Molar Incisor Hypomineralisation: restorative management

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Abstract

Aim The methods for the restoration of permanent molars and incisors affected by Molar Incisor Hypomineralisation are reviewed. The special problems associated with restoring these teeth, such as sensitivity, occlusion and aesthetics are discussed. The various options for restoration are outlined and recommendations made as to the appropriate types of restoration.

Keywords: Hypomineralisation, Molars, Restoration.

Introduction

Molar Incisor Hypomineralisation (MIH) is a relatively common, developmental condition characterised by hypomineralisation defects of the enamel on the first permanent molars and the permanent incisors [Weerheijm et al., 2001]. These defects are illustrated by Weerheijm [2003]. On the first permanent molars these defects range from simple white yellow opacities to severely displastic enamel, which frequently breaks down rapidly following eruption. On permanent incisors, the defective enamel usually seems less severely disrupted and less prone to break down. Incisal enamel defects are, however, frequently quite extensive and most common on the buccal surfaces of the teeth, giving rise to cosmetic concerns.

Patients with MIH often require multidisciplinary dental management. In some instances extraction of severely affected first permanent molars plus or minus active orthodontic intervention is indicated. In other instances, retention and restoration of the first permanent molars, either in the medium or long term, is the treatment of choice. Restorative intervention to improve the appearance of affected permanent incisors may also be desired by the patient. The purpose of this paper is to review the conservative and restorative techniques available for managing Molar Incisor Hypomineralisation.

Indications for restorative management of hypomineralised first permanent molars

The decision to restore rather than extract hypomineralised first permanent molars is influenced by a large number of factors.

Age. The optimum age for elective extraction of poor prognosis lower first permanent molars is around dental age 8.5–9 years [Hallet and Burke, 1961]. In some cases of MIH, first permanent molars exhibit rapid deterioration or are significantly symptomatic very shortly following eruption. Extraction at this stage may prove orthodontically detrimental and intermediate restoration prior to a more definitive decision about long term retention/extraction may be indicated. At the other end of the spectrum, patients presenting with poor quality lower first molars at dental age 10 years or above may end up with residual spacing in the lower arch and poor positioning of the lower second permanent molars if extractions are undertaken at this late stage.

Orthodontic considerations. Restoration may be indicated because of other orthodontic considerations. These include absence of crowding and unfavourable skeletal-base relationships. These and other orthodontic factors are dealt with in detail elsewhere [Gowans and Williams, 2003; Weerheijm, 2003] and will not be considered further in this paper.

Other developmental anomalies. Coincidental developmental anomalies elsewhere in the dentition may preclude extraction of the first permanent molars. The most common example would be congenital absence or severe malformation of second premolars.

Tooth factors. The condition and status of the affected teeth themselves have a considerable influence on the
**Fig. 1** - Affected molar temporised with glass ionomer cement.

**Fig. 2** - Pre and postoperative appearance of a molar treated using a composite resin restoration.

**Fig. 3** - Affected enamel is often easily removed using a steel bur. Normal enamel cannot usually be removed by this method.

**Fig. 4** - Pre and postoperative views of an affected molar restored with a stainless steel crown.

**Fig. 5** - Pre and post-operative appearance of an affected molar restored with an adhesively retained cast gold overlay.

**Fig. 6** - Masking of an enamel opacity following partial thickness enamel reduction using a modern aesthetic composite system (Esthet-X, Dentsply)

**Fig. 7** - Effective masking of enamel opacities can be achieved without enamel reduction using the Esthet-X composite system, but this does result in some increase in the bulk of the teeth.
need for and type of restorative intervention indicated. Severely affected first permanent molars often require rapid and effective restorative intervention if they are to have any chance of being maintained in the medium or long term. Such teeth also often give rise to early symptoms, especially sensitivity to cold or sweet foods and drinks. Not only does this interfere with nutrition, but also makes effective oral hygiene difficult, which further compromises the condition of the affected teeth.

Special problems associated with restorative management of first permanent molars in MIH

Delivering successful restorative care for affected first permanent molars in MIH can pose a number of special problems.

Local analgesia. Hypomineralised first permanent molars are frequently exquisitely sensitive and thus require robust local analgesia to be secured prior to restorative care. In a study of 9 year old children with severe hypomineralised first permanent molars, Jalevik and Klingsberg [2002] demonstrated that dental fear, anxiety and behaviour management problems were far more common in children with severely hypomineralised first permanent molars when compared to unaffected controls. These authors found that in many cases this was associated with attempts at treatment without local analgesia. They concluded that the increased frequency of behaviour management problems was very likely to be related to repeated pain and discomfort during attempts at dental treatment, and that local analgesia and, where indicated, other pain reducing techniques, such as sedation, should be used when treating affected children. In the present author’s experience, even attempting to fissure seal affected first permanent molars can sometimes result in considerable discomfort. Hence, careful attention to achieving profound local analgesia is often an essential prerequisite to the successful restorative management of affected first permanent molars. Nitrous oxide and oxygen inhalation sedation can be a useful adjunct to local analgesia in these patients, especially where adequate local analgesia proves difficult to achieve. A minority of children may even require general anesthesia to allow adequate restorations to be placed.

Access and isolation. By definition, hypomineralised first permanent molars often present as the last standing tooth at the back of a 6 or 7 year old’s mouth. Rubber dam enables easy access whilst providing excellent isolation and improving patient comfort. It also helps to avoid other affected teeth in the mouth being inadvertently exposed to cold air or water aerosols.

Restorative management of affected first permanent molars

A wide range of restorative interventions is possible. The choice of intervention or material is governed by a number of factors, including the extent of the defective enamel, the quality of both defective enamel and the unaffected parts of the tooth, the presence of sensitivity, and the age of the patient.

Desensitising agents. Some affected first permanent molars exhibit significant sensitivity especially in the early posteruptive period. Various desensitizing agents may be of value in the management of such symptoms, although little or no research evidence exists to support their use. 5% sodium fluoride varnish (Duraphat) is well tolerated by young children and can be applied sparingly directly to first permanent molars. Repeated application has been shown to reduce dentine sensitivity [Hansen, 1992; Thrash et al., 1994] but its efficacy on sensitive hypomineralised first permanent molars is as yet untested. Some of the standard commercially available “sensitive tooth” toothpastes may also help in some instances. A number of the author’s patients do seem to have been helped considerably by using 0.4% stannous fluoride gels on a daily basis. Although stannous fluoride gel has been demonstrated to reduce dentine sensitivity [Thrash et al., 1994], this effect has yet to be confirmed by clinical trials in hypomineralised first molars.

Fissure sealants. For mildly affected teeth where the enamel is intact, of good hardness, and the tooth exhibits no abnormal sensitivity, fissure sealants may be the treatment of choice. Prior to placement of sealants the tooth should be confirmed to be caries free both clinically and radiographically. As with fissure sealants placed on any other first permanent molar, it is important to monitor that the fissure sealant is maintained in the long term and that deterioration of the underlying and surrounding tooth tissue does not occur.

Plastic restorations. A number of materials may be used for intracoronal restoration of affected molars. Amalgam is non-adhesive, prone to marginal leakage, offers no mechanical support of adjacent tooth tissue and is a poor insulator. It is therefore of limited value for the restoration of affected molars in MIH.

Glass ionomer cements are adhesive, good insulators and release fluoride in the short term. Their poor wear resistance precludes glass ionomer cements from use as a definitive restorative material in affected molars, but they can be useful for short or medium term temporisation of teeth (Fig. 1). Chemically cured packable glass ionomer cements are probably the most useful in this situation.
Composites (and compomers) can provide a definitive restorative solution for some teeth. When coupled with a suitable bonding agent, these materials are adhesive providing support and protection to adjacent tooth tissue and minimizing the risk of marginal leakage. They also exhibit good wear resistance. Such materials probably perform best in MIH where defective enamel is well demarcated, confined to one or two surfaces with no cusp involvement and has supragingival margins (Fig. 2). If composite is to be used, good isolation (i.e. usually rubber dam) is an essential prerequisite. One specific difficulty when preparing teeth for composite restorations is deciding where the preparation should end. One approach would be to remove all enamel that appears in any way visibly defective. Whilst this approach will almost certainly avoid failure of the restoration secondly to further breakdown of tooth tissue at the restoration margins, it may result in the sacrifice of unnecessarily large amounts of tooth tissue. An alternative approach used by the author is to investigate abnormal looking enamel at the margins of the defect with a slow moving steel bur, extending into the remaining areas of the defect until good resistance is felt (Fig. 3). Initial clinical results using this technique seem promising, although further research is needed if its efficacy is to be confirmed. Treating defective enamel with sodium hypochlorite has been reported to increase bond strengths in amelogenesis imperfecta [Venezie et al., 1994]. The value of this technique in MIH is, as yet, unproven. Fissure sealant should be placed following the composite restoration. This not only protects the remaining fissure system, but also can help to minimize wear on opposing teeth and restorations, a recognised problem with posterior composite restorations which needs to be carefully considered especially where the opposing tooth may also have defective enamel. Both Class I and Class II composite restorations using modern materials have been demonstrated to perform well in permanent molars and premolars [Gaengler et al., 2001]. However, the survival of this type of restoration in patients with MIH has yet to be evaluated.

For molars with extensive defects especially where there is significant cuspal involvement, preformed metal/stainless steel crowns (SSC) often provide an expedient and effective medium term solution [Croll and Castaldi, 1978; Andlaw, 1983; Croll, 1987; Zagdwon et al., 2003]. These crowns are also highly effective at stopping sensitivity and protecting the remaining tooth tissue from further mechanical or carious breakdown. SSCs specifically designed for first permanent molars are available from 3M (Fig. 4). As with the primary version, first permanent molar SSCs are supplied in 6 different sizes for each of the four quadrants. Unlike primary molar SSCs, however, because of the variability in crown length of first permanent molars, the cervical extension of the crowns is not accurately contoured and usually requires some adjustment prior to fitting. This can usually be achieved by trimming any over extension with sharp BB scissors, recrimping the crown edges with crimping or Adams pliers, and finally by smoothing the adjusted edge with an abrasive stone. Preparation of the tooth can usually be confined to minimal occlusal reduction and mesial and distal slicing. These crowns can be cemented with any proprietary luting cement, although the author’s preference is for a glass-ionomer based cement. One potential disadvantage of this type of restoration is that the mesial slice required prior to placement may result in the removal of sound tooth tissue. Whilst this cannot be avoided altogether, in cases where the operator desires to keep mesial tooth tissue removal to a minimal, this can be assisted by placing orthodontic separators one to two weeks prior to preparation. The longevity of SSC restorations on first permanent molars in MIH has been investigated by Zagdwon et al. [2003]. In this study, only 1 of 19 SSCs followed for 12 to 24 months failed.

Adhesively retained onlays or cuspal overlays have been advocated by a number of authors [Crawford and Aboush, 1993; Harley and Ibbetson, 1993; Hunter and Stone, 1997]. Overlay restorations provide cuspal coverage whilst offering the operator considerable flexibility in the placement of restoration margins. Such techniques avoid unnecessary approximal restoration, enable accurate supragingival margins to be established and can be made out of materials with good wear resistance. They are, however, technique sensitive, require accurate impressions, at least two stages to completion, and are relatively expensive. Prepared teeth may also require temporary restoration and postpreparation, which can sometimes be problematical. Such restorations are probably most useful for restoring well demarcated lesions which involve cusps but where the approximal surfaces are not affected, especially if it has been decided that the teeth involved are to be kept in the long term. A number of different materials have been advocated, including gold, nickel chrome, cobalt chrome and ceramics. Where gold is used (Fig. 5), heat treating the fit surface has been demonstrated to enhance retention [Eder and Wickens, 1996]. Cast cobalt chrome onlays and overlays [Harley and Ibbetson, 1993] have the advantage that excellent adhesion can usually be obtained by simple sand blasting of the fit surface prior to cementation. However, post-casting adjustment of
cobalt chrome is far more difficult both in the laboratory and in the mouth. The use of cast nickel chrome onlays has also been described, although concerns about nickel allergy probably preclude the use of this material when other more hypoallergenic alternatives exist.

A number of workers have reported the successful use of cast metal onlays or copings (CAC) in patients with enamel defects on first permanent molars, although in the majority of cases these patients had one of the recognised types of amelogenesis imperfecta [Crawford and Aboush, 1993; Harley and Ibbetson, 1993; Hunter and Stone, 1997]. Zagdwn et al. [2003] compared the longevity of SSC and CAC on first permanent molars on patients with amelogenesis imperfecta and MIH. Some 19 of the stainless steel crowns and 23 castings were followed for 12 to 24 months; one SSC and two CAC failed during follow-up.

The use of laboratory formed indirect ceramic onlays has been described [El-Mowafy, 2000; Koch and García-Godoy, 2000]. Whilst such restorations can have the potential to provide excellent aesthetics, expense and the potential for wear of opposing teeth may limit their applicability, especially in young children.

Management of enamel opacities on anterior teeth

Many children with MIH exhibit enamel opacities on the buccal surfaces of permanent incisors. The extent and severity of these opacities is highly variable and frequently asymmetrical. Not all patients with MIH exhibit enamel opacities on their permanent incisors but the prevalence of this feature may exceed 30% in some populations [Koch et al., 1987]. Breakdown of enamel is far less commonly seen in affected incisors than it is in affected first permanent molars, and abnormal sensitivity seems to be less of a problem. However, the resultant poor aesthetics are frequently a trigger for the patient (or the patient’s parents) to seek dental attention. Ultrastructurally, these opaque defects usually extend through the full thickness of enamel, from the surface of sub-surface down to the amelodentinal junction (ADJ). For this reason, acid/pumice microabrasion techniques tend to produce little improvement when used alone. Bleaching with carbamide peroxide has anecdotally been reported to produce some improvement, especially with yellow brown discoloured defects, but is unlikely to improve the underlying opacity.

Direct composite veneering, with or without preparation of the underlying enamel, probably offers the most reliable way of improving aesthetics of these teeth in the medium term, and the advent of newer materials which include dense opaquing shades have significantly improved the outcome with this technique (Fig. 6). These allow opacities to be much more effectively disguised than with conventional composite materials. For optimum aesthetics without undue increase in the bulk of the tooth, some enamel reduction is often necessary, but this should be kept to a minimum to avoid undue damage to what is very often a young incisor. Following partial thickness enamel preparation, the defect may become even more apparent and is usually best disguised using dark gray opaquer colours (Fig. 6) prior to adding layers of body and enamel composite of the appropriate shade for the tooth. These modern materials can also be used to good effect without enamel preparation although there is some resulting increase in the bulk of the teeth (Fig. 7).

A number of studies have investigated longevity of directly placed composite veneers on young permanent incisors. Welbury [1991] followed 289 directly placed composite veneers for up to 3 years and reported a 14% failure rate. Similar success rates have been reported in other studies [Peuman et al., 1997; Meijering et al., 1998].

Conclusion

The indications for, the available materials, and some of the problems which may be encountered when providing restorative treatment in Molar Incisor Hypomineralisation have been reviewed. Whilst many potential approaches exist, few are yet supported by good quality clinical research data. This paper provides a review of the current state of the art, but there is a great need for further clinical investigation and research to help to validate and refine many of the suggested techniques.

References


