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Recent Advances in the Management of Childhood Dental Caries

Nicola P T Innes and Mark Robertson

Who does childhood dental caries affect?

Dental caries continues to be a serious problem. Affecting 2.4 billion people, it is the most prevalent disease worldwide[1]. Although a highly prevalent condition, the impact of childhood dental caries is often underappreciated as the disease is rarely life-threating or overtly limiting on daily activities. However, it carries significant consequences for children in terms of day to day living and it is expensive to treat.

Dental caries has a linear relationship with poverty, affecting those in lower socio-economic groups most. This variation in disease levels is stark, and can be clearly seen in the UK, with 56% of 5 year-old children in the deprived regions of Blackburn and Darwen having visible decay, but only 4% in the more affluent South Gloucester similarly affected. In England as a whole, a quarter of 5 year-olds have visible dental caries with an average of 3 to 4 decayed teeth each. Tooth extraction is the 6th most common reason for admittance to hospital for general anaesthesia (GA) for the under 5s and the single most common reason for 5 to 9 year olds.[2] These figures are reflected across Europe, the US and beyond.

What is the impact of childhood dental caries

The consequences of the disease have significant impacts on children's daily lives. These include pain[3], interference with sleep, and loss of time[4] from school. Around 50% of 12 and 15 year olds report toothache and around one quarter of them experience difficulty eating. Dental caries can also affect the general health and quality of life of children, impairing growth and cognitive development, interfering with nutrition and school attendance.[5] In 2013, 6% of 12 year-olds and 3% of 15 year-olds reported difficulty with schoolwork because of the condition of their teeth and mouth over the previous 3 months.[6]

Dental caries affects one in three UK 12 year-olds. It has a positive association with deprivation[7-9] and is experienced by almost half of 12-15 year olds in deprived areas.

Economically, treating oral diseases is expensive, costing NHS England £3.4 billion annually[10]. Extraction of decayed primary teeth alone, carried out under GA, costs an estimated £36 million annually.[10]

How does dental caries occur?

There is growing recognition that dental caries is the result of an imbalance in the plaque biofilm. Under healthy conditions, the dental biofilm contains only limited numbers of acidogenic bacteria[11], and the de-mineralisation they cause is balanced by the remineralising influence of minerals available from the supersaturated saliva. However, when dietary sugars

are supplied frequently and in sufficient quantity, acidogenic plaque bacteria thrive, upsetting the balance and promoting a shift from symbiosis to a dysbiosis.

This ecological imbalance brings about a destructive deficit in the delicate re-mineralisation / de-mineralisation process and, without any intervention, will lead ultimately to development of a carious lesion (Fig. 1A-D). By understanding that this dysbiosis in the oral biofilm can be reversed we can put in place measures to re-establish a healthy symbiosis.

In terms of prevention, this means removal of the plaque biofilm through effective tooth brushing, using an appropriately fluoridated toothpaste to encourage re-mineralisation of the tooth surface, and dietary control. In cases where there is cavitation, knowledge relating to the biofilm's ecology and how it is vulnerable to manipulation can be drawn upon, allowing for less invasive, and ultimately less destructive management strategies.

How has the disease been treated?

Historically, and globally, the management of childhood dental caries shows a picture focussed on operative management of the disease. This picture has been one of two extremes: the first being one of highly interventive (and expensive), treatment where children undergo invasive dental procedures, often under GA, to allow for dental rehabilitation; this contrasts vividly with the alternative (and cheaper and easier) option, where treatment is simply not offered, the perspective being to wait for the carious primary dentition to exfoliate, hoping it doesn't cause problems in the meantime. This culture of neglect has been seen in the UK where only around 1 in 10 visibly carious teeth in 5 year olds are treated.[6]

The vast majority of the disease goes untreated, with the Care Index (the proportion of teeth with holes that have had fillings placed) being just over 1 in 10[2 12] in both Scotland and England. The underlying causes of the low Care Index is unknown but seems to be a result of dentists' reluctance to apply invasive treatment to young children for fear of causing treatment induced anxiety, and the children's difficulties coping with it, rather than a lack of access to care.

Critically important is that any treatment plan involving management of carious lesions must also include a preventive plan. This should be built following identification of the factors that have led to the disease (diet investigation, brushing habits, possible effects of other co-morbidities such as reduced saliva flow, cognitive difficulties etc). A programme will be drawn up that will usually involve behaviour change around improving oral hygiene (tooth brushing) and reducing intake of dietary sugars. A key component of these programmes is fluoride; the use of fluoride toothpaste (of which tooth brushing is the vehicle for) and fluoride varnish application by dental professionals[13].

Development of new ways of managing the disease

The understanding of dental caries as a biofilm-driven disease, and treatment options around managing it through manipulating the biofilm environment mean that less invasive methods for managing the disease have been investigated, and are recommended in most national guidelines.[14 15] This paper will concentrate on management of established lesions within the

framework of Minimal Intervention Dentistry (Fig. 2), although this should be known as minimally *invasive* dentistry as there is still a lot of *intervention* required at the behavioural and patient management level; it is simply less invasive.

These less invasive treatments also satisfy the basic requirement that a treatment should be as acceptable to the recipient as possible. Children report that less invasive[16-18] sealing treatments are more acceptable to them than "drill and fill" methods, and by helping to avoid treatment induced anxiety[19], should lead to less dental avoidance in adulthood.

As well as being preferred by children, the success rates for less invasive treatments compare very favourably with traditional approaches, being as successful, if not more so. In part this is because they reduce irritation and trauma to the dental pulp, reducing the need for root treatments. Less invasive treatments causes less weakening of the tooth structure itself. For these reasons, more conservative treatments help maintain the dentition for longer, avoiding pain and infection. These conclusions are based on good evidence from randomised control trials set in different environments, on a variety of lesions and carried out by different dental personnel.[20-22] The synthesised data, considered in its entirety, provides compelling evidence for less invasive dentistry being easier for children to cope with, more successful in outcomes and reducing the sequelae of untreated disease; pain and infection.

Finally, the less invasive options are less expensive to carry out at the time of treatment. Additional cost savings come later; as the treatments are more successful, dental extractions

and other invasive treatments requiring sedation or GA for their provision are avoided, and the spiral of increasing dental treatment associated with failure of restorations over time is slowed down.[23 24]

What are the new approaches to managing the disease?

Historically, the aim of caries lesion management was to remove all dental tissue that showed any signs of decay and then place a restoration, irrespective of whether the lesion was active or had arrested. However, now the aims are very different:

- regeneration (remineralisation) of tissue through prevention whenever possible; or
- arrest of the disease process and maintenance of as much tooth tissue as possible.[25]

These aims are generally achieved through one of two approaches;

- topically, where the biofilm is either removed by toothbrushing (sometimes with opening up of the cavity to aid this), or the biofilm ecology is altered by application of medicaments such as fluoride varnish and silver diamine fluoride, or by reducing the frequency of dietary sugar intake
- sealing in, where the biofilm is isolated from dietary foodstuffs by sealing in with restorative materials

For ease of description of the various treatment options, they have been separated into management options for cavitated lesions, and those where cavitation has not occurred. For further detail on treatment planning and management, the reader is referred to sources with more detail.[15 26]

Repair of Non-cavitated lesions

Non-cavitated lesions generally affect the outer enamel layer, although the demineralisation may extend through to the dentine in some lesions. Managing these lesions involves trying to halt and reverse the lesion, or at least prevent cavitation from occurring. In previous times, this stage, detectable on radiographs, would have resulted in dentists drilling and placing a filling. However, for both permanent teeth and primary teeth, this stage is now considered reversible, and prevention or sealing activities are appropriate. More damage than good will be done by removing tooth substance at this stage in order to place a filling.

Preventive measures alone

The simplest option to reverse the disease is to improve toothbrushing, with an optimally fluoridated toothpaste, and dietary control. Other options include fluoride varnishes that are placed 2-4 times per year by a dental care professional[27], and mouthwashes[28], although these are only suitable for older children. High fluoride toothpaste (containing 2,800ppm F) for over 10 year olds can be prescribed.[14 15]

Sealing in more extensive lesions

Fissure sealants (a low filled resin based material) are used very successfully to prevent decay occurring on the biting surfaces of teeth [29 30] but have also been shown to be successful in stopping the progression of carious lesions[21 29 31] as they prevent the lesion gaining access to dietary sugars that the biofilm needs to thrive (Fig. 3).

There is good evidence that preventive and sealing in approaches to managing the non-cavitated lesion are successful, whether these are fluoride, or other topical formulations or sealants applied to the teeth.[32]

Repair options for managing active cavitated lesions; sealing in strategies

The cavitated lesion in a primary tooth in a young child is one of the most difficult lesions to manage, as the cavity offers a sheltered environment for the biofilm, making it difficult to remove by brushing. Also, exposed collagen fibrils in soft dentine are much more difficult to remove biofilm from than the hard surface of enamel, making effective cleaning of these lesions even more difficult. For these reasons, when it is too difficult to effectively remove the biofilm and stop its progress, then the lesion (cavity) can be sealed from the oral environment. These highly successful sealing strategies all avoid the need for local anaesthetic injections and any drilling.

Hall Technique

This is a method where a preformed metal crown of the correct size is simply filled with cement and pushed over the tooth, sealing the lesion from the environment (Fig. 4A-C). This was considered a radical solution to the problem of the cavitated lesion when it was first demonstrated around 16 years ago as no local anaesthetic is used to numb the tooth, none of the carious tooth tissue is removed and no tooth is cut away to make room for the crown.[33] However, there are now a collection of randomised control trials that have shown this

management option to be superior in avoiding dental pain and infection, to any other. The crowns and the cement used to fix them to the tooth provide a good seal, and the crowned primary tooth eventually sheds naturally.

Selective caries removal and place a filling

This method for managing cavities in teeth is similar to placing the crown, in that the lesion is sealed beneath a restoration, in this case it is a filling (a malleable material) placed in the cavity that then sets. However, for this to be effective, more skill is required on the part of the dentist and more cooperation on the part of the child. The edge of the cavity is cleared of any diseased tissue to provide a good surface for the filling material to adhere to. If this is not achieved, the filling will "leak" and sugar substrate will make its way to the biofilm, feeding it and supporting the progression of the lesion. Clearing the decay is no longer carried out using rotary instruments (drills) but instead with hand instruments which are drawn along the soft (decayed) tooth tissue to scoop it out. This has been shown to be preferred by children to using drills, and less anxiety provoking.[16 18 19]

Non-restorative options

For some lesions, there is no viable sealing in option, either because the lesion is too extensive to repair or because the child has limited ability to cope with the treatment that is required. In these cases, it is sometimes possible to maintain the tooth and avoid an extraction through simply using tooth brushing and remineralisation therapies to arrest the decay. In theory this is

possible as although the biofilm reforms as soon as it is removed, it takes time to "mature" and reach a cariogenic state. Constantly removing the biofilm will lead to the disease arresting. This has been shown in a number of cases but clinical trials indicate that the success is so dependent on the behaviour of the child's parent/carer (who, in effect allowed the disease to occur in the first place) that this is often not a successful option.[34 35] It is also difficult to gain adequate access to the lesion to allow effective toothbrushing, although if the child will tolerate it, it is possible to remove overhanging enamel using hand or rotary instruments. However, the problem of removing the biofilm from dentine when it is embedded in the exposed collagen is still very challenging. For these reasons a non-restorative approach is not recommended unless there is no other option.[15] It also requires a great deal of vigilance on the part of the dentist to detect the lesions which progress, requiring a change in approach and a new treatment plan to be agreed.

Managing the child with dental pain

It is not uncommon for children to present with pain from late stage decay; sometimes with an abscess or swelling associated with the decayed tooth (Fig. 5) and systemic signs of infection. The child with dental pain presents a particular challenge to treat. They are likely to have extensive disease in the tooth causing problems, more than one lesion and are usually fretful, upset and anxious.[12 36] Children find it difficult to differentiate between pain from dental caries and other causes. Caries associated pain is caused by an inflamed dental nerve (pulp) that has been affected by the encroaching carious lesion. Non-carious sources of pain (exfoliation/ eruption, ulcers associated with viral infections or recurrent aphthae) should be ruled out.

The treatment for caries associated pain differs significantly depending on the extent of the inflammation. Earlier stages of dental pulp inflammation are reversible and when the carious lesion is sealed from the environment, with a filling material or a crown, the pain can resolve. However, if the dental pulp has reached a stage where it is very inflamed and even infected, then the treatment must either be a root treatment or an extraction. Both options involve local anaesthetic injections and are highly invasive from the child's perspective, often resulting in treatment induced anxiety and inhibiting future successful treatment.

General anaesthesia and sedation

The invasive and anxiety provoking nature of treatment involving extractions or restoration provision can be difficult for older children to cope with. This can be even more stressful for younger children, who may not have the cognitive ability to understand what is happening during treatment or appreciate that short-term discomfort may be necessary for longer term relief of pain. Adverse dental experiences can lead to longer term negative feelings about receiving treatment and chronic dental fear or even phobia. Despite highly successful, less invasive treatments being available, there are still children whose disease cannot be successfully managed. These include children who have pain and / or serious infection, very young children and children with multiple lesions. In these cases, it is still sometimes necessary to rely on extractions under GA to resolve immediate problems. In some countries, these children are offered the opportunity to have their dentition "rehabilitated" through restorative management but this is extremely costly, carries some risk (both morbidity and mortality) and does not manage the issue that caused the disease initially. In the UK, healthy children

undergoing GA for acute dental problems will have the symptomatic tooth, and usually any other carious primary teeth, extracted.

Sedation, usually inhalation sedation using nitrous oxide, is available through some centres and can be helpful in managing an acute problem or in helping children to gain confidence to cope with further dental treatment.

Some children with systemic diseases or learning disabilities may need to have their dental disease managed using sedation/GA as an adjunct as it would not be possible to carry out their treatment otherwise. However, there is growing evidence that less invasive treatments, such as the Hall Technique, can avoid the need for GA to manage lesions for these children, and still have very successful outcomes.[37]

Conclusion

Oral health is a marker for broader general health and social care in children, but dental caries remains prevalent. Furthermore, the care index for children remains low despite the far-reaching potential consequences of oral disease, including poor general well-being, detriment of the developing dentition and suboptimal performance both socially and educationally.

There have been reductions in caries associated with community based projects such as Childsmile in Scotland (http://www.child-smile.org.uk/) which involve nursery and school based brushing as well as fluoride varnish application programmes.

Less invasive methods that manage dental caries as a biofilm disease are superseding traditional “drill and fill” operative methods. These reparative options must be carried out in conjunction with a preventive program involving diet investigation & management and re-orientation of lifestyle factors negatively affecting oral health. Using child friendly dental techniques and striving to instil in children a positive attitude towards their oral health will perhaps translate in the future to a population of adults who are engaged, who are without dental anxiety stemming back to childhood, and who have taken ownership of their dental and oral health.

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References

1. Kassebaum N, Bernabe E, Dahiya M, et al. Global Burden of Untreated Caries: A Systematic Review and Metaregression. Journal of Dental Research, 2015:650-58.
2. Public Health England. National Dental Epidemiology Programme for England: oral health survey of five-year-old children 2015. Secondary National Dental Epidemiology Programme for England: oral health survey of five-year-old children 2015 2016. http://www.nwph.net/dentalhealth/14_15_5yearold/14_15_16/DPHEP%20for%20England%20OH%20Survey%205yr%202015%20Report%20FINAL%20Gateway%20approved.pdf.
3. Shepherd MA, Nadanovsky P, Sheiham A. Dental public health: The prevalence and impact of dental pain in 8-year-old school children in Harrow, England. British Dental Journal 1999;**187**(1):38-41.
4. Dentistry AAoP. Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies. Pediatric dentistry 2014;**37**(6):15-16.
5. Jackson SL, Vann WF, Kotch JB, et al. Impact of poor oral health on children's school attendance and performance. American journal of public health 2011;**101**(10):1900.
6. Pitts N, Chadwick B, Anderson T. *Children's Dental Health Survey Report 2: Dental Disease and Damage in Children: England, Wales and Northern Ireland*: Health and Social Care Information Centre, 2015.
7. Pine CM, Adair PM, Nicoll AD, et al. International comparisons of health inequalities in childhood dental caries. Community Dent Health 2004;**21**(1 Suppl):121-30.

8. The Scottish Dental Epidemioloty Coordinating Committee. Detailed national dental inspection programme of primary 7 children and the basic inspection of primary 1 and primary 7 children. Secondary Detailed national dental inspection programme of primary 7 children and the basic inspection of primary 1 and primary 7 children 2015. http://ndip.scottishdental.org/wp-content/uploads/2015/10/ndip_scotland2015-P7.pdf.

9. Schwendicke F, Dorfer CE, Schlattmann P, et al. Socioeconomic Inequality and Caries: A Systematic Review and Meta-Analysis. Journal of Dental Research, 2015:10-18.

10. NHS England. Improving dental care - a call to action. Secondary Improving dental care - a call to action 2014. http://www.nwph.net/dentalhealth/reports/Report_NHS_DEP_for_England_OH_Survey_12yr_2008-09.pdf.

11. Fejerskov O. Pathology of dental caries. In: Fejerskov O NB, Kidd EA, ed. Dental caries: The disease and its clinical management. Oxford: Wiley Blackwell, 2015:7-9.

12. Macpherson LMD, Ball G, Carson S, et al. National Dental Inspection Programme (NDIP) 2014. Report of the 2014 Detailed National Dental Inspection Programme of Primary 1 children and the Basic Inspection of Primary 1 and Primary 7 children: The Scottish Dental Epidemiology Co-ordinating Committee, 2014.

13. Marinho VCC. Cochrane reviews of randomized trials of fluoride therapies for preventing dental caries. European Archives of Paediatric Dentistry 2009;**10**(3):183-91.

14. Network SIG. Dental Interventions to prevent caries in children; a national clinical guideline. 2014 March 2014. http://www.sign.ac.uk/pdf/SIGN138.pdf.

15. Programme SDCE. Prevention and Management of Dental Caries in Children. 2010 2010. http://www.sdcep.org.uk/published-guidance/caries-in-children/.

16. van Bochove JA, van Amerongen WE. The influence of restorative treatment approaches and the use of local analgesia, on the children's discomfort. European Archives of Paediatric Dentistry 2006;**1**(1):11-16.

17. Goumans C, Veerkamp JSJ, Aartman IHA. Dental anxiety and behavioural problems: What is their influence on the treatment plan? European Journal of Paediatric Dentistry 2004;**5**(1):15-18.

18. van Amerongen WE, Rahimtoola S. Is ART really atraumatic? Community dentistry and oral epidemiology 1999;**27**(6):431.

19. Santamaria RM, Innes NPT, Machiulskiene V, et al. Acceptability of different caries management methods for primary molars in a RCT. International journal of paediatric dentistry 2015;**25**(1):9.

20. Ricketts D, Lamont T, Innes NP, et al. Operative caries management in adults and children. Cochrane Database Syst Rev 2013(3):CD003808.

21. Dorri M, Dunne SM, Walsh T, et al. Micro-invasive interventions for managing the proximal dental decay in primery and permanent teeth. Cochrane Database of Systematic Review 2015(1):CD010431.

22. Innes NP, Ricketts D, Chong LY, et al. Preformed crowns for decayed primary molar teeth. Cochrane Database Syst Rev 2015(12):CD005512.

23. Schwendicke F, Paris S, Stolpe M. Cost-effectiveness of caries excavations in different risk groups - a micro-simulation study. BMC Oral Health 2014;**14**:153.

24. Schwendicke F, Stolpe M, Meyer-Lueckel H, et al. Cost-effectiveness of one- and two-step incomplete and complete excavations. J Dent Res 2013;**92**(10):880-7.

25. Innes NPT, Frencken JE, Bjørndal L, et al. Managing Carious Lesions: Consensus Recommendations on Terminology. Advances in dental research 2016;**28**(2):49.

26. Innes NP, Manton DJ. Minimum Intervention children's dentistry - the starting point for a lifetime of oral health. British Dental Journal 2017;**in press**(BDJ Minimum Intevention Themed Issue).

27. Ahovuo-Saloranta A, Forss H, Hiiri A, et al. Pit and fissure sealants versus fluoride varnishes for preventing dental decay in the permanent teeth of children and adolescents. Cochrane Database Syst Rev 2016(1):CD003067.

28. Marinho VC, Chong LY, Worthington HV, et al. Fluoride mouthrinses for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2016;**7**:CD002284.

29. Wright JT, Crall JJ, Fontana M, et al. Evidence-based clinical practice guideline for the use of pit-and-fissure sealants: A report of the American Dental Association and the American Academy of Pediatric Dentistry. Journal of the American Dental Association 2016;**147**(8):672-82 e12.

30. Wright JT, Tampi MP, Graham L, et al. Sealants for Preventing and Arresting Pit-and-fissure Occlusal Caries in Primary and Permanent Molars. Pediatr Dent 2016;**38**(4):282-308.

31. Fontana M, González-Cabezas JA, Peters GJ, et al. Monitoring of sound and carious surfaces under sealants over 44 months. Journal of Dental Research 2014;**93**(11):1070-75.

32. Tellez M, Gomez J, Kaur S, et al. Non-surgical management methods of noncavitated carious lesions. Community Dentist andOral Epidemiology, 2013:79-96.

33. Innes NP, Evans DJ, Bonifacio CC, et al. The Hall Technique 10 years on: Questions and answers. Br Dent J 2017;**222**(6):478-83.

34. Santamaria R, Innes N, Machiulskiene V, et al. Alternative caries management options for primary molars: 2.5-yr outcomes of a randomised clinical trial. Caries Research 2017;**in press**.

35. Hansen NV, Nyvad B. Non-operative control of cavitated approximal caries lesions in primary molars: a prospective evaluation of cases. J Oral Rehabil 2017;**44**(7):537-44.

36. Vernazza CR, Rolland SL, Chadwick B, et al. Caries experience, the caries burden and associated factors in children in England, Wales and Northern Ireland 2013. Br Dent J 2016;**221**(6):315-20.

37. Robertson M, Harris J, Innes N, et al. Use of the Hall Technique in Children With Learning Difficulties. Journal of Dental Research 2017;**96**(Spec Iss A. Abstract no 1164).

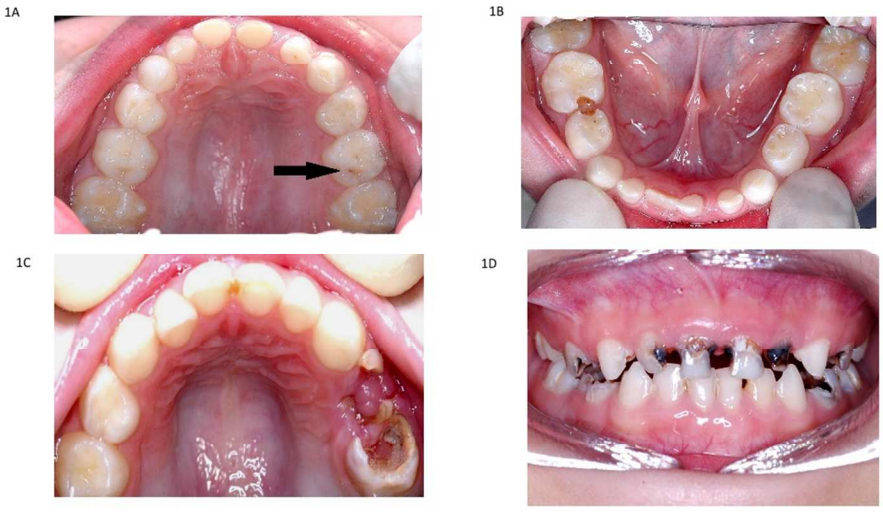

Figure 1. Photographs A-D demonstrate progression through distinct stages of the carious process, from early through to advanced disease.

A Tooth 55 (upper left 2nd primary molar) showing micro-cavitation of the distal aspect (arrowed). There is an established biofilm in the cavity. B Teeth 84 (lower right 1st primary molar) and 85 (lower right 2nd primary molar) with large, cavitated lesions. C Grossly carious remnants of teeth 64 (upper left 1st primary molar) and 65 (upper left 2nd primary molar), subject to advanced disease. D Generalised dental caries affecting the majority of the dentition. Note the presence of both active lesions (yellow/brown) and arrested lesions (black).

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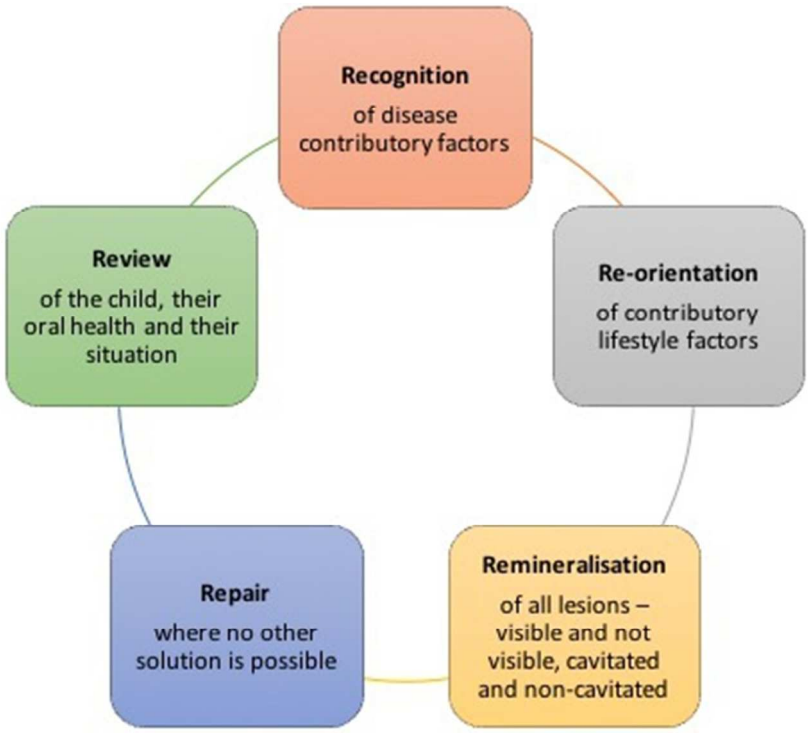

Figure 2. Minimum Intervention Dentistry (MID) is a framework for oral health. It is a comprehensive, person-centred approach that is a response to the ineffectiveness of the traditional surgically-focussed approach to managing dental caries. It can be summarised as an iterative process involving: Recognition of factors contributing to the disease/caries risk; Re-orientation of lifestyle factors and/or oral health behaviours; Remineralisation of all lesions; Repair of lost tooth substance, where no other management solution is appropriate; and Review of the child, their oral health and their situation. These principles apply not only to the child as an individual, but also to the child's life environment, which includes parents, extended family, principle carers and schooling. Reproduced courtesy of the British Dental Journal (Springer Nature)

156x128mm (72 x 72 DPI)

Figure 3. Tooth 46 following placement of an opaque, resin fissure sealant. An opaque, low viscosity resin is bonded to the tooth surface, sealing the pits and fissures of the bite surface away from the oral environment. With appropriate monitoring and maintenance of the fissure sealant, early caries underneath will arrest due to isolation from dietary sugars (the bacterial substrate).

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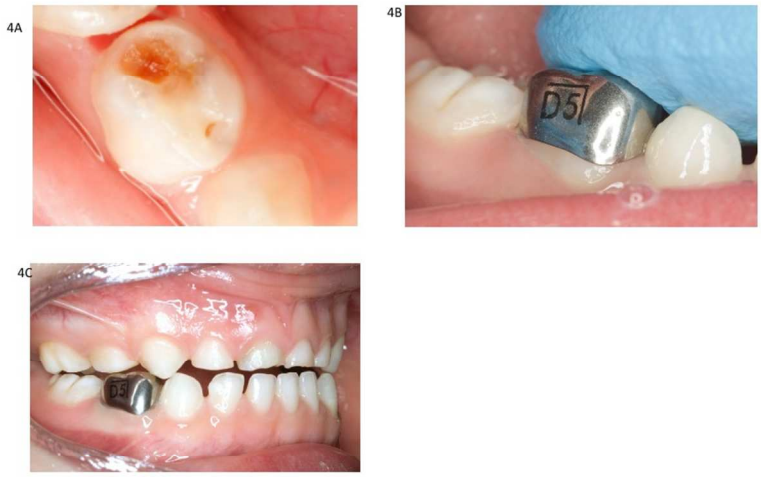

Figure 4. Series of three photographs showing a crown being fitted using the Hall Technique

A Cavitated tooth 84 (lower right 1st primary molar) B The correct size of crown is chosen from a preformed selection and then cemented over the tooth, sealing in the decayed tooth and biofilm. No local anaesthetic, caries removal or tooth preparation is required. C The crown fitted in place having been pushed on to the tooth. Note the slight opening of the child's occlusion – this will normalise in the next 2-4 weeks.

More detailed explanations can be found at https://en.wikipedia.org/wiki/Hall_Technique.

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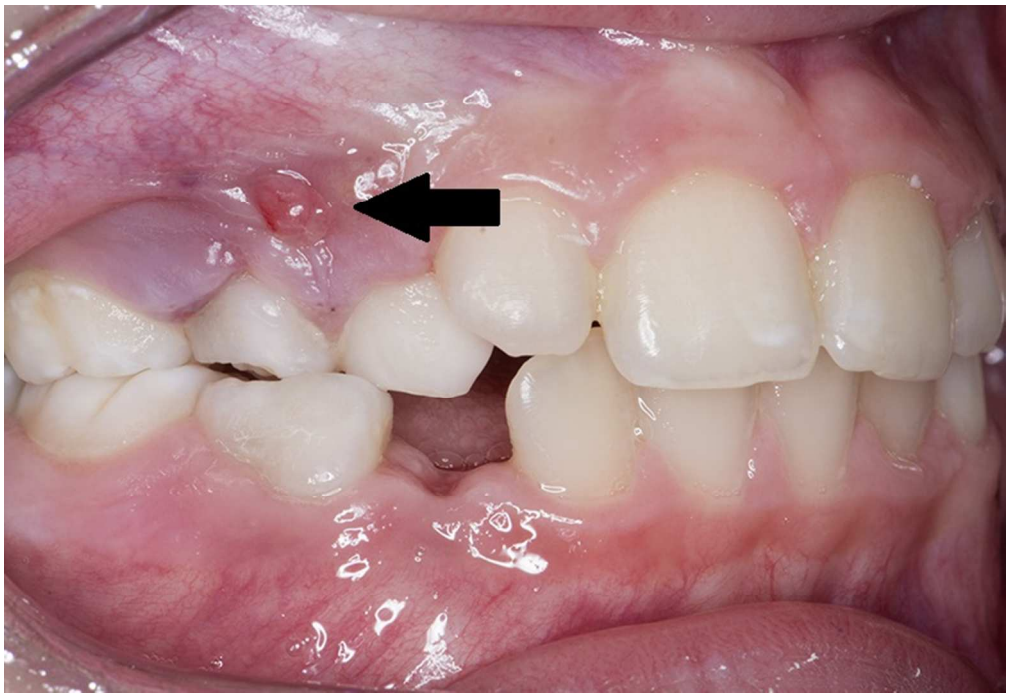

Figure 5. Abscess on buccal mucosa of tooth 54 (upper right 1st primary molar) indicating infection of dental pulp and need for dental treatment.

68x47mm (300 x 300 DPI)