one such example of this. Interceptive extraction at the right time can guide the second permanent molar (SPM) into their space, thus eliminating or reducing the problem. Poor planning, however, can leave residual space which may be difficult to restore. In the UK, the Royal College guidance is most often cited when decision-making for compromised FPMs.[1] However, even with these guidelines, the management of compromised FPMs generates significant amounts of confusion and uncertainty, with pathways varying greatly between general dental practitioners and specialists in the UK.[2]

[1]University College London, Paediatric Dentistry, 256 Gray's Inn Road, London, UK; [2]University College London, Division of Craniofacial & Development Sciences, Orthodontic Unit, 256 Gray's Inn Road, London, UK.
*Correspondence to: Paul Ashley
Email: p.ashley@ucl.ac.uk

Refereed Paper.
Accepted 4 April 2019
DOI: 10.1038/s41415-019-0561-7

The aim of this paper is to:

1. Review the rationale behind interceptive removal of FPMs
2. Provide clear, simple management guidance for cases with one or more compromised FPMs.

What is the rationale behind the interceptive removal of the compromised FPM in a developing child?

In the UK, the idea that FPMs should be removed to eliminate teeth with a poor long-term prognosis and to encourage mesial migration of the SPM is an accepted treatment strategy in common usage (Fig. 1). This treatment approach is not widely used in other countries, so why is it worth considering?

There are four situations where an interceptive extraction approach might be warranted:[3,4,5,6]

1. Where the restoration required to repair the compromised FPM is likely to be large. Large restorations have a poorer prognosis. When these restorations fail, teeth will ultimately need to be root-filled or extracted. This in turn will necessitate an implant or some other prosthesis if there is unwanted space. In this situation, patients may prefer an interceptive extraction approach as it saves them from the lifetime burden associated with maintaining the restoration
2. Where the FPM is compromised because of molar-incisor hypomineralisation (MIH). Patients with MIH often have significantly

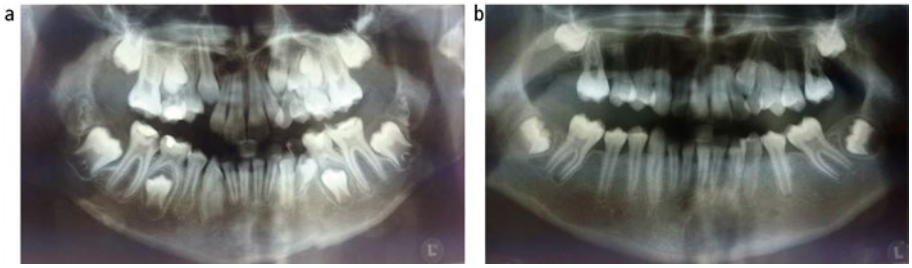
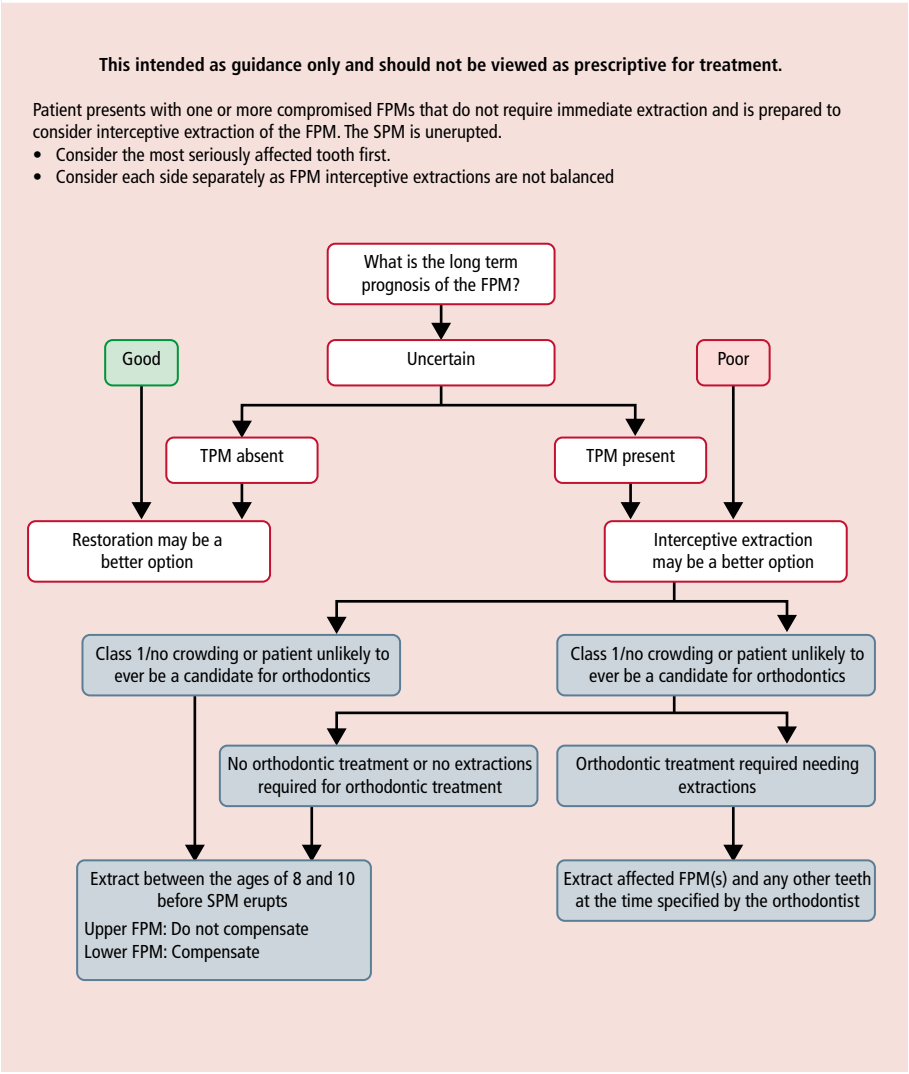


Fig. 1 Dental panoramic tomograph: a) before; and b) after interceptive extraction of first permanent molars showing a successful outcome

Fig. 2 Flowchart of first permanent molar management



affected FPMs but the remaining molars are usually unaffected and not at risk. The quality of the enamel in the affected FPM in MIH means these patients have to endure a lifetime of difficult, and potentially costly, treatment with uncertain outcomes. In these cases, interceptive removal of the affected molars will leave the patient dentally healthy

3. Orthodontics requiring loss of tooth units. In this case we should consider removing a compromised FPM (even if it is well restored) rather than a sound premolar tooth
4. Presence of third permanent molars. Approximately a quarter of all people with third permanent molars will experience some sort of impaction. Associated with this are the risks of pericoronitis, caries in the SPM, and morbidity related to surgical removal of the third permanent molar (TPM). Extraction of the FPM can reduce the risk of impaction of third molars. Recent work has also shown that the presence of a third molar increases the chance that the erupting SPM will migrate into the FPM space when FPMs are extracted early. Finally, if the TPM is present and the FPM is removed, this will still leave the patient with two molar units.

Management of compromised FPMs: clinical protocol

In the following section we present a step-by-step guide to managing these teeth (as summarised in Figure 2). It is important to acknowledge that the quality of the evidence is generally low and that, in a lot of these cases, specialist paediatric and/or orthodontic input would be beneficial. Nevertheless, dentists still need to make the best decisions, particularly when specialist services are not available. The following clinical protocol makes the following assumptions:

- The second permanent molar is not erupted; if it is there is no advantage to an interceptive approach as the SPM in occlusion will not migrate mesially
- Access to dental panoramic radiographs (DPT). A DPT is essential to assess SPM position and development, and, more importantly, detect the presence or absence of third permanent molars. If there is no access to DPT radiographs, the patient will need to be referred to a clinic with this facility. We normally recommend referral at 8–8.5 years of age, as in most cases a determination of presence or absence of the TPM can be made
- Absence of severe symptoms such as pain, swelling, infection, and that the affected FPM(s) can be temporised if required. If this is not the case, then the affected FPMs need to be managed on their own merits
- Absence of any other significant dental problems such as hypodontia, amelogenesis imperfecta. These patients will always require specialist care.

Step one: assess the prognosis of the FPM

Evidence-based decisions around prognosis are difficult to make. Any restoration is likely to fail eventually; people are also remaining dentate for longer. Teeth affected with MIH that appear intact but have opacities are likely to break down later (Fig. 3).[7] When thinking about prognosis, a long-term view is essential and this long-term view should be communicated to the patient. Some patients may prefer to lose a tooth rather than have a lifetime burden of restoration maintenance and repair. Others may choose to maintain a tooth at all costs.

Step two: determine presence or absence of third permanent molar (TPM)

The TPM is usually visible from approximately 8.5 years of age.[8] Clearly, development times will vary between patients, however it is important not to delay making the decision regarding loss of the FPM for so long that the SPM erupts. In our experience, a cut-off age of nine years old is usually appropriate to make a decision regarding the TPM if dental development is otherwise normal.

Evaluate the information so far

At this point you need to evaluate the information collected so far and decide whether an interceptive approach should be considered. If the prognosis for affected FPMs is good or the patient is not interested in an interceptive extraction then the FPM(s) should

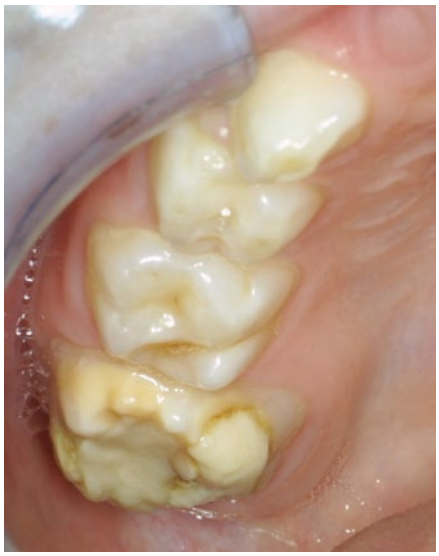


Fig. 3 Tooth affected with molar-incisal hypomineralisation

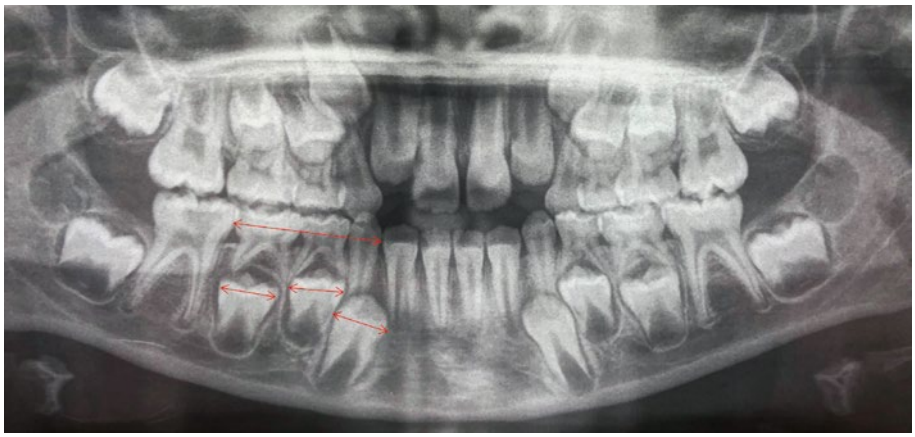


Fig. 4 OPG and the assessment of crowding

be restored. If the decision is made to keep any affected teeth, make sure this is highlighted. If the patient subsequently has orthodontic treatment requiring extractions, obviously the affected FPMs should be removed rather than sound premolar teeth.

If the prognosis is uncertain then you might use the presence or absence of the TPM to help you decide on extraction. Presence of the TPM might be enough to push the decision towards extraction (because it will reduce the risk of TPM impaction and the likelihood of mesial migration of the SPM is higher[5,6]). Conversely, if the TPM is absent then you might decide to maintain the FPM

If the prognosis is poor, then the affected teeth should be extracted. If extraction is the treatment of choice, then the next steps are to make a decision on timing and extraction pattern.

Step three: determine the appropriate time for extraction

To determine the appropriate time for extraction you first need to determine if the patient is likely to need orthodontic treatment in the future (and/or is able to access it and accept it). If the patient has a well-aligned dentition with no crowding, then the affected teeth should be removed. Obviously this needs to be done before the SPM erupts into occlusion. The best time is normally sometime between the ages of age eight and ten, as this is the stage where the presence or absence of the TPM can be reliably determined before the SPM erupts. This is supported by the RCS guidance[1] where an age range of 8–10 years is quoted. Furcation development is no longer recommended as a predictor of success with regards to mesial migration of the SPM in the RCS guidance and there is some limited evidence to support this.[6,9]

If you think the patient might need orthodontic treatment, then this will have a bearing on extraction timing; the affected teeth might need to be maintained and taken out as part of orthodontic treatment (instead of sound premolar teeth). The best person to make the final decision on orthodontic treatment is obviously an orthodontist. In the referral specify which FPM(s) need to be extracted and ask for advice on the timing and pattern of the extraction. Provide the orthodontist with the likelihood that you could maintain the affected FPM until orthodontic treatment was started.

Management if orthodontic input is not available

Clearly this is less than ideal, but in the real world this is a decision facing dentists without orthodontic support, therefore we believe some guidance should be given. There are two aspects to any orthodontic assessment: patient factors and factors relating to the occlusion or malocclusion.

Assessing patient factors such as medical history which may prevent a patient being able to cope with orthodontic appliances can be undertaken by any practitioner as well as the patient themselves and their parents.

For the second aspect, consideration needs to be made to the patient's orthodontic aspirations and an assessment of occlusal features as well as the number and position of the developing teeth. A DPT is essential to assess tooth position and general crowding in the developing dentition. Where there is no easy access to an orthodontist for this opinion, this assessment might have to be carried out by the general practitioner. A thorough understanding of eruption times, an ability to determine crowding on a DPT (Fig. 4) and a detailed clinical assessment are essential.

If, after assessment, it is determined that the patient is likely to require orthodontic treatment with extractions, then, where possible, affected FPMs should be maintained until the orthodontic treatment is provided. If orthodontic treatment is unlikely, the teeth should be extracted. An assessment of crowding can be made by measuring the widths of the teeth and the distance between the lateral incisor and first molar. Predicting the size of any unerupted tooth is done with reference to any that are erupted. Using these comparisons, it is possible to estimate the magnification of the OPG with enough accuracy to determine crowding. Add the individual tooth widths (or predicted widths if rotations are present) and compare to the distance between molar and incisor.

If the difference is 0–3 mm there may be crowding which may resolve with development of the secondary dentition. If the difference is 3–6 mm there is crowding that probably won't resolve with development of the secondary dentition. In these cases, careful monitoring of the developing secondary dentition is required. If the difference is over 6 mm there is severe crowding which will definitely require extractions to accommodate the developing secondary dentition.

Step four: extraction pattern

FPM extractions are not balanced across the arch. Where an upper FPM is removed and the lower FPM does not require removal, do not compensate. This is because mesial migration

of the upper SPM is rapid enough to prevent over-eruption of the lower SPM (which may not over-erupt anyway).

If a lower FPM is removed and the upper FPM is not occluding on a tooth other than the lower FPM, consider extraction of the upper FPM as over-eruption is more likely (the lower SPM is much slower to migrate mesially). This does not always happen but the patient should be made aware and this risk should be factored into any overall decision regarding the extraction pattern. Remember an over-erupted opposing tooth can be extracted later if required.

Conclusion

Interceptive extraction of compromised first permanent molars is a treatment option. Good planning requires an assessment of prognosis of these teeth, presence or absence of the third permanent molar and determination of the future need for orthodontics.

Acknowledgements

We would like to acknowledge the help of Jayne Owen, Susan Parekh and Priti Acharya.

References

1. Cobourne M, Williams A, Harrison M. *A Guideline for the Extraction of First Permanent Molars in Children: An Update of the 2009 Guidelines*. London: Royal College of Surgeons, 2014. Available at https://www.rcseng.ac.uk/-/media/files/rcs/fds/publications/a-guideline-for-the-extraction-of-first-permanent-molars-in-children-rev-sept-2014.pdf (accessed July 2019).
2. Taylor G D, Pearce K F, Vernazza C R. Management of compromised first permanent molars in children. Cross-sectional analysis of attitudes of general dental practitioners and specialists in paediatric dentistry. *Int J Paediatr Dent* 2019; **29:** 267–280.
3. Jalevik B, Klingberg G. Treatment outcomes and dental anxiety in 18yearolds with MIH, comparisons with healthy controls - a longitudinal study. *Int J Paediatr. Dent*. 2012; **22:** 85–91.
4. Carter K, Worthington S. Predictors of third molar impaction: a systematic review and meta-analysis. *J Dent Res* 2016; **95:** 267–276.
5. Bayram M, Özer M, Arici S. Effects of first molar extraction on third molar angulation and eruption space. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009; **107:** e14–e20.
6. Patel S, Ashley P, Noar J. Radiographic prognostic factors determining spontaneous space closure after loss of the permanent first molar. *Am J Orthod Dentofacial Orthop* 2017; **151:** 718–726.
7. Neves A B, Americano G C A, Soares D V, Soviero V M. Breakdown of demarcated opacities related to molar-incisor hypomineralization: a longitudinal study. *Clin Oral Investig* 2019; **23:** 611–615.
8. AlQahtani S J. Atlas of Human Tooth Development and Eruption. 2009. Available at https://www.atlas.dentistry.qmul.ac.uk/content/english/atlas_of_tooth_development_in_English.pdf (accessed July 2019).
9. Teo T K, Ashley P F, Parekh S, Noar J. The evaluation of spontaneous space closure after the extraction of first permanent molars. *Eur Arch Paediatr Dent* 2013; **14:** 207–212.