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Managing compromised first permanent molars in children: minimally invasive treatment protocols for practitioners

Abstract: Employing minimally invasive operative techniques to manage compromised first permanent molars is discussed as a treatment regimen to achieve a favourable medium- to long-term prognosis in modern paediatric dental management. It is known that patient cooperation, stage of dental development and eruption state, as well as chronological age and severity of tissue breakdown of the compromised tooth have an influence on the prognosis of treatment.

CPD/Clinical Relevance: Understanding the various prognostic factors involving compromised first permanent molar teeth is essential if optimum treatment is to be provided.

Dent Update 2022; 49: 651–662

The first molars are generally the first permanent teeth to erupt in a child and are pivotal in establishing a balanced and functional occlusion.[1] Sadly, untreated caries in permanent teeth affect approximately 2.3 billion people globally[2] and the first permanent molar (FPM), generally known in the UK as the 'six', is the most affected by both dental caries[3] and by hypomineralization defects.[4] A recent survey of UK specialists' and GDPs' preferences for managing patients with compromised FPMs (cFPMs) reported that almost 60% of the specialists favoured extractions under general anaesthesia (GA), compared to approximately 20% of GDPs.[5] This treatment discrepancy may be linked to the difficulties in the interpretation of the clinical and radiographic findings in order to derive the diagnosis and thereby the prognosis, along with the availability of GA pathways of care for UK specialists and the requests/expectations of the patient's family/carers. Ultimately, agreeing with parents on management of these teeth will require following Montgomery principles of informed consent, where patients/parents should be told about all the possible complications linked with any of the treatment options available to be able to make their true informed consent.[6]

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Current global practice

A survey in the United Arab Emirates among GDPs and specialists in paediatric dentistry found that almost 85% of them believed in restoring rather than extracting cFPMs.[7] Similarly, 94% of Norwegian dentists would choose to retain a cFPM[8] as well as 74% of practitioners in France.[9] Interestingly, a recent study into the cost-effectiveness of different treatment options for hypomineralized FPMs within the German healthcare system has shown that, assuming spontaneous alignment occurs after extraction, and no orthodontic intervention is needed, timed extractions of cFPMs are the best practice in the long term.[10]

Current UK practice

In the UK, extraction of cFPMs under GA is an accepted practice. This is based on an historic and pragmatic orthodontic approach to extracting FPMs that are considered to be of dubious prognosis at the optimal age to allow spontaneous space closure during the developing dentition. However, nowadays, the determination of the prognosis of cFPMs needs to be re-evaluated in light of contemporary concepts in cariology, diagnosis and operative dentistry, alongside evidence-based preventive care. Certainly, when mildly affected teeth are planned for extraction, this 'extraction-for-prevention' approach might be considered overtreatment, unless there is need to compensate for a mandibular FPM extraction.[11] Although no clear guidelines are available, an article published in 2020 suggested preventive and restorative care pathways to manage cFPMs in these patients.[12]

The UK orthodontic guidelines focus on the best timing for extraction and rely upon a pre-determined empirical judgement of 'poor prognosis' made by practitioners. Dental extraction should be considered a treatment of last resort, but it is currently based on the anticipated failure of restorative care, albeit in the best interests of the growing child. The extraction guidelines recommend the timed removal of cFPMs to allow spontaneous space closure, when there is radiographic evidence of the beginning of calcification of the furcation of the second permanent molars (8–10 years; Demirjian's developmental stages E or F), in children with a standard occlusion (Angle Class I) and if there are no congenitally missing teeth.[13] Spontaneous space closure is more likely to occur (85%) when FPMs are extracted in cases where, radiographically, the second premolar is engaged in the second primary molar bifurcation and there is mesial angulation of second and third permanent molars. However, the third molar may not be radiographically visible before 8–9 years of age, but the confirmation of its presence and subsequent extraction of the FPM at a slightly later age (but before half the root of the second permanent molar is fully developed) may still result in favourable occlusal outcomes.[14]

Dental age and the stage of development of the second molar significantly impact the success of space closure in the maxillary arch and, if the appropriate timing for extraction is followed, spontaneous alignment occurs in 72% of the cases.[15] However, this is not so predictable for the mandibular arch,[16] with results from a meta-analysis indicating spontaneous alignment occurring in only 48% of cases.[16] It is important to note however, that extracting a cFPM too early or too late significantly impacts the odds for spontaneous space closure.[17] A recent study showed that presence of severe defects in the FPM was associated with hypomineralization defects being present in the second permanent molars also.[18] Thus, in some situations, extracting these molar–incisor hypomineralization-affected FPMs may not simply solve the issue of the presence of poor-prognosis teeth in young children.

A 2017 systematic review showed that the quality of evidence on the 'optimal time for extraction of FPMs was graded 'low' or 'very low'.[19] This means that extraction of FPMs, even when timed perfectly to allow favourable spontaneous alignment of the permanent teeth, might still result in an unpredictable outcome. Regarding the need for removal of contralateral teeth, a 2020 clinical protocol suggested that balancing FPM extractions should not be performed.[20] Singularly affected upper FPMs can be extracted without balancing or compensating extractions.[21] Extraction of a mandibular FPM however, has been recommended to be accompanied by the extraction of the ipsilateral maxillary FPM to facilitate mesial drift of the second permanent molar, but this is based on little scientific evidence.[22] In the UK, there are no studies that report on the number of children who are left with molar spaces after 'timed' extractions, perhaps because most of these cases are not eligible for NHS-funded orthodontic treatment and thus, most people simply accept the gap.

Extraction of cFPMs is usually performed under GA[23] despite the known adverse physical and psychological effects of this mode of care.[24] The main reason for a GA hospital admission for children aged between 6 and 10 years in the UK is for dental treatment.[25] A recent report from one of the largest UK treatment centres showed that 80.7% (201/249) of the patients who were referred due to cFPMs had or were planned to have extraction of at least one cFPM. GA was used as a method of pain control in 97.5% cases.[26] Interestingly, in 52.3% of these children, the 'worst' radiographic ICDAS (International Caries Detection and Assessment System) score of the extracted teeth was '≤4' (radiolucency limited to the middle third of dentine).[26] From a restorative point of view, these teeth could be restored to function successfully without the need for extraction.

How does the histopathology of caries and hypomineralization defects inform prognosis?

Hypomineralized enamel is highly porous, has fewer distinct morphological characteristics and is less mineralized than sound enamel.[27] Excessive protein retention during enamel maturation results in reduced mechanical and structural properties.[28] This often leads to post-eruptive breakdown (PEB) and biomaterial adhesive failure after restoration placement. Histologically, the clinically demarcated opacities are similar to incipient carious lesions. However, hypomineralization defects begin at the enamel–dentine junction (EDJ), remaining limited to the inner third of enamel in mild cases, or involve the entire enamel thickness in more severe cases.[20] Carious lesions begin beneath the enamel surface and progress towards the EDJ and the tooth surface. Dentine subjacent to hypomineralized enamel seems to have similar adhesive characteristics as in sound teeth.[29]

The prognosis for hypomineralized FPMs should be based on the colour of the demarcated opacities. Yellow-brown lesions are more porous than white lesions, and as such, they have a higher risk of PEB and therefore, a poorer long-term prognosis.[31] Although this decision should be aided by information from radiographic examination, it has been suggested that hypomineralized molars often have a worse clinical appearance than their radiographic

analysis indicates.[12] This is because the defective tissue is usually confined to the outer two-thirds of the crown, while the cervical enamel area of the affected teeth is usually less affected.[28] As full molar eruption/alveolar process growth may take up to 4 years,[32] the prognosis of cFPMs improves with the child's development. This may explain the frequent judgement of poor prognosis of these teeth given by practitioners when examining young children, where the full clinical crown of the affected tooth may not be fully exposed.[33]

Minimally invasive (MI) restorations

Studies have reported that children presenting with hypomineralized teeth have more subsequent restoration failures and treatment needs compared to unaffected children.[34,35] However, current clinical and scientific evidence points to the improved adhesion and mechanical properties of modern bio-interactive restorative materials that may help improve the prognosis of these teeth.[36] A minimally invasive approach, with provisional restorative management of young patients, may help to retain these compromised teeth, symptomless and functioning, until a definitive restorative solution can be provided in the future.[33]

Two approaches regarding preparation of hypomineralized enamel before restoration placement have been proposed:

- Removal of all clinically hypomineralized tissue until the margins of the restoration are placed on clinically sound enamel;
- A more conservative approach, where only the softer, friable enamel is removed, with margins retained within the harder, yet clinically hypomineralized tissue.

A clinical study evaluated the two approaches (invasive versus conservative enamel removal) on resin composite restorations placed in hypomineralized molars of children who were 8–12 years old. The conservative approach resulted in a lower success rate (58.1%) compared to the more invasive technique (81.2%) after 2 years. However, the conservative approach, with an associated enamel pre-treatment with 5% NaOCl after acid etching, increased the success rate up to 78.1%.[37]

A systematic review revealed no significant differences in bond strength or clinical success rate between self-etch adhesives and etch and rinse adhesives on hypomineralized enamel but, for etch and rinse adhesives, pre-treatment with 5% NaOCl after acid etching resulted in higher bond strengths.[38] Because the use of NaOCl may increase sensitivity or lead to a potential inflammatory effect on the pulp, especially in a young permanent molars with large pulp chambers, chemo-mechanical caries removal agents have been suggested as an alternative approach.[39] In this *in vitro* study, pre-treatment of hypomineralized enamel with a papain-based chemo-mechanical caries removal agent significantly improved the bond strength; however, compared with NaOCl-treated enamel, there were no statistically significant differences.

Treatment options and prognosis of restored cFPMs

Ultimately, the most important treatment decision to be made is to retain or extract the affected element(s), but, unfortunately, this conversation usually takes place very early in the child's life owing to the need to match the 'ideal' timing for the forced extractions to allow spontaneous migration of the second permanent molar. This important decision should take into account the severity of the compromise in the FPM, the age of the patient, stage of tooth eruption, commitment of the patient and parents/carers, cost and availability of treatment options, presence of third molars and the possibility of hypomineralization defects affecting other teeth, such as the second permanent molars.[40] A cFPM with radiolucency extending into the outer and/or middle third of dentine due to caries or enamel hypomineralization defects could be restored using MI techniques, especially if the sensitivity and patient's preventive behaviour could be managed until a later and more definitive treatment phase.

The available evidence shows that resin-based sealants have a survival rate of 72% after 18 months in 6–8-year-old children presenting with mild defects,[41] direct composites have a success rate of 60% in severely affected cFPMs and 70% in moderate defects, while conventional glass-ionomer cement (GIC) restorations have a 40% success rate in moderate and severely affected cFPMs after 24 months.[42] Prefabricated stainless steel crowns showed a 94.7% success rate after 24 months in 6–14-year-old children with severe defects[43] and cast metal restorations or indirect resin composite restorations had success rates of 90% and 85.7%, respectively, in cFPMs of 8–13-year-old children after 36 months.[44] Such clinical data are helpful in planning long-term treatment options if the patient/family/carer is willing to maintain the provisionally restored cFPMs during childhood and adolescence. Personalized care plans should be focused around suitable, pragmatic primary preventive regimens to help maintain function in these teeth and provisional restorations. Patients and parents should accept periodic maintenance of sealants, provisional glass ionomer or composite restorations until the child reaches early adulthood, when the tooth may receive a more definitive restoration, including direct or indirect resin composite inlays, onlays or crowns. It is also important to remember that, at this age, behavioural control during dental treatment will be probably insignificant and treatments could be carried out without the need for hospital/specialist facilities. Finally, an evaluation of more than 6 million restorations placed by dentists in the UK found that only 10% of restorations in molar teeth, placed at 18 years of age had to be replaced before 15 years of clinical function.[45]

A 2020 publication reviewed the MI treatment options for retaining cFPMs according to the severity of the case[12] and these clinical protocols are illustrated, step by step, in the following section.

MI techniques for management of cFPMs

Managing hypomineralized/demineralized enamel

Standard home-based preventive approaches, such as supervised toothbrushing using a fluoridated dentifrice, may provide effective biofilm disruption. Combined with the optimal amount of topical fluoride to prevent caries progression, these should used first line in the management of erupting FPMs.[46] In children at high risk of caries with visible signs of active enamel demineralization, professional preventive care is required to help the patient and their families/carers establish a tailored approach for effective oral hygiene, based on the stage of the development of the dentition, combined with dietary advice and topical fluoride varnish application.[47]

Sensitivity in hypomineralized teeth, triggered by thermal, sweet and mechanical stimuli, including

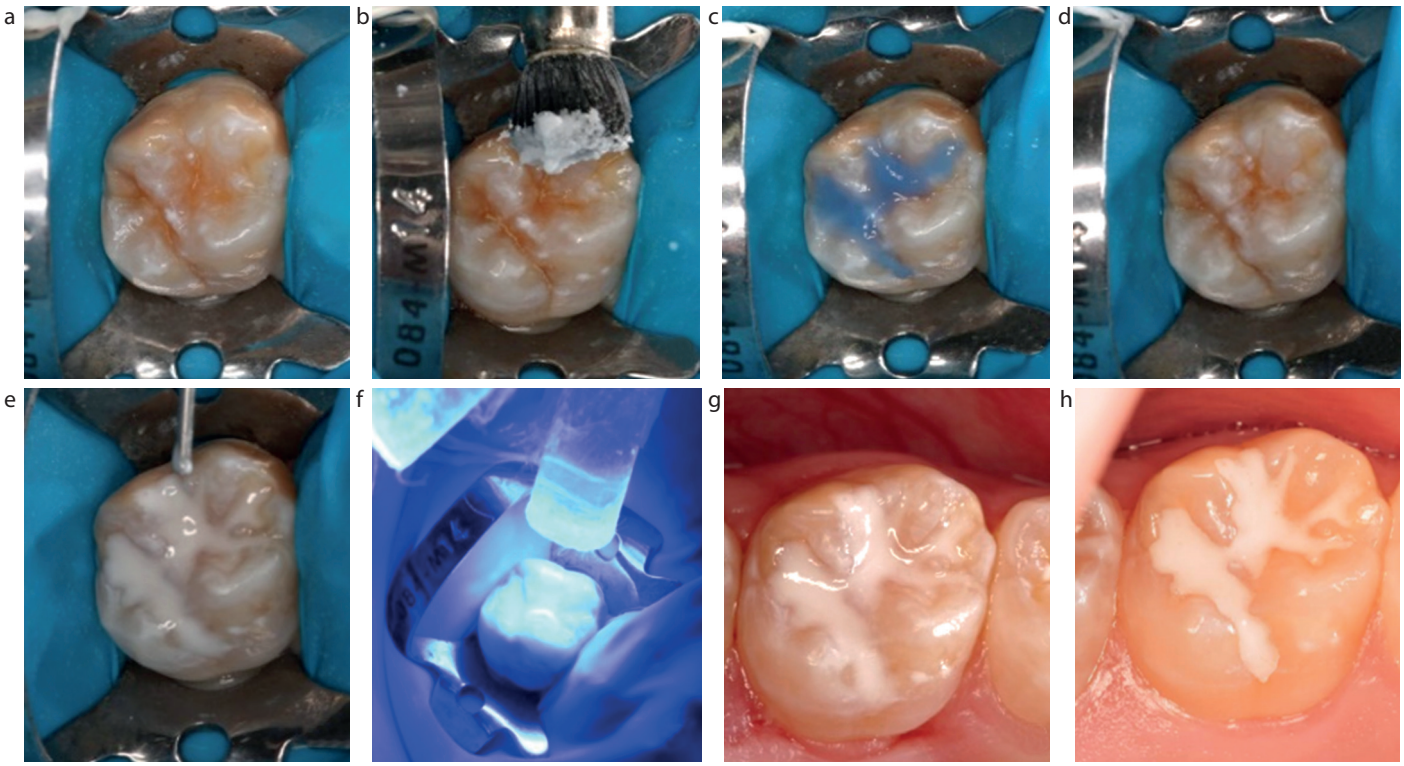

Figure 1. (a–h) Mild hypomineralized maxillary first molar, without post-eruptive breakdown (PEB) or sensitivity, managed using a resin-based fissure sealant.

toothbrushing,[40] is reported to occur in at least 35% of young patients.[48] It can be present even in apparently mildly affected teeth, varying from a slight response to an external stimulus to spontaneous acute hypersensitivity. The mechanism involved in the sensitivity of hypomineralized teeth is believed to be due to the porous enamel leaving dentine vulnerable to oral stimuli and the presence of wide and patent dentine tubules encouraging tubular fluid movement, allowing bacteria to reach dentine tubules and leading to subclinical pulp inflammation and stimulation of nerve

1	Isolate the tooth, preferably using rubber dam (Figure 1a) and remove surface debris using a non-fluoride pumice (Figure 1b)
2	If a conventional etch and rinse protocol is used (Figure 1c), enamel treatment with a de-proteinising agent (5% NaOCl) may be used after etching and before adhesive application (Figure 1d)
3	Apply the resin-based fissure sealant using a ball-ended probe to cover all occlusal fissures and affected surfaces to cusp level (Figure 1e). Then, light cure for 20 seconds (Figure 1f)
4	Check the sealant retention with a probe and the occlusion with a carbon paper (Figure 1g and h)

Table 1. Clinical steps in the application of resin-based fissure sealants in cFPMs (see Figure 1).

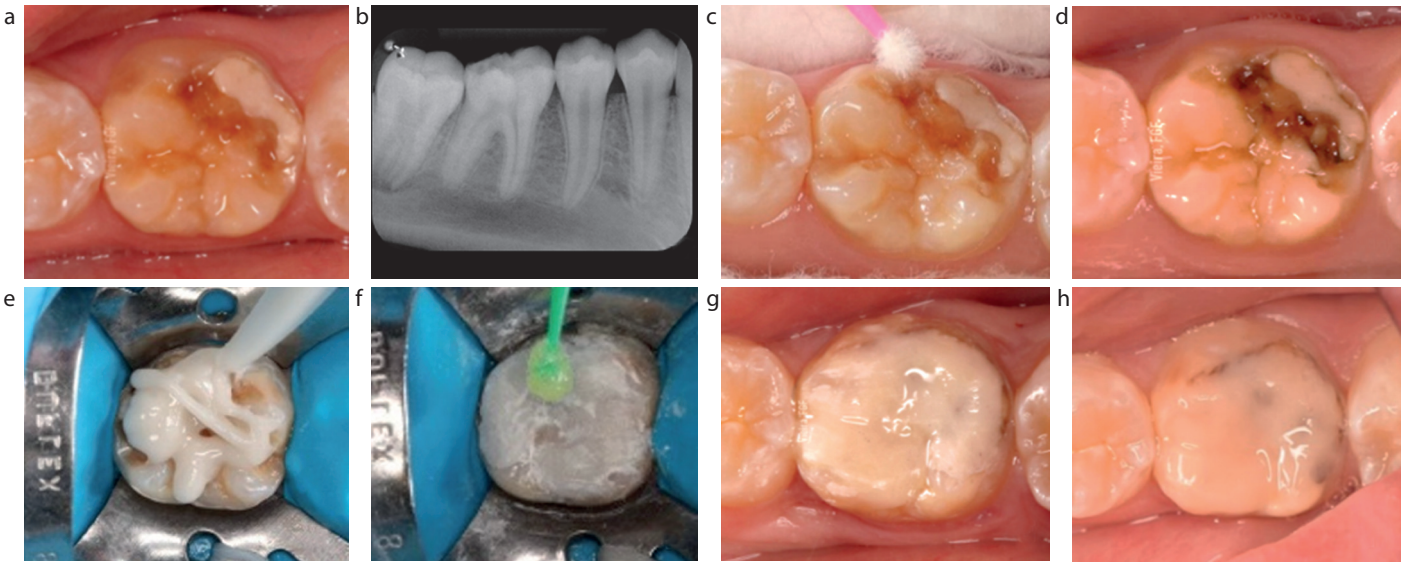

Figure 2. (a–h) Severely affected and highly sensitive lower first permanent molar, managed using the silver-modified atraumatic restorative technique (SMART) and restored with a glass hybrid restorative material.

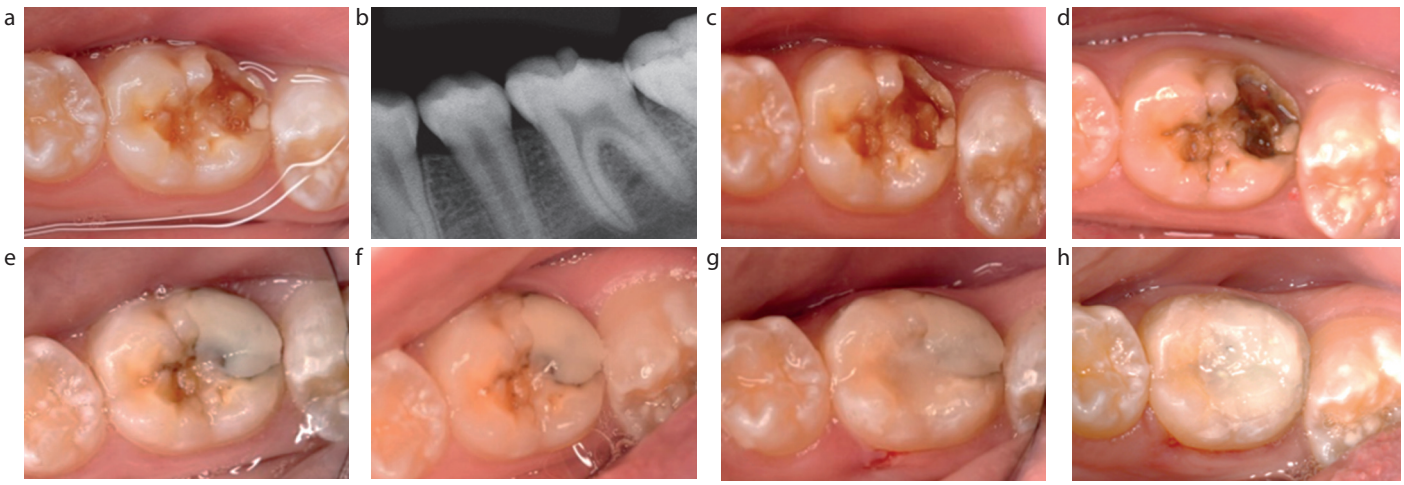

Figure 3. (a–h) Severely affected and highly sensitive lower first permanent molar, managed with the silver-modified atraumatic restorative technique (SMART) and finally restored with a resin composite restoration.

fibres.[49] Managing sensitivity of these teeth in young children is essential to achieve a good long-term prognosis.

Topical fluoride varnish

Although treatment of sensitive teeth in adults (related to exposed cervical dentine) may benefit from fluoride varnish applications,[50] for hypomineralized and sensitive FPMs, there is little evidence available to support this. One study evaluated enamel remineralization (measured by changes in fluorescence) of hypomineralized incisors after four, weekly applications of fluoride varnish and found there were no significant changes compared to the placebo group.[51] For this reason, while fluoride varnish applications certainly have a role in caries preventive regimens,[52] other alternative remineralization strategies may be more effective to deal with hypersensitivity issues in purely hypomineralized FPMs.

CPP-ACP

The use of casein phosphopeptide–amorphous calcium (fluoro-) phosphate (CPP-ACP) to increase the surface mineral content of hypomineralized teeth has been advocated by the European Academy of Paediatric Dentistry since 2010.[53] *In vitro* studies have shown that CPP-ACP improves the degree of mineralization in hypomineralized enamel,[54] but more recently, other clinical studies have reported a significant reduction in sensitivity.[55,56] This could improve comfort and standard home-based oral hygiene procedures for patients. The product is especially useful in cases of mildly affected teeth or those without PEB that would need fissure sealing procedures. Application of a CPP-ACP paste over the affected teeth should be performed after conventional toothbrushing procedures, before bedtime, for a minimum of 8 weeks. In the UK, Tooth Mousse and MI Paste Plus (GC Europe, Leuven, Belgium) are the available CPP-ACP products presently on the market. Other options for home-care use, targeting sensitive hypomineralized molars are those dentifrices containing arginine,[57] such as Colgate Sensitive Pro-Relief or Elmex Sensitive (Colgate-Palmolive, New York, NY, USA).

Fissure sealants

Fissure sealants are indicated in mildly affected cFPMs to reduce sensitivity and to assist the patient in reducing the accumulation of biofilm, protecting the enamel surface against mineral loss and to some extent, PEB. If there is no sensitivity and moisture control can be achieved effectively, conventional resin-based sealants are the best treatment option for mild cases, where cusp PEB is not present (Figure 1). In cases of partially erupted and/or hypersensitive cFPMs with minimal post-eruptive enamel breakdown, where adequate moisture control becomes an issue, a GIC sealant using the 'finger-press' technique can be a good temporary option to keep the patient pain free and still allow effective biofilm control.[47] Figure 1 and Table 1 detail the clinical steps for resin-based fissure sealing of mildly affected hypomineralized molars.

1	Protection of the patient's lips and peri-oral areas with petroleum jelly to avoid accidental staining with SDF
2	Clean the tooth of debris and isolate with cotton rolls, absorbent pads and suitable suction
3	Place a drop of SDF in a Dappens pot and, using a microbrush, paint delicately onto the tooth surface and let it rest for 1–3 minutes (Figure 2c)
4	Gently remove/dry the excess of SDF with cotton pledgets or gauze. Air-drying may trigger dental hypersensitivity It is recommended to wait 2–4 weeks before placing the glass ionomer restoration to ensure sensitivity is reduced and to avoid staining the restoration (Figures 2d, 3d)
5	Remove surface debris using with pumice and rotating brush
6	Application of dentine conditioner (10% phosphoric acid) for 15 s, rinsing and drying
7	Application and adaptation of the restorative material inside the cavity. Light cure, if required (Figure 3e)
8	Check occlusion, adjust with finishing burs if needed. If using a glass hybrid restorative, apply a layer of resin coating and then light cure (Figure 2f)
9	The SMART restoration can be overlaid/replaced later, when patient's behaviour and/or sensitivity issues are resolved, by a conventional resin composite restoration (Figure 3h)

Table 2. Clinical steps of the SMART technique, followed by a glass ionomer/resin composite restoration in sensitive, severely affected cFPMs.

Managing post-eruptive breakdown (PEB) of enamel

Air abrasion

Air abrasion is an operative technique used during cavity preparation for removal of sound and carious enamel and dentine, small existing restorations, conditioning the tooth surface before placement of composites, porcelain or ceramics and removal of superficial enamel defects or staining as an adjunct to conventional rotary burs.[59–62] Air abrasion works by using a stream of aluminium oxide particles generated by compressed air, bottled carbon dioxide or nitrogen gas. However, the non-selectivity of the aluminium oxide particles[52] combined with potential inhalation concerns,[64] have led to the introduction of more biocompatible bioactive glass powders.[65] Studies have showed promising results for Sylc (OSspray Ltd, UK) in selective removal of demineralized enamel, surface stains and debris, resulting in MI conservative preparations[66,67] and good patient acceptance of the technology, in terms of the lack of vibration, low heat generation and the reduced need for local anaesthesia.[68] Air-abrasion procedures using this bioactive glass particle resulted in immediate bond strength similar to aluminium oxide air abrasion[69] and therefore, it may be a suitable alternative to rotary bur preparation for hypomineralized enamel margins with PEB. In the current post-pandemic era, with the use of non-aerosol generating procedures (non-AGPs) being more routinely advocated, this technology may show advantages in view of other MI techniques.

Silver diamine fluoride and the SMART technique

Silver diamine fluoride (SDF) is a topical agent capable of reducing sensitivity and arresting caries progression,[70] but its main disadvantage is the resulting black staining of affected tissues, raising aesthetic concerns

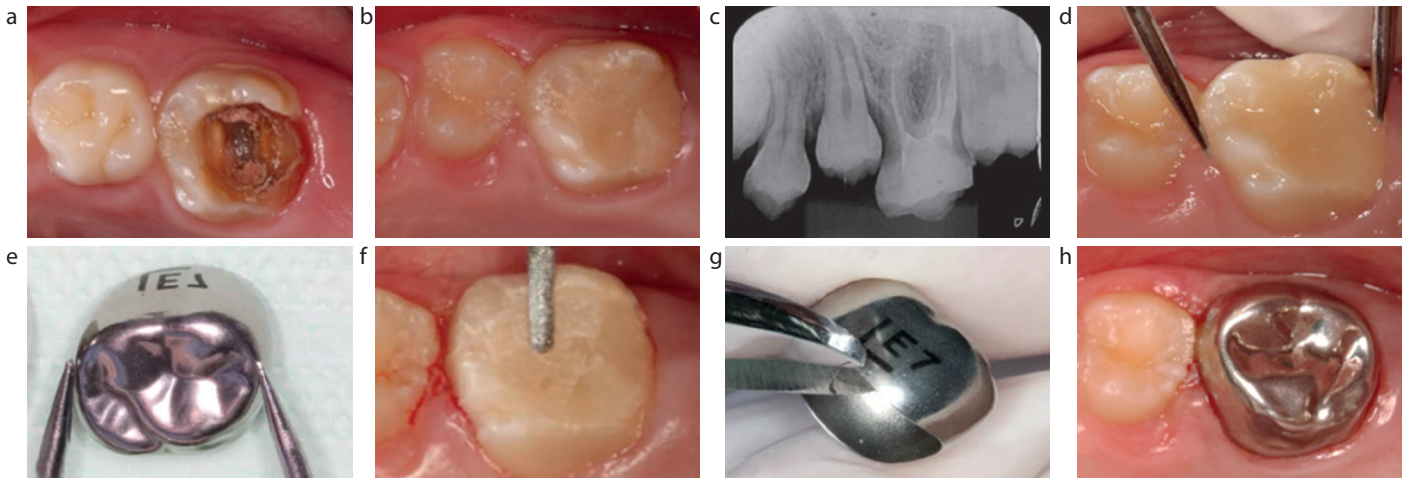

Figure 4. (a–h) Hypomineralized molar with pulp involvement managed with root canal treatment and a stainless-steel crown in an 11-year-old patient. Endodontic treatment and restoration with an SSC was performed, since the family and child were not keen on extraction and the child was able to cooperate. One visit was needed for the endodontic treatment and another visit was needed for the crown fitting. The family and patient are aware that the SSC will need replacement in the future and that the chance of the child retaining the tooth for her whole life is low.

even when applied on posterior teeth.[71] This discolouration is caused by the oxidation of ionized silver into metallic silver and is indicative that silver precipitation on the tooth has occurred and the caries process is arrested.[72] In an attempt to combine the benefit of arresting caries and masking the poor aesthetic appearance, GIC restorations have been used to cover SDF-treated lesions.[73] This approach, known as silver-modified atraumatic restorative treatment (SMART), can be useful in children suffering from acute dental hypersensitivity in cFPMs, since its application does not require anaesthesia or removal of affected tooth structure. The adhesion of the GIC does not appear to be impaired by the SDF itself.[74] Table 2 describes the steps for performing the SMART technique and Figures 2 and 3 show cases of severely affected hypomineralized molars being restored with a glass hybrid restorative material and a resin composite restoration after using the SMART technique, respectively.

1	Consider local anaesthesia, depending on the case, either via nerve block or infiltration prior to preparation
2	Choose the correct size SSC based on the mesio-distal dimension of the tooth (Figure 4d,e)
3	Minimally invasive preparation protocol starting with removal of caries-infected dentine, placing GIC restoration (if needed, Figure 4b) followed by suitable occlusal reduction
4	The mesial and distal aspects of the tooth are relieved minimally, to allow crown insertion proximally (Figure 4f). Alternatively, interdental separation with orthodontic elastic separators helps facilitate crown insertion
5	The buccal and lingual surfaces are used for retention of the crown, so mechanical reduction to these areas should be judiciously minimal. The finishing line is a feather edge and placed just 0.5–1 mm below the free gingival tissue, if required
6	In some instances, uncontoured SSCs may be too long (usually observed by extreme gingival blanching on placement). In this case, trim with SSC scissors or stones to reduce the SSC length. Crimping is indicated for correct contour to the tooth and retention
7	Fill the SSC with a self-curing glass ionomer cement and seat. Bite sticks can be used to apply force, or the patient can bite the crown into occlusion
8	Scalers and floss are used to remove excess cement around the margins of the crown (Figure 4h)

Table 3. Clinical steps to place stainless steel crowns (SSC) as a provisional measure on sensitive, severely affected cFPMs.

Glass hybrid restoratives

Conventional glass ionomer cements (GICs) are composed of a powder (calcium–aluminum fluorosilicate glass) and a liquid (35–65% polyacrylic acid) that are mixed together to set as a result of metallic salt bridges formed between the Al^{2+} and Ca^{2+} ions leached from the glass and the acid. They are considered chemically self-adhesive materials, as true chemical bonding occurs at the interface between the cement and the tooth tissue, through ionic bonds formed between the carboxyl groups of the polyalkenoic acid and the calcium of the hydroxyapatite remaining around the exposed surface collagen.[75]

High-viscosity restorative GICs, such as GC Fuji IX, use an increased powder to liquid ratio during mixing. Resin-modified (light-cured) GICs (RMGICs), such as GC Fuji II LC, incorporate resin monomers in the liquid component. More recently, glass hybrid materials, such as Equia Forte, based on GIC technology, have been developed using ultrafine, highly reactive glass particles dispersed within the conventional glass ionomer structure and a higher molecular weight polyacrylic acid.[76] Furthermore, application of a

nano-protective multi-functional monomer coating produces a tougher surface resin matrix, improving the material properties.[77]

A clinical trial employing glass hybrid GICs to restore hypomineralized FPMs and permanent incisors found, after 1-year follow-up, a cumulative survival rate of 98.3%,[36] which is higher than a previous trial that used high-viscosity GICs to treat hypomineralized teeth (78%).[78] It is important to remember that GIC restorations can be overlaid with resin composite in the future, as illustrated in Figure 3.

Stainless steel crowns

Being minimally invasive and providing excellent long-term survival rates, stainless steel crowns (SSC) are an excellent option for retaining severely affected cFPMs and providing protection against further tissue breakdown. These are crowns specifically designed for permanent molars (3M ESPE Unitek, St Paul, MN, USA) with six different sizes for each FPM in each quadrant. Figure 4 illustrates a case of management of a severely affected, endodontically treated cFPM using this approach. In 2016, a US study suggested that use of permanent tooth SSCs as an interim restoration in FPMs resulted in an 88% success rate, with an average lifespan of 3.7 years in all age groups,[79] supporting its use as a provisional treatment on young permanent molars, until the appropriate time to receive a more definitive restoration. This procedure has a low sensitivity to moisture, provides full coverage and is a durable restorative option.[80] Some indications for using SSCs on compromised FPMs include carious lesions or severe hypomineralization breakdown extending over more than two-thirds of the occlusal surface or in endodontically treated teeth.

Conclusions

Understanding the relationship between the severity of cFPMs and the corresponding clinical/radiographic signs and symptoms and histological changes, provides a more evidence-based prognostic judgement guide for the practitioner. In the long term, arrested caries or mild enamel defects may remain as 'tissue scars' during the patient's life, while premature extraction of teeth can be considered as tissue 'amputation'. However, in order to keep these tooth elements functional for a considerable period of time, post-eruptive breakdown should be monitored by the clinician/oral healthcare team and managed according to its severity and symptoms, ranging from interim coverage with GICs (with or without SDF application) or an SSC in more severe cases of tissue loss, until the patient can cope with a more definitive prosthetic/restorative replacement procedure. Unfortunately, owing to the lack of evidence on the long-term prognosis of cFPMs in children, no specific thresholds for indication of extractions can be given at the moment. In this regard, continuing improvements in adhesion technology, mechanical properties of restorative bioactive/bio-interactive materials and MI operative techniques have an important role in providing a provisional solution for management of mild/moderate cFPMs in young children.

The clinical judgements that underpin the management of cFPMs are challenging for families and clinicians alike. General anaesthesia is not without risk, and the extraction itself is traumatizing for the child and so it should be carefully considered and limited to specific clinical scenarios, particularly when the defect is mild or moderate in severity.

Acknowledgements

This article is an outcome from a clinical research collaboration with Brazil entitled 'Children Experiencing Dental Anxiety Collaboration on Research and Education (CEDACORE)', funded by FAPERJ grant number E-26/202.612/2019, CAPES and Newton Fund Researcher Links Workshop, grant number 2016/17 [261766649]. The College of Dentistry, Princess Nourah Bint Abdul Rahman University, Saudi Arabia is also acknowledged for grant sponsorship of the first author. The funders had no role in study design, data collection and analysis, the decision to publish or preparation of the manuscript.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the article.

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