

Minimal intervention dentistry in the management of the paediatric patient

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VERIFIABLE CPD PAPER

IN BRIEF

- Provides an overview of the applicability of minimal intervention dentistry to the management of carious lesions in children.
- Emphasises the importance of carrying out a proper diagnosis for the decision making-process.
- Presents treatment options for enamel and dentine carious lesions according to the principles of minimal intervention dentistry.

PRACTICE

Minimal intervention dentistry (MID) is a philosophy of care that aims to conserve tooth tissues throughout a person's life. This paper aims to review the literature on topics that are related to MID approaches for the management of dental caries and that can be applicable to the paediatric patient. Tools for caries diagnosis and early lesion detection are presented and discussed. More conservative and less invasive techniques for managing enamel and dentine carious lesions in primary and permanent teeth are compared to the traditional treatments. The traditional treatments are centred on the disease and on restoring its sequels, and have been shown to be insufficiently effective in controlling caries disease over time. In contrast, the MID philosophy has created potentially very suitable options for treating children that are considered more child-friendly, less anxiety provoking, preserve more tooth tissues and are equally good as the traditional treatments.

INTRODUCTION

Better understanding of the caries process, together with the improvement of dental materials in the last decades, enables the clinician to provide less invasive and much more conservative care than was previously possible. Consequently, the philosophy of how to deliver dental care, previously based on surgical approaches, has changed significantly, to a model of care named 'minimal intervention dentistry' (MID); the cornerstones of which are earliest detection and prevention of disease, followed by less invasive treatments.¹ MID is an approach that aims to keep teeth functional for life.² Therefore, it is applicable in every dental specialty, particularly paediatric dentistry. Thinking about providing oral care to a young patient while ignoring the concepts that govern MID is difficult. Besides all the benefits that the philosophy offers in terms of tooth tissue preservation, MID is considered a friendly approach, reducing patient anxiety and offering health-oriented treatment options.³ It can thus contribute to patient behaviour management; an accepted key factor in providing oral care to the paediatric patient.⁴

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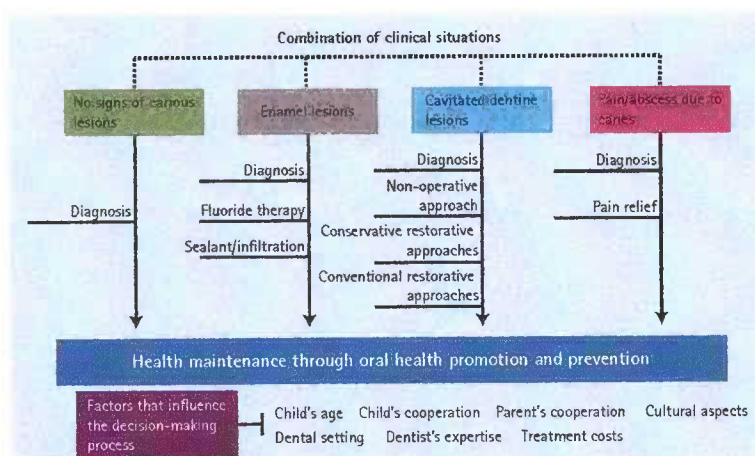


Fig. 1 Scheme representing different clinical scenarios, possible intervention approaches based on MI concepts and factors that might influence the dentist decision-making process

Because dental caries is the main oral health problem in childhood, this paper focuses on the evidence supporting the use of MID in preventing the occurrence of the first signs of the disease and, when disease is already present, treating it. It is important to note that this article is not aimed at covering all aspects of MID. Topics that are of special interest for caries control in children were selected.

THE PAEDIATRIC PATIENT

A child can present to a dentist with very distinct clinical situations or a combination of them, as shown in Figure 1.

The best scenario would be one in which a child visits the dentist without any clinical

sign of dental caries. This would be hugely beneficial, enabling the establishment of an excellent dentist-patient relationship in terms of behavioural management, as only non-invasive procedures would be needed. Most importantly, such a situation increases the chances of keeping that child caries-free, through planned regular return visits and motivating parents/caregivers to take responsibility for the oral health of the child. This aspect is extremely important, as the choice of visiting a dentist is not a decision made by the child, but by the parents or caregivers. Families should be provided with advice about essential home-based caries preventive programmes so that good oral

habits and attitudes can be established.⁵

Unfortunately, a considerable number of children have many carious teeth, even at a very young age. Although there is worldwide evidence of a decrease in caries prevalence, dental caries is still the most prevalent childhood disease,⁶ especially in vulnerable populations. According to the American Academy of Paediatric Dentistry the presence of one or more primary teeth with caries (cavitated or non-cavitated) in a child 71 months of age or younger is defined as early childhood caries. An international survey that aimed to compare the oral health condition of young children (26–34 months of age) in five different countries showed a variation of caries prevalence, ranging from 17% (Germany) to 31% (Russia). Cavitated dentine lesions were considered to be the cut-off point for caries.⁷ If not controlled, these lesions will progress, causing pain and negatively affecting both child behaviour and family quality of life.^{8,9}

In view of the fact that dental caries is preventable, a dental visit should occur before the first signs of the disease are present. Therefore, it is recommended that at approximately 12 months of age or just after a primary tooth starts to erupt a child should undergo the first oral evaluation.¹⁰ This recommendation is totally in line with the MID philosophy in which the individual, in this case the family of the young patient, should be empowered with regard to maintenance of oral health of the child. For that purpose, the first dental visit should be focused on the child's medical/dental history, identification of the child's risk factors, establishment of an individual preventive oral health programme and finally, decisions about the child's recall visits. Parents/caregivers should be advised regarding diet, oral hygiene and fluoride exposure. In cases where carious lesions are already detected, minimally invasive interventions according to the severity of the lesion are recommended, together with a strict preventive programme for avoiding the occurrence of new lesions.

DIAGNOSING THE SITUATION

The concept of caries diagnosis involves more than merely detecting an enamel and/or dentine carious lesion. A broader evaluation that considers all caries risk factors directly contributing to the caries risk of the individual is an essential part of the process.¹¹ In that context and considering that the child's health results from the complex interaction of biological determinants with socio-cultural, family and community variables,¹² the professional's attention should also be driven to the environment



Fig. 2a Clinical aspect of the anterior-superior front teeth at baseline. Observe the buccal surfaces of teeth 11 and 21, showing the white spot lesions



Fig. 2b The anterior-superior front teeth after 30 days of brushing with fluoridated toothpaste, showing a reduction of the white spot lesions

and circumstances around the child. A clear relationship between family income, maternal level of education, disparities in access to dental care and dental caries in children has been well-documented.^{13,14} Therefore, an accurate diagnosis of the overall situation will assist the professional in establishing the child's caries risk profile. Moreover, the adoption of specific tools developed for caries risk assessment (CRA) is being advocated.¹⁵ However, independently of the method selected by the professional for CRA, the child's past caries experience and the dentists' intuition are still the most reliable caries predictors.^{16,17}

With regard to the caries diagnosis itself, all efforts to effectively record early enamel lesions should be taken, as such lesions are considered the equivalent of cavitated lesions when caries risk is determined in young children.¹⁸ Thus the threshold, cavitated *versus* non-cavitated lesions, which is the cut-off point for caries assessment according to the World Health Organisation (WHO) method, will underestimate the child's caries risk by not including enamel lesions. Indices that register enamel lesions, such as ICIDAS II¹⁹ and Nyvad²⁰ criteria, are good instruments for clinical/investigation purposes, whereas CAST²¹ is particularly suitable for epidemiological surveys. In terms of caries detection, although quite a number of detection aids have been developed in the past decades, visual inspection – using careful clinical observation of a properly cleaned and illuminated surface – in combination with radiographs, is capable of providing the most relevant information.²²

MANAGEMENT OF ENAMEL CARIOUS LESIONS

An enamel carious lesion can be detected in both pits and fissures, as well as in smooth surfaces. The decision as to whether an intervention is needed depends on the lesion activity. Inactive lesions indicate that the disease is under control, not requiring anything other than positive reinforcement for patients to keep them inactive. However,

what does MID recommend in cases where an active carious lesion is present? Different options, at individual level, are offered and are discussed below.

The caries process results from an interaction between acidogenic microorganisms and fermentable carbohydrates within the biofilm over a period of time.²³ In order to avoid the occurrence of clinical signs of the disease a simple, but effective measure is disturbance of the biofilm through daily brushing with a fluoridated toothpaste.²⁴ Parents should be aware that the younger the child, the more important their participation is in the process.

However, in many cases parents/children are not successful in implementing good oral hygiene or in controlling the sugar intake at home and visible carious lesions occur. In Figure 2 active enamel lesions on the buccal surfaces of the recently erupted anterior teeth can be observed. Owing to the open bite, a 6-year-old child was having difficulties in removing the biofilm from those areas. Both child and mother were instructed on how to correctly perform the brushing while using fluoridated toothpaste and a new appointment 30 days later was scheduled. A reduction on the white spot areas was observed clinically, showing the effectiveness of the carious control method implemented. However, such good result depends on the compliance of the family/child.

In some situations, in addition to counselling parents about the need for changing specific practices at home, oriented carious lesion control measures can be implemented by the professional, taking into consideration the parent's opinion, child's age and the affected tooth surface. The use of topical fluoride therapies – varnish, gel and mouth rinses – in combination with fluoridated toothpaste was shown to have an additional caries reduction effect.²⁵ A personalised treatment plan, considering the child CRA, will assist the professional in deciding whether and which of these therapies are needed.



Fig. 3 (a, c) Clinical aspect of the occlusal surfaces of teeth 16 and 26, showing white and active spot carious lesions; (e, f) tooth 36 still covered by the gingiva at the distal part, but already presenting active enamel carious lesions; (b, d, g) clinical aspect of the ART sealants on teeth 16, 26 and 36 immediately after placement

Pits and fissures

Undoubtedly, when properly indicated, the use of a sealant has proved to be effective in preventing or controlling caries progression in occlusal surfaces of permanent molars.²⁶ However, some debate regarding which sealant material to choose does exist. The most commonly used materials for sealing pits and fissures are the resin-based and conventional glass-ionomer cements. Evidence shows that these materials have a similar caries-preventive effect.^{26,27} Therefore, the professional is free to choose either of the two materials, independent of the fact that resin-based materials, on average, are retained longer than glass-ionomer-based sealant materials. However, the resin-based materials require a very good control of humidity, which is not always possible owing to the child's lack of collaboration and/or the stage of tooth eruption. An example of partially erupted first permanent molars already presenting active enamel lesions is shown in Figure 3. In this case, the material chosen was a conventional high-viscosity glass-ionomer cement that was placed through the press-finger technique (atraumatic restorative treatment [ART] sealant). In such a situation the required moisture control cannot be guaranteed. That would have an effect on the resin-based sealant retention (in case this material was selected) and consequently on its effectiveness.

Proximal lesions

A very promising approach for controlling caries progression in proximal areas,

within the philosophy of MID, is the infiltration method. The concept is based on the penetration of a low-viscosity light-curing resin into the porosities of the non-cavitated lesion that was previously etched with hydrochloric acid.²⁸ Although few clinical trials testing this therapy were conducted in children, the results so far have demonstrated that resin infiltration might be a good strategy for controlling proximal lesion progression in primary molars.²⁹ However, clinicians should be aware that case selection is based on early lesion detection and bitewing radiographs are essential for the decision making-process. This can be considered a technical limitation, mainly for the younger patients, due to lack of collaboration.

MANAGEMENT OF DENTINE CARIOUS LESIONS

Non-cavitated

Usually, in the past, the presence of an obvious cavitated dentine lesion was a requirement for classifying an individual as diseased. With the decline of dental caries observed in recent decades, more precise and accurate methods for caries detection were developed and have already been discussed herein. Recording of lesions that are not yet cavitated but already show internal caries-related discolouration in dentine has been proposed by the ICDAS II¹⁹ and CAST.²³ An example of such lesion is shown in Figure 4. How should these lesions be clinically managed? Some years ago the only possible recommendation would be to use the



Fig. 4a Clinical aspect of a non-cavitated dentine carious lesion



Fig. 4b Histological aspect of the lesion showing dentinal involvement

'drill and fill' approach. However, the current knowledge about the caries process shows that carious lesions can be arrested at any stage, even when cavitated. The literature supports the placement of sealants over non-cavitated caries lesions in pits and fissures of permanent teeth in children, adolescents and young adults as an effective strategy for arresting carious lesions.^{30,41} In that way, the decision about whether to invade, seal or control should be made in light of the most recent knowledge covering the

effectiveness of these treatments, while also considering the patient's caries risk profile. Active lesions, not visible on a radiograph, should be sealed and those that are visible radiographically can be sealed or restored according to the MID principles.³²

Cavitated dentine lesions

In discussing the management of cavitated dentine lesions there is a need to differentiate between primary and permanent dentition. Considering that a primary tooth will remain in the mouth for a 'relatively short period of time', that because of its peculiar anatomy, a caries lesion progresses faster and that the chances of reaching the pulp during an invasive procedure are higher than for a permanent tooth, the options for managing carious lesions in these two dentitions also differ. As some management approaches presented below were proposed and tested for use in primary teeth only, the discussion of this topic is restricted to the primary dentition.

Traditionally, we were taught that whenever a cavity is present a restoration needs to be placed but is there evidence that a restoration is really required to keep a primary tooth in the mouth symptomless up to exfoliation and if so, which material is best for restoring a primary tooth? Regarding the first question; a longitudinal study that followed-up 1,012 cavitated primary teeth for 3.5 years in China showed that only 7.2% of these teeth were restored during the observation period. Moreover, of the 92.9% teeth that were not restored, the large majority (81.5%) exfoliated without symptoms.³³ These results are in line with two retrospective studies conducted in the UK, which showed that the bulk of unrestored carious primary molars exfoliated naturally and were symptomless.^{34,35} Regarding the second question; a Cochrane systematic review that aimed to identify which type of restorative material provides the best performance in primary teeth concluded that insufficient evidence exists for making any recommendations about which filling material should be used.³⁶ With the signing of the 'Minamata Convention on Mercury' treaty in October 2013, amalgam will be phased down and alternative mercury-free materials need to be developed.³⁷

Considering the observations made above and taking into account MID pleas for less invasive treatment interventions, the conventional restorative approach in which all carious tissue is removed might not always be the best option when there is a need for restoration of a primary molar. Furthermore, use of the drill and needle are considered to be the most fear-inducing aspects of dental

Table 1 Conservative and non-operative approaches proposed for managing cavitated dentine lesions in primary teeth

Approach	Definition	Advantages/disadvantages	References
Conservative restorative approaches			
Atraumatic Restorative Treatment	Carious tissue is removed with hand instruments and the resultant cavity and (adjoining) pits and fissures are restored and sealed with an adhesive material, usually high viscosity glass-ionomer cement	Anesthesia hardly used (+) High survival rates for single surface restorations (+) Friendly approach – especially for the youngest children (+) Uses the most biological restorative material (+) Applicable for both posterior and anterior teeth (+) Survival rates for multiple surface restorations need to be improved (-) Removes only completely demineralised dentine tissues (+)	Frencken <i>et al.</i> , 2012 ⁴¹ de Amorim <i>et al.</i> , 2012 ⁴²
Hall Technique	Pre-formed metal crowns are cemented in cavitated dentine lesions in primary molars, with a glass-ionomer cement, with no caries removal, tooth preparation, or local anesthesia	Anesthesia is not needed (+) No need to remove carious tissue (+) Just 1 clinical trial available (-) Suitable only for posterior teeth (-)	Innes <i>et al.</i> , 2006 ⁴³ Innes <i>et al.</i> , 2011 ⁴⁴
Non-operative approach			
Ultraconservative approach	Small cavitated dentine lesions are restored according to the ART protocol. Medium-sized cavitated dentine lesions are enlarged (not restored) with a hatchet Large cavitated dentine lesions are left unrestored Medium and large cavities are brushed clean with fluoridated toothpaste	Anesthesia is not needed (+) Supervised toothbrushing is required at the moment (+/-) Only 1 clinical trial available (-) Suitable method to be used in deprived areas (+) Not tested in private practice (-) The effect of cavity cleaning on alignment of permanent teeth is not known yet (-)	Mijan <i>et al.</i> , 2013 ⁴⁵

treatment.³⁸ Additionally, two systematic reviews indicate that incomplete caries removal significantly reduces the risk of pulpal exposure.^{39,40} Therefore, less invasive approaches in which both anaesthesia and drilling can be avoided were proposed: atraumatic restorative treatment (ART),^{41,42} the Hall Technique^{43,44} and very recently, the ultraconservative (UCT) approach.⁴⁵ The main characteristics of each approach are presented in Table 1.

The ART approach has been investigated for more than 25 years and differs from the Hall Technique and the UCT as it requires carious tissue removal. The Hall Technique has been described as a method that seals the carious tissue, as the preformed metal crown covers the carious lesions completely. Regarding the UCT approach, small-sized cavities need to be restored (ART) because the toothbrush bristles are not able to penetrate small cavities to remove the biofilm properly. The rationale of the latter aspect of the UCT is based on the concept that carious lesions can be arrested by disturbing the biofilm with a fluoridated toothpaste.³⁴

The three approaches have a common implementation requirement: a symptomless tooth, without pulp involvement. They all share the advantage of being much more patient-friendly than the conventional approach, as the drill is not used and the needle is rarely used. The few clinical trials that have investigated the Hall Technique and the UCT approach indicate that both protocols have a great potential to contribute substantially to improving the overall oral health of the young patient. However, more studies are required before these treatments can be unrestrictedly recommended.

Before deciding which approach is best for treating a cavitated dentine lesion in a primary molar, the professional should consider more aspects than those discussed above. These include: the child's age, lesion size and depth, child behaviour, family expectations, the treatment costs and professional's expertise.

Giving emphasis to these conservative approaches does not imply that use of the conventional drill and fill approach is obsolete. Some might argue that there is

no strong evidence that supports the use of these newly developed conservative approaches. However, there appears to be no evidence that removing all carious tissue with a drill and restoring the tooth with composite, amalgam or a preformed metal crown (PMC) is, indeed, the best strategy for managing cavitated dentine lesions in primary teeth. A systematic review that aimed to compare clinical outcomes for primary molar teeth restored with PMC to outcomes for those restored with filling materials, failed to provide evidence that PMCs are more durable restorations, as no randomised controlled trials comparing PMCs to other restorative materials were carried out.⁴⁶ Another systematic review that investigated the success rate for occlusoproximal ART restorations using high-viscosity glass-ionomer in primary teeth in comparison to amalgam or composite restorations concluded that ART presented similar survival rates to those of the conventional approach.⁴⁷

Saying that the literature was/is not able to provide sufficient information to indicate which procedure is more effective does not mean that the traditional/conservative approaches are not effective. It does indicate that many professionals base their clinical decisions on non-evidence-based information. Hence, more well-designed randomised controlled studies are needed.

Finally, it is worth noting that providing a restoration will not cure the disease *per se*; it is part of the cure. More important is investing time on oral health promotion and prevention in such a way that risk factors can be changed and a healthy lifestyle can be adopted by parents/child.

CONCLUSION

There is no better way of concluding this review than to go back to its beginning: the best scenario would be one in which a child without clinical signs of a carious lesion visits the dentist. However, this is not a reality for many. The traditional methodology of care provision, centred on the disease and on restoring its sequels, has been shown to be insufficiently effective, as dental caries remains globally the most prevalent child disease. On the contrary, the MID philosophy intends to assist the dentist in keeping the child's teeth healthy and, if a cavity has developed, to provide care through less invasive approaches and to empower parents/caretakers to prevent the development of new lesions by motivating the family to take responsibility for the child's future well-being.

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