



Scottish Dental
Clinical Effectiveness Programme

Prevention and Management of Dental Caries in Children

Guidance Development Methodology

May 2018

Scottish Dental Clinical Effectiveness Programme

Dundee Dental Education Centre, Frankland Building,
Small's Wynd, Dundee DD1 4HN

Email scottishdental.cep@nes.scot.nhs.uk

Website www.sdcep.org.uk



NICE has accredited the process used by the **Scottish Dental Clinical Effectiveness Programme** to produce the second edition of its Prevention and Management of Dental Caries in Children guidance. Accreditation is valid for 5 years from 15 March 2016. More information on accreditation can be viewed at www.nice.org.uk/accreditation.

For further information about SDCEP's accreditation, visit www.sdcep.org.uk/how-we-work/nice-accreditation.

Contents

1	Overview of the SDCEP Guidance Development Process.....	3
2	The Guidance Development Group.....	4
3	Scoping Research.....	5
4	Clinical Questions.....	6
5	Literature Search.....	7
6	Evidence Appraisal and Synthesis.....	8
7	Considered Judgements and Development of Recommendations.....	9
8	Consultation and Peer Review.....	10
9	Updating guidance.....	10
10	Conflicts of Interest.....	10
11	Equality Impact Assessment for the Guidance.....	12
	Appendix 1 – Evidence Searches.....	14
	Appendix 2 - Summary of Guidelines and Systematic Reviews.....	30
	Appendix 3 – Evidence Appraisal Forms.....	34
	Caries Risk Assessment.....	34
	Caries Prevention – Motivation and Action Planning.....	36
	Caries Prevention – Toothbrushing.....	38
	Caries Prevention – Dietary Advice.....	38
	Caries Prevention – Fissure Sealants.....	42
	Caries Prevention – Topical Fluoride.....	44
	Caries Management Primary and Permanent Teeth.....	46
	Pulp Therapy in Primary Teeth.....	63
	Behaviour Management/Helping Children Accept Dental Care.....	72
	Appendix 4 – Summaries of Evidence and Considered Judgements.....	76
	Caries Risk Assessment.....	76
	Caries Prevention – Motivation and Action Planning.....	77
	Caries Prevention – Toothbrushing.....	78
	Caries Prevention – Dietary Advice.....	80
	Caries Prevention – Fissure Sealants.....	82
	Caries Prevention – Topical Fluoride.....	83
	Caries Management.....	85
	Pulp Therapy in Primary Teeth.....	90

Behaviour Management/Helping Children Accept Dental Care.....	93
Providing Additional Support.....	94
References	96

1 Overview of the SDCEP Guidance Development Process

SDCEP first published *Prevention and Management of Dental Caries* in 2010. Since then there have been various developments that have merited an update to this guidance, including the publication in 2014 of SIGN guideline 138, *Dental interventions to prevent caries in children*.¹ Previous SIGN guidelines on dental caries, which informed much of the first edition of the SDCEP guidance, have since been withdrawn. Accordingly, SDCEP convened a Guidance Development Group (GDG) to review and update the guidance. This comprised many of the original GDG members and several new members (see Section 2).

In accordance with SDCEP's guidance development process, the review of this guidance involved searching for relevant sources of information and evidence, focusing on guidelines and systematic reviews, and appraisal of all eligible sources to assess their quality and to inform their utility as the basis for recommendations within this guidance.

The guidance development process that SDCEP follows has been accredited by NICE (National Institute for Health and Care Excellence; www.nice.org.uk/about/what-we-do/accreditation) and is as described in the SDCEP Guidance Development Process Manual (Version 1.3, February 2016). The review of *Prevention and Management of Dental Caries in Children* followed SDCEP's standard guidance development process as outlined below, with the exception of the first step (topic proposal and selection) which is not relevant for an update:

- Topic proposal and selection;
- GDG selection;
- Scoping including horizon scanning literature review and baseline research on stakeholder attitudes to the topic and proposed guidance;
- Agreement on scope and key clinical questions;
- Preparation of draft guidance for consultation including:
 - Systematic literature review,
 - Evidence appraisal, synthesis and summary,
 - Considered judgements,
 - Formulating recommendations,
 - Grading recommendations;
- Open consultation and peer review;
- Review of consultation feedback and revision of the guidance and other related products;
- Final draft sign off;
- Design for publication;
- Dissemination and implementation.

For further details of the standard process see the SDCEP Guidance Development Process Manual available at www.sdcep.org.uk/how-we-work/sdcep-guidance-development-process/. Consistent with SDCEP's standard guidance development methodology, the update of *Prevention and Management of Dental Caries in Children* aimed to be transparent, systematic

and to adhere as far as possible to international standards set out by the AGREE (Appraisal of Guidelines Research and Evaluation) Collaboration (www.agreetrust.org).

Specific details of the methodology used for the update of the *Prevention and Management of Dental Caries in Children* guidance are presented either in the full guidance (www.sdcep.org.uk/published-guidance/caries-in-children/) or in the following sections of this methodology document.

For further details, queries or requests for unpublished information, please contact SDCEP using the details provided on the front page of this document.

2 The Guidance Development Group

A Guidance Development Group (GDG) comprising individuals from a range of relevant branches of the dental profession was convened to update this guidance. Two patient representatives also participated in the guidance update.

Barbara Chadwick (Co-Chair)	Professor of Paediatric Dentistry, Vice-Dean, School of Dentistry, Cardiff University
Nicola Innes (Co-Chair)	Professor of Paediatric Dentistry, School of Dentistry, University of Dundee
Paul Ashley	Consultant in Paediatric Dentistry, UCL Eastman Dental Institute, London
Sarah-Louise Blackwood	Patient Representative
Dafydd Evans	Honorary Senior Lecturer in Paediatric Dentistry, University of Dundee
Timothy Cooke	Senior Dental Officer, Public Dental Service, Nairn, NHS Highland
Brett Duane	Associate Professor in Dental Public Health, Trinity College, Dublin
David Conway	Professor of Dental Public Health, University of Glasgow
Martin Foster	Specialist in Paediatric Dentistry, Children's Dental Service, NHS Lothian
Alex Keightley	Consultant and Honorary Senior Clinical Lecturer in Paediatric Dentistry, Edinburgh Dental Institute
Nicole Kettles	General Dental Practitioner, Perth
Peter King	Childsmile Programme Manager (West Region)

Maxine Lee	Associate Medical Director – Dental (retired), NHS Greater Glasgow BSc Programme Lead, Oral Health Sciences, Dundee Dental Hospital
Gillian Nevin	General Dental Practitioner; Assistant Director for Postgraduate GDP Education, NHS Education for Scotland
Derek Richards	Consultant in Dental Public Health, South East Scotland
Maguerite Robertson	Patient Representative
Margaret Ross	Senior Lecturer for Dental Care Professionals, Edinburgh Dental Institute

3 Scoping Research

SDCEP's research collaborators TRiADS (Translation Research in a Dental Setting; www.triads.org.uk) carried out research during the development of the first edition of the *Prevention and Management of Dental Caries in Children* (PMDCC) guidance and after its publication. Following the TRiADS framework for translating guidance recommendations into practice,² this focused on evaluating whether users of the guidance had changed their practice since its publication and investigated factors that influence practitioner behaviour with respect to prevention and management of dental caries in general dental practice.^{3,4} In patient feedback, supervising tooth brushing and limiting sugar intake were considered to be important factors for preventive oral health for children. Confirming the efficacy of self-care, alleviating anxiety and toothbrushing demonstration were proposed as enablers to improving children's oral health.³ This work was presented to the guidance development group convened to update the guidance.

In addition, SDCEP carried out a scoping survey to gain feedback on the published PMDCC guidance. Invitations to participate in the survey were sent to individuals with a particular interest or experience in this topic, vocational trainees, undergraduates and over 200 dentists. An open invitation was posted on the SDCEP website and a news item was posted on scottishdental.org. In addition, the Childsmile Executive was specifically invited to comment. Respondents were asked to comment on any aspect of the guidance, its impact on their practice, considerations for the update and suggestions for improvement. Overall, the feedback on the published guidance was positive. There were many suggestions for improvements or additional content. Feedback from this survey was considered by the guidance development group to inform the guidance update.

4 Clinical Questions

The following clinical questions relevant to the scope of the guidance were drafted by the SDCEP Programme Development Team (PDT) based around the recommendations made in first edition of the SDCEP guidance and the updated SIGN guideline 138.¹ These formed the basis for the evidence summaries and considered judgements made by the GDG.

Assessment
1. What factors should be taken into account to inform an assessment of the risk of a child developing dental caries?
Prevention
2. Is there any evidence that delivery of dental brief interventions (oral health education) by members of the dental health team in a practice setting lead to health behaviour changes/healthy dental behaviours (e.g. compliance with toothbrushing)?
3. What factors influence the effectiveness of toothbrushing for the prevention of dental caries in children?
4. What evidence is there for the effectiveness of giving dietary advice for the prevention of dental caries in children?
5. What is the evidence for effectiveness of sealants in preventing dental caries in children?
6. What is the evidence for effectiveness of topical fluoride interventions in preventing dental caries in children and what are the adverse effects (eg risk of fluorosis)?
Management
7. In children, what evidence is there for the effectiveness of individual methods for the treatment or management of caries in primary teeth?
8. In children and adolescents, what evidence is there for the effectiveness of individual methods for the treatment or management of caries in the permanent teeth?
9. In children, what evidence is there for the effectiveness of individual methods for pulp therapy for primary teeth? Consider: Mineral trioxide aggregate/formocresol/ferric sulphate; preformed metal/stainless steel crown.

Helping children accept care

10. In children and adolescents, what evidence is there for the effectiveness of specific methods for the management of behaviour or anxiety to enable dental care? Consider non-pharmacological methods.

Providing Additional Support

11. What indicators of dental neglect should the dental team be aware of and what actions should they take to ensure the wellbeing of the child?

5 Literature Search

The guiding principle for developing guidance within SDCEP is to first source existing guidelines, policy documents, legislation or other recommendations. Similarly, relevant systematic reviews are also identified. These documents are appraised for their quality of development, evidence base and applicability to the remit of the guidance under development. In the absence of these documents or when supplementary information is required, other published literature and unpublished work may be sought.

For this guidance, evidence to inform recommendations for prevention of dental caries was largely derived from SIGN guideline 138¹, including systematic reviews used in its development. The SIGN 138 methodology included consideration of the level of the body of evidence, benefits and potential harms, clinical impact, equality impact and implementability. Some of the systematic reviews utilised in SIGN 138 have since been updated and consequently when referred to in the guidance and this methodology document, the more recent versions are cited. For management of dental caries, including pulp therapy, and helping children accept dental care, comprehensive searches of MEDLINE, EMBASE and the Cochrane Library, were first conducted by the Trials Search Coordinator of the Cochrane Oral Health Group in January 2014 and subsequently updated on 3 October 2017. No date limits were applied. For each database, three search strategies were employed with specific combinations of search terms to focus on the following:

- 1) Caries management - to identify evidence on alternative techniques for managing carious lesions in children.
- 2) Pulp therapy - to identify evidence on the effectiveness of pulp therapy/treatment of primary molar teeth
- 3) Behaviour management - to identify evidence on non-pharmacological methods for the management of behaviour or anxiety to facilitate dental care for children.

The total number of retrieved records for each search was 1) Caries management: 1121, 2) Pulp therapy: 154, 3) Behaviour management 885.

The details of the searches can be found in **Appendix 1**.

Potentially eligible articles were identified from the list of titles and abstracts retrieved in duplicate by researchers within SDCEP. An article was considered potentially eligible if it met both of the following criteria:

1. The article was a systematic review or a guideline. For this purpose, an article would be included as a systematic review, if it included a methods section, a search of one or more electronic databases and a table of included studies. An article was included as a guideline if it made recommendations for clinical practice.
2. The article was concerned with a relevant aspect of management of dental caries in children (primary or permanent teeth).

Copies of potentially eligible articles were retrieved and further checked against the criteria above. Additional manual searching of guideline repositories and other resources, and follow up of citations from relevant articles found through the systematic searching was also carried out. Other sources of evidence identified by GDG members were also considered, taking relevance and quality into account. A summary of the 6 guidelines and 19 systematic reviews appraised to inform this guidance can be found in **Appendix 2**.

6 Evidence Appraisal and Synthesis

Eligible articles that were potentially relevant to each of the clinical questions were identified. Precedence was given to the most recent articles, where of suitable quality, published in English. A reviewer assessed the full text of each article and extracted the information applicable to the clinical question(s). The evidence appraisal form for each of the relevant articles can be found in **Appendix 3**.

For the development of this guidance SDCEP used the AMSTAR checklist⁵ or the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) approach to assess and rate the quality of evidence presented in the systematic reviews. AMSTAR is a simple and validated instrument and provides a methodological quality score ranging from 0 (very poor) to 11 (excellent). The GRADE framework is a widely accepted system for grading both the evidence and the recommendations, and is used internationally by other guideline producers (www.gradeworkinggroup.org).

The AGREE II instrument was used to assess the methodological quality of the retrieved guidelines (www.agreetrust.org). The AGREE II instrument is a simple and validated assessment tool that provides an overall quality score for each guideline and an indication of how reliable the guideline might be. The appraisals produced using the AGREE II tool used for assessing guidelines are available on request.

7 Considered Judgements and Development of Recommendations

The synthesised evidence from guidelines and systematic reviews for each clinical question was summarised (Appendix 4) and used to inform and facilitate the development of the recommendations in the guidance. Where authoritative evidence was unavailable, the GDG was asked to make recommendations based on current best practice and expert opinion, reached by consensus.

The process for development of recommendations was informed by the GRADE approach, in that considered judgements were made for each clinical question taking into account the quality of evidence and other factors, including the balance of risks and benefits the values and preferences of patients and the practicalities of the treatment or care. The impact of potential barriers to implementation of the recommendations, which were identified during guidance development and through stakeholder involvement and external consultation, was also considered. The relative importance of each of these criteria for a given recommendation was decided by the GDG.

Amongst the overarching principles of *Prevention and Management of Dental Caries in Children* (described in Section 2 of the guidance) is provision of care in a manner that aims to avoid the child experiencing pain and minimises the likelihood of treatment-induced anxiety. In line with this, when making recommendations the Guidance Development Group considered both the benefits and the potential harms of interventions and of alternatives. As this is also a consideration for the clinician, the Group also endeavoured to communicate the factors that the clinician must take into account when agreeing personal care plan.

According to GRADE the strength of a recommendation may be defined as:

<p><i>Strong for/or strong against</i></p>	<p><i>The guideline panel is confident that the desirable effects of an intervention outweigh its undesirable effects (strong recommendation for an intervention) or that the undesirable effects of an intervention outweigh its desirable effects (strong recommendation against an intervention).</i></p> <p><i>A strong recommendation implies that most or all individuals will be best served by the recommended course of action.</i></p>
<p><i>Weak for/or weak against (or conditional)</i></p>	<p><i>A weak recommendation is one for which the desirable effects probably outweigh the undesirable effects (weak recommendation for an intervention) or undesirable effects probably outweigh the desirable effects (weak recommendation against an intervention) but appreciable uncertainty exists.</i></p> <p><i>A weak recommendation implies that not all individuals will be best served by the recommended course of action.</i></p>

Evidence summaries, GDG consideration of the criteria and the resulting outcomes for each recommendation are recorded in the Considered Judgement Forms (one for each clinical

question) which can be found in **Appendix 4**. Some of the recommendations were subject to further review and revisions by the group during the course of the guidance development process. Brief explanations of the basis for each recommendation are included in the guidance text.

8 Consultation and Peer Review

The twelve-week open consultation period was initiated in May 2017 and notification of this was sent to a wide range of individuals and organisations across the UK with a particular interest in this topic, in addition to professional bodies and charities representing patient groups. Notice was sent to all dentists in Scotland via the NES Portal. During this period the consultation draft was available on the SDCEP website for comment with a consultation feedback form provided to facilitate the process. Implementation interviews with potential end-users of the guidance also took place at this time.

Topic experts were invited to contribute to targeted external peer review by providing feedback on the guidance, the recommendations and, in particular, the guidance development process used. The five peer reviewers who provided feedback included two specialists in paediatric dentistry, two consultants in paediatric dentistry and a consultant in dental public health. These peer reviewers were asked to declare any interests.

All comments received through the consultation and peer review process were reviewed, the feedback was considered by the GDG, and the guidance was amended accordingly prior to publication. The compiled feedback comments and GDG responses are available on request.

9 Updating guidance

A review of the context of this guidance (e.g. regulations, legislation, trends in working practices, evidence) will take place five years after publication and, if this has changed significantly, the guidance will be updated accordingly.

10 Conflicts of Interest

All contributors to SDCEP, including members of the GDG and external expert peer reviewers, are required to complete an SDCEP Declaration of Interests form to disclose relevant interests including financial conflicts of interest, such as receipt of fees for consulting with industry, and intellectual conflicts of interest, such as publication of original data bearing directly on a recommendation. These forms are held by SDCEP, updated yearly and are available on request. At the beginning of each group meeting during guidance development, participants are asked to confirm whether there are any changes to their Declaration of Interests.

Declared interests which could have potentially constituted a conflict of interest were considered by the SDCEP programme development team, the GDG chair and the group to decide whether and how the extent of the individual's participation in the guidance development should be limited (e.g. exclusion from certain decisions or stages, or complete withdrawal).

Further information on SDCEP's approach to conflicts of interest is available in the SDCEP Guidance Development Process Manual (version 1.3, February 2016).

The Declarations of Interest forms for all individuals involved in the *Prevention and Management of Dental Caries in Children* guidance update project are available on request. A summary of the declarations and the consideration of potential conflicts of interest and management decisions are provided in the following table.

Summary of Disclosures	
<p>All of the GDG members, peer reviewers and members of the SDCEP PDT completed and returned the Declaration of Interests form. Professional roles in provision of dental care for children or teaching through employment were not considered to be a conflict of interests. A number of group members declared membership of committees or societies relevant to the guidance topic, but this was also considered unlikely to lead to a conflict of interest. Two of the seventeen external GDG members and one peer reviewer declared direct financial interests relevant to the guidance topic which could potentially cause, or be perceived to cause, conflicts of interest.</p> <p>None of the SDCEP PDT members had any interests relevant to the guidance.</p>	
1	One co-chair declared that they had NIHR grant funding for research related to the topic.
2	One peer reviewer declared that they had research funding from a charity that is related to the topic.
3	One GDG member declared that they had a) received an award for travel from a commercial source relevant to the topic b) had received public funding for research related to the topic.
Consideration of potential to cause conflict(s) of interest	
<p><i>Are these interests likely in any way to affect the impartiality of the group member in his/her role in the guidance development e.g. in making recommendations?</i></p> <p>1, 2, 3b Involvement in these research activities was regarded to be unlikely to affect the impartiality of the individual or directly influence group decision making concerning the recommendations in the guidance. Therefore these declared interests are considered to be unlikely to cause (or be perceived to cause) a conflict of interests.</p>	

3a This travel award was for the period 2009-10 and therefore not considered to cause a conflict of interests.

Decision on the management of the conflict(s) of interest

Should the group member be excluded from any stages of guidance development or decisions, or be asked to withdraw from the process?

As the declared interests were not considered to cause conflicts of interests, it was agreed that no specific action was required.

The appointment of two co-chairs enabled an individual with no declared interests to lead as chair at all times.

GDG members were notified that if at any point in the guidance development they felt that their impartiality could be affected, then they should raise this within a meeting and/or contact SDCEP and a group co-chair to advise of this.

11 Equality Impact Assessment for the Guidance

The potential for any work carried out by SDCEP, within the Clinical Effectiveness workstream of NHS Education for Scotland (NES), to discriminate against or disadvantage any group of individuals has been considered through an Equality Impact Assessment (EQIA) published on the NES website (<http://www.nes.scot.nhs.uk/about-us/equality-and-diversity/equality-impact-assessments.aspx>).

The possibility of inequalities associated specifically with the *Prevention and Management of Dental Caries in Children* guidance was considered at various stages during guidance development, in accordance with the EQIA. Potential issues were identified through discussions with guidance development group members, practitioners and patients and from feedback from the external consultation.

Most of those consulted thought that no groups would be disadvantaged. Suggestions from those that did included:

- Children with special needs might require toothbrushing aids or special techniques, which are not discussed in the guidance.
- The language used should not be gender biased
- The language used should be inclusive of children who are not cared for by their parents.
- Use of additional aids (translations, DVDs etc) to overcome language barriers to ensure valid consent is obtained should be mentioned.
- Use of postcode to identify socioeconomic status to inform caries risk assessment could be seen as disadvantaging certain individuals.
- Children who do not access dental services due to cultural or social barriers.

These issues were considered by the GDG and several of the clinical practice advice points in the consultation draft of the guidance were revisited and where possible revised to address the potential equality issues described.

Further details of the issues identified and specific actions taken or planned are recorded in an EQIA checklist which is available on request.

Appendix 1 – Evidence Searches

Literature searching was carried out as described in Section 5. Details of the systematic searches of literature databases for 1) caries management, 2) pulp therapy and 3) behaviour management are provided below.

1) SDCEP Caries management

Summary of Searches Searches carried out by the Trials Search Co-ordinator, Cochrane Oral Health Group			
January 2014			
Database	Version/issue	Date of search	Records retrieved
The Cochrane Library	To Issue 12, 2013	08.01.14	CDSR: 108 Other reviews: 47
MEDLINE via OVID	1946 – 8 January 2014	08.01.14	321
EMBASE via OVID	1980 – 8 January 2014 (week 1)	08.01.14	590
After deduplication			698
Update Search October 2017			
Database	Version/issue	Date of latest search	Records retrieved
The Cochrane Library	Issue 12, 2013 to Issue 9, 2017	03.10.17	CDSR: 35 Other reviews: 16
MEDLINE via OVID	8 January 2014 to 3 October 2017	03.10.17	286
EMBASE via OVID	8 January 2014 to 3 October 2017	03.10.17	289
After deduplication			423
Total			1121

THE COCHRANE LIBRARY SEARCH STRATEGY

- #1 [mh "Tooth demineralization"]
- #2 (teeth near/5 (cavit* or caries or carious or decay* or lesion* or deminerali* or reminerali*))
- #3 (tooth near/5 (cavit* or caries or carious or decay* or lesion* or deminerali* or reminerali*))
- #4 (dental near/5 (cavit* or caries or carious or decay* or lesion* or deminerali* or reminerali*))
- #5 (enamel near/5 (cavit* or caries or carious or decay* or lesion* or deminerali* or reminerali*))
- #6 (dentin near/5 (cavit* or caries or carious or decay* or lesion* or deminerali* or reminerali*))
- #7 [mh "Dental health surveys"]
- #8 ("Dental Plaque Index" or "DMFT Index")
- #9 [mh ^"Dental plaque"]
- #10 ((dental or teeth or tooth) near/3 plaque)
- #11 {or #1-#10}
- #12 [mh Child]
- #13 [mh "Primary dentition"]
- #14 (pediatric* or paediatric* or child* or infant* or baby or babies or adolescen* or teenage* or toddler* or schoolage* or "school age*" or school-age* or preteen* or pre-teen*)
- #15 (or #12-#14)
- #16 #11 and #15

MEDLINE via OVID SEARCH STRATEGY

1. exp Tooth demineralization/
2. (teeth adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
3. (tooth adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
4. (dental adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
5. (enamel adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
6. (dentin adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
7. exp Dental health surveys/
8. ("Dental Plaque Index" or "DMFT Index").mp.

9. Dental plaque/
10. ((dental or teeth or tooth) adj3 plaque).mp.
11. or/1-10
12. Meta-Analysis as Topic/
13. meta analy\$.tw.
14. metaanaly\$.tw.
15. Meta-Analysis/
16. (systematic adj (review\$1 or overview\$1)).tw.
17. exp Review Literature as Topic/
18. or/12-17
19. cochrane.ab.
20. embase.ab.
21. (psychlit or psyclit).ab.
22. (psychinfo or psycinfo).ab.
23. (cinahl or cinhal).ab.
24. science citation index.ab.
25. bids.ab.
26. cancerlit.ab.
27. or/19-26
28. reference list\$.ab.
29. bibliograph\$.ab.
30. hand-search\$.ab.
31. relevant journals.ab.
32. manual search\$.ab.
33. or/28-32
34. selection criteria.ab.
35. data extraction.ab.
36. 34 or 35
37. Review/
38. 36 and 37
39. Comment/
40. Letter/
41. Editorial/
42. animal/
43. human/
44. 42 not (42 and 43)
45. or/39-41,44
46. 18 or 27 or 33 or 38
47. 46 not 45
48. guideline.pt.
49. practice guideline.pt.

50. guideline\$.ti.
51. or/48-50
52. 46 or 51
53. exp Child/
54. Primary dentition/
55. (pediatric\$ or paediatric\$ or child\$ or infant\$ or baby or babies or adolescen\$ or teenage\$ or toddler\$ or schoolage or "school age" or school-age or preteen\$ or pre-teen\$).ti,ab.
56. or/53-55
57. 11 and 52 and 56

EMBASE via OVID SEARCH STRATEGY

1. Dental caries/
2. (teeth adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
3. (tooth adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
4. (dental adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
5. (enamel adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
6. (dentin adj5 (cavit\$ or caries or carious or decay\$ or lesion\$ or deminerali\$ or reminerali\$)).mp.
7. Dental plaque/
8. ((dental or tooth or teeth) adj3 plaque).mp.
9. ("Dental Plaque Index" or "DMFT Index").mp.
10. or/1-9
11. exp Child/
12. Deciduous tooth/
13. (pediatric\$ or paediatric\$ or child\$ or infant\$ or baby or babies or adolescen\$ or teenage\$ or toddler\$ or schoolage or "school age" or school-age or preteen\$ or pre-teen\$).ti,ab.
14. or/11-13
15. 10 and 14
16. exp Meta Analysis/
17. ((meta adj analy\$) or metaanalys\$).tw.
18. (systematic adj (review\$1 or overview\$1)).tw.
19. or/16-18
20. cancerlit.ab.
21. cochrane.ab.

22. embase.ab.
23. (psychlit or psyclit).ab.
24. (psychinfo or psycinfo).ab.
25. (cinahl or cinhal).ab.
26. science citation index.ab.
27. bids.ab.
28. or/20-27
29. reference lists.ab.
30. bibliograph\$.ab.
31. hand-search\$.ab.
32. manual search\$.ab.
33. relevant journals.ab.
34. or/29-33
35. data extraction.ab.
36. selection criteria.ab.
37. 35 or 36
38. review.pt.
39. 37 and 38
40. letter.pt.
41. editorial.pt.
42. animal/
43. human/
44. 42 not (42 and 43)
45. or/40-41,44
46. 19 or 28 or 34 or 39
47. 46 not 45
48. guideline\$.mp.
49. 47 or 48
50. 15 and 49

2) SDCEP Pulp therapy

Summary of Searches Searches carried out by the Trials Search Co-ordinator, Cochrane Oral Health Group			
January 2014			
Database	Version/issue	Date of search	Records retrieved
The Cochrane Library	To Issue 12, 2013	08.01.14	CDSR: 24 Other reviews: 5

MEDLINE via OVID	1946 – 8 January 2014	08.01.14	22
EMBASE via OVID	1980 – 8 January 2014 (week 1)	08.01.14	66
After deduplication			101
Update Search October 2017			
Database	Version/issue	Date of latest search	Records retrieved
The Cochrane Library	Issue 12, 2013 to Issue 9, 2017	03.10.17	CDSR: 13 Other reviews: 0
MEDLINE via OVID	8 January 2014 to 3 October 2017	03.10.17	21
EMBASE via OVID	8 January 2014 to 3 October 2017	03.10.17	39
After deduplication			53
Total			154

THE COCHRANE LIBRARY SEARCH STRATEGY

- #1 [mh ^"Dental pulp capping"]
- #2 [mh ^Pulpectomy]
- #3 [mh ^Pulpotomy]
- #4 [mh "Root canal therapy"]
- #5 [mh ^Endodontics]
- #6 #1 or #2 or #3 or #4 or #5
- #7 ((root next canal) and (therap* or treat*))
- #8 pulpectom*
- #9 pulpotom*
- #10 (pulp near cap*)
- #11 (#7 or #8 or #9 or #10)
- #12 [mh Child]
- #13 [mh "Primary dentition"]
- #14 (pediatric* or paediatric* or child* or infant* or baby or babies or adolescen* or teenage* or toddler* or schoolage or "school age" or school-age or preteen* or pre-teen*)

- #15 #6 or #11
- #16 (or #12-#14)
- #17 #15 and #16

MEDLINE via OVID SEARCH STRATEGY

1. Dental Pulp Capping/
2. PULPECTOMY/
3. PULPOTOMY/
4. exp "Root Canal Therapy"/
5. ENDODONTICS/
6. or/1-5
7. (root canal and (therap\$ or treat\$)).mp.
8. (pulpectom\$ or pulpotom\$).mp.
9. (pulp adj6 cap\$).mp.
10. or/7-9
11. 6 or 10
12. exp Child/
13. Primary dentition/
14. (pediatric\$ or paediatric\$ or child\$ or infant\$ or baby or babies or adolescen\$ or teenage\$ or toddler\$ or schoolage or "school age" or school-age or preteen\$ or pre-teen\$).ti,ab.
15. or/12-14
16. 11 and 15
17. Meta-Analysis as Topic/
18. meta analy\$.tw.
19. metaanaly\$.tw.
20. Meta-Analysis/
21. (systematic adj (review\$1 or overview\$1)).tw.
22. exp Review Literature as Topic/
23. or/17-22
24. cochrane.ab.
25. embase.ab.
26. (psychlit or psyclit).ab.
27. (psychinfo or psycinfo).ab.
28. (cinahl or cinhal).ab.
29. science citation index.ab.
30. bids.ab.
31. cancerlit.ab.
32. or/24-31
33. reference list\$.ab.

Appendix 1 – Evidence Searches

34. bibliograph\$.ab.
35. hand-search\$.ab.
36. relevant journals.ab.
37. manual search\$.ab.
38. or/33-37
39. selection criteria.ab.
40. data extraction.ab.
41. 39 or 40
42. Review/
43. 41 and 42
44. Comment/
45. Letter/
46. Editorial/
47. animal/
48. human/
49. 47 not (47 and 48)
50. or/44-46,49
51. 23 or 32 or 38 or 43
52. 51 not 50
53. guideline.pt.
54. practice guideline.pt.
55. guideline\$.ti.
56. or/53-55
57. 52 or 56
58. 16 and 57

EMBASE via OVID SEARCH STRATEGY

1. endodontics/
2. (pulp adj6 cap\$).mp.
3. (pulpectom\$ or pulpotom\$).mp.
4. ((root adj canal) and (therap\$ or treat\$)).mp.
5. or/1-4
6. exp Child/
7. Deciduous tooth/
8. (pediatric\$ or paediatric\$ or child\$ or infant\$ or baby or babies or adolescen\$ or teenage\$ or toddler\$ or schoolage or "school age" or school-age or preteen\$ or pre-teen\$).ti,ab.
9. or/6-8
10. 5 and 9
11. exp Meta Analysis/

12. ((meta adj analy\$) or metaanalys\$.tw.
13. (systematic adj (review\$1 or overview\$1)).tw.
14. or/11-13
15. cancerlit.ab.
16. cochrane.ab.
17. embase.ab.
18. (psychlit or psyclit).ab.
19. (psychinfo or psycinfo).ab.
20. (cinahl or cinhal).ab.
21. science citation index.ab.
22. bids.ab.
23. or/15-22
24. reference lists.ab.
25. bibliograph\$.ab.
26. hand-search\$.ab.
27. manual search\$.ab.
28. relevant journals.ab.
29. or/24-28
30. data extraction.ab.
31. selection criteria.ab.
32. 30 or 31
33. review.pt.
34. 32 and 33
35. letter.pt.
36. editorial.pt.
37. animal/
38. human/
39. 37 not (37 and 38)
40. or/35-36,39
41. 14 or 23 or 29 or 34
42. 41 not 40
43. guideline\$.ti,ab.
44. 42 or 43
45. 10 and 44

3) SDCEP Behaviour management

Summary of Searches Searches carried out the Trials Search Co-ordinator, Cochrane Oral Health Group			
January 2014			
Database	Version/issue	Date of search	Records retrieved
The Cochrane Library	To Issue 12, 2013	10.01.14	CDSR: 438 Other reviews: 11
MEDLINE via OVID	1946 – 8 January 2014	10.01.14	102
EMBASE via OVID	1980 – 8 January 2014 (week 1)	10.01.14	201
After deduplication			722
Update Search October 2017			
Database	Version/issue	Date of latest search	Records retrieved
The Cochrane Library	Issue 12, 2013 to Issue 9, 2017	03.10.17	CDSR: 9 Other reviews: 5
MEDLINE via OVID	8 January 2014 to 3 October 2017	03.10.17	95
EMBASE via OVID	8 January 2014 to 3 October 2017	03.10.17	126
After deduplication			163
Total			885

THE COCHRANE LIBRARY SEARCH STRATEGY

- #1 [mh dentistry]
- #2 (dental* or dentist*)
- #3 (oral near/5 surg*)
- #4 (orthodontic* or pulpotom* or pulpect* or endodont* or "pulp cap**")

- #5 ((dental or tooth or teeth or molar*) near/5 (fill* or restor* or extract* or remov* or "cavity prep*" or caries or carious or decay*))
- #6 (root canal and (therap* or treat*))
- #7 (tooth near/3 replant*)
- #8 {or #1-#7}
- #9 [mh child]
- #10 [mh "Primary dentition"]
- #11 (pediatric* or paediatric*)
- #12 (child* or infant* or baby or babies or adolescen* or teenage* or toddler* or schoolage or "school age" or school-age or preteen* or pre-teen*)
- #13 ^{1-#12}
- #14 [mh Psychotherapy]
- #15 [mh "Behavior therapy"]
- #16 [mh ^"Child behavior"]
- #17 [mh "Behavior control"]
- #18 ((behavior or behaviour or psycholog* or cognitive) near/5 (control* or intervention* or therap*))
- #19 (music or song or sound or auditory or audio)
- #20 (relax* or calm* or distract*)
- #21 (play* or game* or toy*)
- #22 (image* or picture* or photo* or colour or color)
- #23 (hypnosis or "auto suggest*" or autogenic)
- #24 [mh ^"Audiovisual aids"]
- #25 (audiovisual or audio-visual or video or film* or dvd* or podcast* or vodcast* or movie* or visual*)
- #26 [mh ^reading]
- #27 (story* or stories or narrative*)
- #28 ("hand over mouth" or HOME)
- #29 (voice and (control* or tone* or volume*))
- #30 ("mouth prop*" or "bite block*")
- #31 [mh "Reinforcement (psychology)"]
- #32 ("positive reinforcement" or reward* or punish*)
- #33 ("papoose board*" or restrain* or immobil*)
- #34 (handholding or (hold* near/3 hand*))
- #35 "tell show do"
- #36 ("systematic desensiti*" or "coping mechanism*" or "counter stimulation")
- #37 (or #14-#36)
- #38 #8 and #13 and #37

MEDLINE via OVID SEARCH STRATEGY

1. exp DENTISTRY/
2. (dental\$ or dentist\$).ti,ab.
3. (oral adj5 surg\$).ti,ab.
4. (orthodontic\$ or pulpotom\$ or pulpect\$ or endodont\$ or "pulp cap\$").mp.
5. ((dental or tooth or teeth or molar\$) adj5 (fill\$ or restor\$ or extract\$ or remov\$ or "cavity prep\$" or caries or carious or decay\$)).mp.
6. (root canal and (therap\$ or treat\$)).mp.
7. (tooth adj3 replant\$).mp.
8. or/1-7
9. exp Child/
10. Primary dentition/
11. (pediatric or paediatric).ti,ab.
12. (child\$ or infant\$ or baby or babies or adolescen\$ or teenage\$ or toddler\$ or schoolage or "school age" or school-age or preteen\$ or pre-teen\$).ti,ab.
13. or/9-12
14. exp Psychotherapy/
15. exp Behavior therapy/
16. Child behavior/
17. exp Behavior control/
18. ((behavior or behaviour or psycholog\$ or cognitive) adj5 (control\$ or intervention\$ or therap\$)).ti,ab.
19. (music or song or sound or auditory or audio).ti,ab.
20. (relax\$ or calm\$ or distract\$).ti,ab.
21. (play\$ or game\$ or toy\$).ti,ab.
22. (image\$ or picture\$ or photo\$ or colour or color).ti,ab.
23. (hypnosis or "auto suggest\$" or autogenic).ti,ab.
24. Audiovisual aids/
25. (audiovisual or audio-visual or video or film\$ or dvd\$ or podcast\$ or vodcast\$ or movie\$ or visual\$).ti,ab.
26. Reading/
27. (story\$ or stories or narrative).ti,ab.
28. ("hand over mouth" or HOME).ti,ab.
29. (voice and (control\$ or tone\$ or volume\$)).ti,ab.
30. ("mouth prop\$" or "bite block\$").ti,ab.
31. exp "Reinforcement (Psychology)"/
32. ("positive reinforcement" or reward\$ or punish\$).ti,ab.
33. ("papoose board" or restrain\$ or immobil\$).ti,ab.
34. (handholding or (hold\$ adj3 hand\$)).ti,ab.
35. "tell show do".ti,ab.
36. ("systematic desensiti\$" or "coping mechanism\$" or "counter stimulation").ti,ab.

37. or/14-36
38. 8 and 13 and 37
39. Meta-Analysis as Topic/
40. meta analy\$.tw.
41. metaanaly\$.tw.
42. Meta-Analysis/
43. (systematic adj (review\$1 or overview\$1)).tw.
44. exp Review Literature as Topic/
45. or/39-44
46. cochrane.ab.
47. embase.ab.
48. (psychlit or psyclit).ab.
49. (psychinfo or psycinfo).ab.
50. (cinahl or cinhal).ab.
51. science citation index.ab.
52. bids.ab.
53. cancerlit.ab.
54. or/46-53
55. reference list\$.ab.
56. bibliograph\$.ab.
57. hand-search\$.ab.
58. relevant journals.ab.
59. manual search\$.ab.
60. or/55-59
61. selection criteria.ab.
62. data extraction.ab.
63. 61 or 62
64. Review/
65. 63 and 64
66. Comment/
67. Letter/
68. Editorial/
69. animal/
70. human/
71. 69 not (69 and 70)
72. or/66-68,71
73. 45 or 54 or 60 or 65
74. 73 not 72
75. guideline.pt.
76. practice guideline.pt.
77. guideline\$.ti.

78. or/75-77
79. 74 or 78
80. 38 and 79

EMBASE via OVID SEARCH STRATEGY

1. exp DENTISTRY/
2. (dental\$ or dentist\$).ti,ab.
3. (oral adj5 surg\$).ti,ab.
4. (orthodontic\$ or pulpotom\$ or pulpect\$ or endodont\$ or "pulp cap\$").mp.
5. ((dental or tooth or teeth or molar\$) adj5 (fill\$ or restor\$ or extract\$ or remov\$ or "cavity prep\$" or caries or carious or decay\$)).mp.
6. (root canal and (therap\$ or treat\$)).mp.
7. (tooth adj3 replant\$).mp.
8. or/1-7
9. exp Child/
10. Deciduous tooth/
11. (pediatric or paediatric).ti,ab.
12. (child\$ or infant\$ or baby or babies or adolescen\$ or teenage\$ or toddler\$ or schoolage or "school age" or school-age or preteen\$ or pre-teen\$).ti,ab.
13. or/9-12
14. exp Psychotherapy/
15. exp Behavior therapy/
16. Child behavior/
17. exp Behavior control/
18. ((behavior or behaviour or psycholog\$ or cognitive) adj5 (control\$ or intervention\$ or therap\$)).ti,ab.
19. (music or song or sound or auditory or audio).ti,ab.
20. (relax\$ or calm\$ or distract\$).ti,ab.
21. (play\$ or game\$ or toy\$).ti,ab.
22. (image\$ or picture\$ or photo\$ or colour or color).ti,ab.
23. (hypnosis or "auto suggest\$" or autogenic).ti,ab.
24. Audiovisual equipment/
25. (audiovisual or audio-visual or video or film\$ or dvd\$ or podcast\$ or vodcast\$ or movie\$ or visual\$).ti,ab.
26. Reading/
27. (story\$ or stories or narrative).ti,ab.
28. ("hand over mouth" or HOME).ti,ab.
29. (voice and (control\$ or tone\$ or volume\$)).ti,ab.
30. ("mouth prop\$" or "bite block\$").ti,ab.

31. exp Reinforcement/
32. ("positive reinforcement" or reward\$ or punish\$).ti,ab.
33. ("papoose board" or restrain\$ or immobil\$).ti,ab.
34. (handholding or (hold\$ adj3 hand\$)).ti,ab.
35. "tell show do".ti,ab.
36. ("systematic desensiti\$" or "coping mechanism\$" or "counter stimulation").ti,ab.

37. or/14-36
38. 8 and 13 and 37
39. exp Meta Analysis/
40. ((meta adj analy\$) or metaanalys\$).tw.
41. (systematic adj (review\$1 or overview\$1)).tw.
42. or/39-41
43. cancerlit.ab.
44. cochrane.ab.
45. embase.ab.
46. (psychlit or psyclit).ab.
47. (psychinfo or psycinfo).ab.
48. (cinahl or cinhal).ab.
49. science citation index.ab.
50. bids.ab.
51. or/43-50
52. reference lists.ab.
53. bibliograph\$.ab.
54. hand-search\$.ab.
55. manual search\$.ab.
56. relevant journals.ab.
57. or/52-56
58. data extraction.ab.
59. selection criteria.ab.
60. 58 or 59
61. review.pt.
62. 60 and 61
63. letter.pt.
64. editorial.pt.
65. animal/
66. human/
67. 65 not (65 and 66)
68. or/63-64,67
69. 42 or 51 or 57 or 62
70. 69 not 68

Appendix 1 – Evidence Searches

- 71. guideline\$.ti,ab.
- 72. 70 or 71
- 73. 38 and 72

Appendix 2 - Summary of Guidelines and Systematic Reviews

The following guidelines and systematic reviews were identified through literature searching and subsequent eligibility screening as detailed in Section 5.

Ref. No	Title	Author/Source	Year	Citation/Access	Relevance to guidance
G1	Dental interventions to prevent caries in children.	Scottish Intercollegiate Guidelines Network (SIGN).	2014	www.sign.ac.uk/sign-138-dental-interventions-to-prevent-caries-in-children.html	Caries prevention
SR1	Motivational Interviewing in Improving Oral Health: A Systematic Review of Randomized Controlled Trials	Gao X, Man Lo EC, Ching Ching Kot S, Wai Chan KC.	2014	J Periodontol. 2014. 85: 425-437	Caries prevention
SR2	Effect on Caries of Restricting Sugars Intake: Systematic Review to Inform WHO Guidelines	Moynihan PJ, Kelly SA.	2013	J Dent Res. 2014; 93: 8-18	Caries prevention - diet
SR3	One-to-one dietary interventions undertaken in a dental setting to change dietary behaviour	Harris R, Gamboa A, Dailey Y, Ashcroft A	2012	Cochrane Database of Systematic Reviews 2012, Issue 3. Art. No.: CD006540. DOI	Caries prevention - diet
G2	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	Wright JT, Crall JJ, Fontana M, Gillette EJ et.al.	2016	J Am Dent Assoc 2016; 147: 672-682	Caries prevention – fissure sealants
G3	Topical fluoride for caries prevention: Full report of the updated clinical recommendations and supporting systematic review	Weyant RJ, Tracy SL, Anselmo TT, Beltrán-Aguilar ED, Donly KJ et al. American Dental Association Council on Scientific Affairs	2013	http://ebd.ada.org/~media/EBD/Files/Topical_fluoride_for_caries_prevention_2013_update.pdf?la=en Executive Summary: <i>Journal of the American Dental Association</i> . 2013; 144:1279-91	Caries prevention – topical fluoride

Appendix 2 – Summary of Guidelines and Systematic Reviews

		Expert Panel on Topical Fluoride Caries Preventive Agents			
SR4	Non-surgical management methods of noncavitated carious lesions	Tellez M, Gomez J, Kaur S, Pretty IA, Ellwood R, Ismail AI	2013	Community Dent Oral Epidemiol 2013; 41; 79–96	Caries management
SR5	Operative caries management in adults and children	Ricketts D, Lamont T, Innes NPT, Kidd E, Clarkson JE.	2013	Cochrane Database of Systematic Reviews 2013, Issue 3. Art. No.: CD003808	Caries management
SR6	Failure of incompletely excavated teeth--a systematic review.	Schwendicke F, Meyer-Lueckel H, Dörfer C, Paris S.	2013	J Dent. 2013 Jul;41(7):569-80.	Caries management
SR7	Incomplete caries removal: a systematic review and meta-analysis	Schwendicke F, Dörfer CE, Paris S.	2013	J Dent Res. 2013 Apr;92(4):306-14	Caries management
SR8	Caries removal in primary teeth—a systematic review.	Ferreira JM, Pinheiro SL, Sampaio FC, de Menezes VA.	2012	Quintessence Int. 2012 Jan;43(1):e9-15.	Caries management
SR9	Long-term survival and vitality outcomes of permanent teeth following deep caries treatment with step-wise and partial-caries-removal: A Systematic Review	Hoefler V, Nagaoka H, Miller C	2016	Journal of Dentistry 54 (2016) 25–32	Caries management
SR10	Absence of carious lesions at margins of glass-ionomer cement and amalgam restorations: An update of systematic review evidence	Mickenautsch S, Yengopal V.	2011	BMC Res Notes. 2011 Mar 11;4:58.	Caries management
SR11	Preformed crowns for decayed primary molar teeth	Innes NPT, Ricketts D, Chong LY, Keightley AJ, Lamont T, Santamaria RM.	2015	Cochrane Database of Systematic Reviews 2015, Issue 12. Art. No.: CD005512	Caries management
SR12	Micro-invasive interventions for managing proximal dental decay in primary and permanent teeth	Dorri M, Dunne SM, Walsh T, Schwendicke F.	2016	Cochrane Database of Systematic Reviews 2015, Issue 11. Art. No.: CD010431	Caries management

Appendix 2 – Summary of Guidelines and Systematic Reviews

SR13	Caries remineralisation and arresting effect in children by professionally applied fluoride treatment – a systematic review	Gao SS, Zhang S, Mei ML, Lo EC and Chu C	2016	BMC Oral Health (2016) 16:12	Caries management
SR14	Are topical fluorides effective for treating incipient carious lesions?	Lenzi TL, Montagner AF, Soares FZ, de Oliveira Rocha R	2016	Journal of the American Dental Association. 2016;147:84-91.e81.	Caries management
G4	The pulp treatment of the primary dentition	British Society of Paediatric Dentistry: HD Rodd, PJ Waterhouse, AB Fuks, SA Fayle & MA Moffat	2006	Int J Paed Dent 2006; 116 (Suppl. 1): 15-23	Pulp therapy
SR15	Is there sufficient evidence to support the long-term efficacy of mineral trioxide aggregate (MTA) for endodontic therapy in primary teeth?	Anthonappa RP, King NM, Martens LC.	2013	Int Endod J. 2013 Mar;46(3):198-204	Pulp therapy
SR16	Pulp treatment for extensive decay in primary teeth	Smail-Faugeron V, Courson F, Durieux P, Muller-Bolla M, Nadin G, Glenny A-M, Fron Chabouis H.	2014	The Cochrane database of systematic reviews. 2014;8:CD003220	Pulp therapy
SR17	MTA and Ferric Sulfate in Pulpotomy Outcomes of Primary Molars: A Systematic Review and Meta-Analysis	Asgary S, Shirvani A, Fazlyab M	2014	Journal of clinical pediatric dentistry. 2014;39(1):1-8	Pulp therapy
SR18	Evidence of pulpotomy in primary teeth comparing MTA, calcium hydroxide, ferric sulphate, and electrosurgery with formocresol	Stringhini Junior E, Vitcel MEB, Oliveira LB	2015	Eur Arch Paediatr Dent (2015) 16:303–312	Pulp therapy
SR19	Vital Pulp Therapy: A Systematic Review and Meta-analysis	Coll JA, Seale, NS, Vargas, K, Marghalani AA, Al Shamali, S. and Graham, L.	2017	Pediatric Dentistry Volume : 39 Pages: 16-123 2017	Pulp therapy
G5	Update of Non-pharmacological behaviour management guideline	British Society of Paediatric Dentistry: C Campbell, F	2011	http://bspd.co.uk/Resources/BSPD-Guidelines	Behaviour management

Appendix 2 – Summary of Guidelines and Systematic Reviews

		Soldani, A Busuttil-Naudi and B Chadwick			
G6	Guideline on Behavior Guidance for the Pediatric Dental Patient	American Academy on Pediatric Dentistry Clinical Affairs Committee-Behavior Management, Subcommittee	2015	Paediatric Dentistry 30: 124-33	Behaviour management

Appendix 3 – Evidence Appraisal Forms

Evidence appraisal was carried out as described in Section 6.

Caries Risk Assessment

Guideline G1: SIGN guideline 138 (2014)¹

Author: Scottish Intercollegiate Guidelines Network (SIGN). Title: Dental interventions to prevent caries in children. Edinburgh: SIGN; 2014. (SIGN publication no. 138). [March 2014]. Available from URL: http://www.sign.ac.uk/sign-138-dental-interventions-to-prevent-caries-in-children.html				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
Guideline AGREE score: 6 (/7)	TOTAL NO. PATIENTS: N/A PATIENT CHARACTERISTICS:	Caries preventive advice or interventions that are applied at an individual rather than a population level, including oral health advice, toothbrushing, other tooth cleaning methods, topical anticaries interventions, sealants.		
Aim(s)	This guideline provides recommendations based on current evidence for best practice in dental interventions to prevent caries in children and young people aged 0–18 years carried out by dental care teams within dental practices in Scotland.			
Authors' quality assessment of studies included in review	The SIGN Grading system 1999-2012 was used (http://www.sign.ac.uk/assets/sign_grading_system_1999_2012.pdf) i.e. Levels of Evidence 1++, 1+ 1- etc and Grades of Recommendation A, B, C, D and good practice points. The assessment of evidence quality focuses on the study design and how well each study was conducted but may take into account other factors. Recommendations take into account the body of available evidence, its quality, applicability to the target audience, consistency of results.			
Main Findings / Recommendations	Key Recommendations The following recommendations were highlighted by the guideline development group as the key clinical recommendations that should be prioritised for implementation. The grade of recommendation relates to the strength of the supporting evidence on which the recommendation is based. Delivery of dental brief interventions in the practice setting Oral health promotion interventions should facilitate daily toothbrushing with fluoride toothpaste. (Grade B) Toothbrushing with fluoride toothpaste Following risk assessment, children and young people up to the age of 18 years who are at standard risk of developing dental caries should be advised to use toothpastes in the range 1,000 to 1,500 ppmF. (Grade A)			

	<p>Following risk assessment, children aged from 10 to 16 years who are at increased risk of developing dental caries should be advised to use toothpastes at a concentration of 2,800 ppmF. (Grade A)</p> <p>Toothbrushing with fluoride toothpaste should take place at least twice daily. (Grade A)</p> <p>Topical anticaries interventions</p> <p>Fluoride varnish should be applied at least twice yearly in all children. (Grade A)</p> <p>Sealants</p> <p>Resin-based fissure sealants should be applied to the permanent molars of all children as early after eruption as possible. (Grade A)</p> <p>In addition, several other lower grade recommendations were included.</p> <p>Other Recommendations</p> <ul style="list-style-type: none"> • The following factors should be considered when assessing caries risk: <ul style="list-style-type: none"> clinical evidence of previous disease; dietary habits, especially frequency of sugary food and drink consumption; social history, especially socioeconomic status; use of fluoride; plaque control; saliva; medical history. (Grade C) • Specialist child healthcare professionals should consider carrying out a caries risk assessment of children in their first year as part of the child's overall health assessment. (Grade D) • Children whose families live in a deprived area should be considered as at increased risk of early childhood caries when developing preventive programmes. (Grade D) • As part of the patient assessment, a social history should be taken which will contribute to dental brief interventions being specific to individuals and tailored to their particular needs and circumstances. (Grade C) <p>Several 'good practice points' relating to the recommendations above were also provided.</p>
Adverse events	There was particular consideration of the potential adverse effects of excess fluoride in toothpaste and other formulations, which informed the recommendations made.
Study details / Limitations	<p>SETTINGS:</p> <p>COUNTRIES: This guideline is primarily targeted at dental professionals in Scotland, but will also be of direct applicability elsewhere in the UK and further afield.</p> <p>FUNDING SOURCES:</p> <p>STUDY LIMITATIONS:</p>
Reviewers' Comments:	<p>SIGN guideline 138 was developed using a methodology that at the time of development was rigorous and transparent. Some of the information about the methodology used for this guideline are not presented within it, instead being found in SIGN 50 and/or the SIGN website. Some improvements to SIGN methodology have taken place since this guideline was published.</p> <p>This guideline includes extensive narratives describing the background to the intervention, an analysis of the evidence identified and its application in practice. Evidence quality and other factors have been considered when formulating the recommendations. There has been some consideration of the implementation of the recommendations and key points for audit are provided as a tool for implementation. Many of the recommendations within this guideline were based on systematic reviews of the evidence that were available at the time. Some of these systematic reviews have since been updated and consequently it is the most recent versions that are cited within <i>Prevention and Management of Dental Caries in Children</i>.</p> <p>This guideline should be considered to be an important and reliable source of recommendations for clinical practice for the prevention of dental caries in children in Scotland and also further afield, where the recommendations are likely to equally relevant.</p>

Caries Prevention – Motivation and Action Planning

Guideline G1: SIGN guideline 138 (2014)¹ - see appraisal form under Caries Risk Assessment above.

Systematic Review SR1: Gao et al. (2014)⁶

Author: Gao X, Man Lo EC, Ching Ching Kot S, Wai Chan KC. Title: Motivational Interviewing in Improving Oral Health: A Systematic Review of Randomized Controlled Trials. Citation: J Periodontol. 2014. 85: 425-437				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 6 (/11)	<p>TOTAL NO. PATIENTS:</p> <p>PATIENT CHARACTERISTICS: dental patients, special need groups (adults with mental illness), disadvantaged communities (low-income families and ethnic minorities), or people in certain occupational sectors (veterans and children of medical staff)</p>	MI vs comparator (information only, e.g. brochure, routine advice, cognitive behaviour treatments)	oral health (status of the teeth, oral cavity, and related tissues) or related behaviours	Randomised Controlled Trials
Aim(s)	To synthesize the evidence on the effectiveness of Motivational Interviewing (MI), in comparison with Conventional health Education (CE), in improving oral health.			
Authors' quality assessment of studies included in review	<p>16 studies included. Study quality was assessed on a 21-point scale. Nine studies scores 15 or above. In nine studies, at least one objective outcome measure was adopted, instead of solely relying on self-reported behaviours and perceptions. Outcome assessors were blinded in 12 studies. Sample size was justified in seven studies. In 11 studies, the drop-out rate was below 10% or was accounted for.</p> <p>In four studies, each participant joined more than one MI sessions, whereas in 11 studies, single MI session was conducted. Number of sessions was unclear in one study.</p> <p>Only in two studies was the quality of MI formally monitored. The MI sessions lasted 5-90 minutes (typically 15-40 minutes).</p> <p>The studies were qualitatively synthesized. Quantitative synthesis (meta-analysis) for generating an estimate on the effect size was not possible due to the great heterogeneity of studies in target behaviors and conditions, timing of outcome assessment, and observed outcomes.</p>			
Main Findings / Recommendations	<p>MI is defined as client-centred directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence.</p> <p>Periodontal health: MI was delivered for improving periodontal health through reinforcing oral hygiene measures in seven studies. MI outperformed conventional education in five studies with greater improvement in at least one outcome measure (e.g. plaque, gingival bleeding, treatment success). In the remaining two studies, no significant difference was found between groups.</p>			

	<p>Preventing Early Childhood Caries: MI was delivered to mothers and other caregivers in four studies for preventing early childhood caries (mainly in infants). The behaviours addressed were infants feeding practice and diet, oral hygiene measures and dental visit. In the first trial by Weinstein and co-authors, combining MI with conventional education significantly reduced the number of new carious lesions in 1 year (0.71 vs. 1.91; $p < 0.01$) and the chance of new caries in 2 years (odds ratio=0.35, 95% CI=0.15-0.83; hazard ratio=0.54, 95% CI=0.35-0.84). However, in further trials carried out by other researchers, significant between-group difference was absent in children's caries increment, although MI seemed to reduce the caries severity (fewer decayed teeth at or beyond the dentin level). Behaviour-wise, some positive changes were associated with MI, such as less use of shared utensils, more frequent cleaning of child's teeth, brushing at bedtime, and checking the child for 'precavities'. No changes were found in children's use of nursing bottle and snacking habits.</p> <p>Other Oral Health Problems: On smoking prevention and cessation, two studies targeted adolescents and showed no difference between MI and conventional education. Among outpatients seeking treatment for facial trauma in oral and maxillofacial department, MI outperformed conventional education in treating alcohol abuse in one study, while another study detected no between-group difference in alcohol abstinence but a greater effect of MI in reducing illicit drug use.</p> <p>Reviewed randomized controlled trials showed varied success of MI in improving oral health. The potential of MI in dental healthcare, especially on improving periodontal health, remains controversial. Further studies with methodological rigor are needed for a better understanding of the roles of MI in dental practice.</p>
Adverse events	
Study details / Limitations	<p>SETTINGS: Not specified COUNTRIES: Not specified FUNDING SOURCES: not stated STUDY LIMITATIONS: publications in English only. Some aspects of review methodology not well reported.</p>
Reviewers' Comments:	<p>A fairly comprehensive search of multiple databases, though limited to publications in English and no grey literature was sought. This review focussed on randomised clinical trials. Heterogeneity of the included studies was high.</p> <p>Success of MI compared to conventional health education was variable in different settings and for different health outcomes. However, in four studies on preventing early childhood caries, MI outperformed CE in improving at least one outcome.</p>

Caries Prevention – Toothbrushing

Guideline G1: SIGN guideline 138 (2014)¹ - see appraisal form under Caries Risk Assessment above.

Caries Prevention – Dietary Advice

Guideline G1: SIGN guideline 138 (2014)¹ - see appraisal form under Caries Risk Assessment above.

Systematic Review SR2: Moynihan and Kelly, 2013⁷

Author: Moynihan PJ, Kelly SA. Title: Effect on Caries of Restricting Sugars Intake: Systematic Review to Inform WHO Guidelines. Citation: J Dent Res. 2014; 93: 8-18				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 8 (/11)	TOTAL NO. PATIENTS: - PATIENT CHARACTERISTICS: healthy humans (without acute illness, but those overweight or with hypertension or diabetes could be included) in developing, transitional, or industrialized countries. All age groups were included.	Any intervention intended to alter sugars intake in one arm of the study compared with diet with a different sugars content in another study arm.	The absolute amount of total sugars and dental caries, measured as prevalence, incidence and/or severity, measured as DMF Index, DMFT, dmft, DMFS, dmfs, deft, dft, or comparisons between caries and no caries or higher caries vs.	All appropriate randomized controlled trials (RCTs) and observational studies, published since 1950, were sought. Reviews were included if they contained a new analysis of existing data. Observational studies were included if they reported absolute sugars or change in sugars intake and also included information on dental caries (as defined above). All timescales were included.

			lower caries with a timescale of at least one year.	Studies were included if they reported a <i>per capita</i> population sugar intake. Studies that reported solely on frequency of sugars intake were excluded.
Aim(s)	To systematically review the evidence on the association between the amount of sugars intake and levels of dental caries in both adults and children, and on the effect of restricting sugars intake to < 10% and < 5% energy (E) on caries to inform the updating of World Health Organization guidelines on sugars consumption. The evidence relating to amount, and not frequency, of sugars was assessed.			
Authors' quality assessment of studies included in review	The review was conducted and reported in accordance with the PRISMA statement, and the evidence was assessed according to GRADE Working Group guidelines, taking into consideration factors including: design limitations, consistency of results across the available studies, precision of results, directness and likelihood of publication bias, magnitude of effect, evidence of a dose response, strength of association, and the direction of plausible biases. The quality of the evidence could be categorized as high, moderate, low, or very low. Overall, the quality of evidence was assessed as moderate.			
Main Findings / Recommendations	<p>55 studies were eligible – 3 intervention, 8 cohort, 20 population, and 24 cross-sectional. No randomised controlled trials were identified. Data reporting formats varied considerably e.g. range of outcomes. Types of outcomes, age of studied population, study length, information about fluoride exposure. Data variability limited meta-analysis.</p> <p>Of these studies, 42 out of 50 of those in children and 5 out of 5 in adults reported at least one positive association between sugars and caries. 7 out of 8 cohort studies (all in children) reported higher dental caries with higher sugars intake.</p> <p>Population studies support the dose-response effect, with 18 out of 20 showing a positive, one a neutral, and one a negative association between sugars intake and dental caries. Nine population studies provided evidence of positive correlations between sugars intake and caries levels. Cohort studies found higher caries with sugars intake > 10% E compared with < 10% E (moderate quality evidence). This finding was supported by population studies. Three Japanese population studies support the benefit of limiting free sugars intake to < 5% E, though evidence is of very low quality and studies were in non-fluoridated populations reported in 1959-60.</p> <p>This in-depth systematic review shows consistent evidence of moderate quality supporting a relationship between the amount of sugars consumed and dental caries development. There is evidence of moderate quality to show that dental caries is lower when free-sugars intake is < 10% E. There may be benefit in limiting sugars to < 5% E to minimize the risk of dental caries throughout the life course as dental caries progresses with age and even low levels of caries in childhood are of significance to levels of caries in later life.</p>			
Adverse events	-			
Study details / Limitations	<p>SETTINGS:</p> <p>COUNTRIES: various developed and developing</p> <p>FUNDING SOURCES:</p> <p>STUDY LIMITATIONS:</p>			
Reviewers' Comments:	Comprehensive search of multiple databases. No grey literature. Thorough review with careful assessment of evidence quality.			

Systematic Review SR3: Harris et al., 2012⁸

Author: Harris R, Gamboa A, Dailey Y, Ashcroft A Title: One-to-one dietary interventions undertaken in a dental setting to change dietary behaviour. Citation: <i>Cochrane Database of Systematic Reviews</i> 2012, Issue 3. Art. No.: CD006540.				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 10 (/11)	TOTAL NO. PATIENTS: PATIENT CHARACTERISTICS: children and adults of any age receiving dietary advice as a one-to-one intervention in a dental practice setting or in dental settings where one-to-one advice is given	one-to-one dietary intervention with an aim to prevent dental caries or erosion or to influence general health versus no advice or different advice	The primary outcome measure assessed related to changes in the frequency, amount or timing of food/drink consumption, and were specific to changes in relation to sugary/low sugar foods, chewing gum, drinks and other types of food. Changes in relation to consumption of non-milk extrinsic sugars (NMES) and intrinsic sugars (fruit) and other sugars, sucrose, glucose, xylitol and other intense sweeteners were recorded. The primary outcomes were based on self reported measures, or other means of recording dietary change such as diaries and methodologies using 24-hour recall. The secondary outcomes studied included both oral health and general health outcomes and depended on the aim of the intervention.	All randomised controlled trials (RCTs) that follow individuals for a minimum of 1 month were included
Aim(s)	To assess the effectiveness of one-to-one dietary interventions for all ages carried out in a dental care setting in changing dietary behaviour. The effectiveness of these interventions in the subsequent changing of oral and general health is also assessed.			
Authors' quality assessment of studies included in review	Used Cochrane risk of bias assessment tool. Due to high degree of heterogeneity in the included studies relating to: study design, recruitment and sampling methods, participant characteristics, type of intervention and behavioural outcome; it was not possible to conduct a meta-analysis. Consequently, the description of the studies and report of the findings was narrative.			
Main Findings / Recommendations	Five studies met the criteria for inclusion in the review. Two of these were multi-intervention studies where the dietary intervention was one component of a wider programme of prevention, but where data on dietary behaviour change were reported. One of the single intervention studies was concerned with dental caries prevention. The other two concerned general health outcomes. There were no studies concerned with dietary change aimed at preventing tooth erosion. In four out of the five included studies a significant change in dietary behaviour was found for at least one of the primary outcome variables. There is tentative evidence that one-to-one dietary interventions delivered in a dental setting aimed at promoting general rather than oral health, are effective at changing dietary behaviour. There is some evidence that one-to-one dietary interventions in the dental setting can change behaviour, although the evidence is greater for interventions aiming to change fruit/vegetable and alcohol consumption than for those aiming to change dietary sugar consumption (but mainly because very few studies have been undertaken in this area, and where studies have been undertaken, most			

	have significant methodological weaknesses). There are no studies of one-to-one dietary interventions delivered in the dental setting which are aimed at preventing tooth erosion.
Adverse events	
Study details / Limitations	<p>SETTINGS: Dental hospital (4 studies), dental practice.</p> <p>COUNTRIES: UK (2 studies), Finland, Netherlands, Sweden</p> <p>FUNDING SOURCES: Not stated</p> <p>STUDY LIMITATIONS: Overall, two trials were assessed as being at high risk of bias and the remaining three were assessed as being unclear of the risk of bias.</p>
Reviewers' Comments:	Well conducted review based on extensive literature search.

Caries Prevention – Fissure Sealants

Guideline G1: SIGN guideline 138 (2014)¹ see appraisal form under Caries Risk Assessment above.

Guideline G2: Wright et al 2016 (2016)⁹

<p>Author: Wright JT, Crall JJ, Fontana M, Gillette EJ, Nový BB, Dhar V, Donly K, Hewlett ER, Quinonez RB, Chaffin J, Crespín M, Iafolla T, Siegal MD, Tampi MP, Graham L, Estrich C, Carrasco-Labra A.</p> <p>Title: 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.</p> <p>Citation: J Am Dent Assoc 2016; 147: 672-682</p>				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
Guideline AGREE score: 6 (/7)	TOTAL NO. PATIENTS: N/A PATIENT CHARACTERISTICS: Children and adolescents	Pit and fissure sealants Resin based or glass ionomer cement based.		Randomised Controlled Trials
Aim(s)	This guideline presents evidence-based clinical recommendations for the use of pit-and-fissure sealants on the occlusal surfaces of primary and permanent molars in children and adolescents. A guideline panel convened by the American Dental Association (ADA) Council on Scientific Affairs and the American Academy of Pediatric Dentistry conducted a systematic review and formulated recommendations to address clinical questions in relation to the efficacy, retention, and potential side effects of sealants to prevent dental caries; their efficacy compared with fluoride varnishes; and a head-to-head comparison of the different types of sealant material used to prevent caries on pits and fissures of occlusal surfaces			
Authors' quality assessment of studies included in review	This is an update of the ADA 2008 recommendations on the use of pit-and-fissure sealants on the occlusal surfaces of primary and permanent molars. The authors used the Grading of Recommendations Assessment, Development, and Evaluation approach to assess the quality of the evidence and to move from the evidence to the decisions.			
Main Findings / Recommendations	<p>The guideline panel formulated 3 main recommendations. They concluded that sealants are effective in preventing and arresting pit-and-fissure occlusal carious lesions of primary and permanent molars in children and adolescents compared with the non use of sealants or use of fluoride varnishes. They also concluded that sealants could minimize the progression of noncavitated occlusal carious lesions (also referred to as initial lesions) that receive a sealant. Finally, based on the available limited evidence, the panel was unable to provide specific recommendations on the relative merits of one type of sealant material over the others.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> The sealant guideline panel recommends the use of sealants compared with nonuse in permanent molars with both sound occlusal surfaces and noncavitated occlusal carious lesions in children and adolescents* Strong recommendation based on Moderate quality evidence. 			

	<ul style="list-style-type: none"> • The sealant guideline panel suggests the use of sealants compared with fluoride varnishes in permanent molars with both sound occlusal surfaces and noncavitated occlusal carious lesions in children and adolescents* Conditional recommendation based on Low quality evidence. • The panel was unable to determine superiority of one type of sealant over another owing to the very low quality of evidence for comparative studies; the panel recommends that any of the materials evaluated (for example, resin-based sealants, resin-modified glass ionomer sealants, glass ionomer cements, and polyacid-modified resin sealants, in no particular order) can be used for application in permanent molars with both sound occlusal surfaces and noncavitated occlusal carious lesions in children and adolescents (conditional recommendation, very low-quality evidence)*† Conditional recommendation based on Very low quality evidence. <p>* These recommendations are applicable to both sound surfaces and noncavitated carious lesions: “Noncavitated lesions are characterized by a change in color, glossiness, or surface structure as a result of demineralization before there is macroscopic breakdown in surface tooth structure. These lesions represent areas with net mineral loss due to an imbalance between demineralization and remineralization. Reestablishing a balance between demineralization and remineralization may stop the caries disease process while leaving a visible clinical sign of past disease.”</p> <p>† The guideline panel suggests that clinicians should take into account the likelihood of experiencing lack of retention when choosing the type of sealant material most appropriate for a specific patient and clinical scenario. For example, in situations in which dry isolation is difficult, such as a tooth that is not fully erupted and has soft tissue impinging on the area to be sealed, then a material that is more hydrophilic (for example, glass ionomer) would be preferable to a hydrophobic resin-based sealant. On the other hand, if the tooth can be isolated to ensure a dry site and longterm retention is desired, then a resin-based sealant may be preferable.</p>
Adverse events	None identified.
Study details / Limitations	<p>From the systematic review on which this guideline is based:</p> <p>SETTINGS: Unclear</p> <p>COUNTRIES (number of studies): Colombia, Canada, United States (2), (2) Turkey (4), Australia, Spain, Germany, Brazil (5), India (2), Egypt, China(3)</p> <p>FUNDING SOURCES: not stated.</p> <p>STUDY LIMITATIONS: Serious risk of bias (unclear method for randomization and allocation concealment) in included studies for Recommendation 1; Serious risk of bias (unclear method for randomization, allocation concealment, inconsistency) in included studies for Recommendation 2; Serious risk of bias (unclear method for randomization and allocation concealment and serious issues of imprecision) in included studies for Recommendation 3;</p>
Reviewers’ Comments:	<p>This is a rigorously developed guideline using current methodology and based on a well- conducted systematic review¹⁰. There are some weakness, mainly related to limited consideration of the implementation of the recommendations. This guideline should be used in conjunction with other sources to inform recommendations for prevention and management of dental caries in children and young people in the UK.</p> <p>No studies were identified regarding the effects of sealants in adult patients, though similar effects may reasonably be predicted.</p>

Caries Prevention – Topical Fluoride

Guideline G1: SIGN guideline 138 (2014)¹- see appraisal form under Caries Risk Assessment above.

Guideline G3: Weyant et al., 2013¹¹

<p>Author: Weyant RJ, Tracy SL, Anselmo TT, Beltrán-Aguilar ED, Donly KJ, Frese WA, Hujoel PP, Iafolla T, Kohn W, Kumar J, Levy SM, Tinanoff N, Wright JT, Zero D, Aravamudhan K, Frantsve-Hawley J, Meyer DM; American Dental Association Council on Scientific Affairs Expert Panel on Topical Fluoride Caries Preventive Agents Title: Topical fluoride for caries prevention: Full report of the updated clinical recommendations and supporting systematic review Available at: http://ebd.ada.org/~media/EBD/Files/Topical_fluoride_for_caries_prevention_2013_update.pdf?la=en Also reported in Weyant et al. Topical fluoride for caries prevention: Executive summary of the updated clinical recommendations and supporting systematic review. Citation: J Am Dent Assoc. 2013 Nov; 144(11):1279-91.</p>				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
Guideline AGREE score: 5 (7)	TOTAL NO. PATIENTS: N/A PATIENT CHARACTERISTICS: Patients at elevated risk of developing dental caries	Fluoride varnish (2.26% and 0.1% fluoride) APF gel (1.23% fluoride) APF Foam (1.23% fluoride) Prophylaxis pastes containing fluoride Prophylaxis prior to application of topical fluoride Prescription strength, home-use (0.5% fluoride) gel/paste agents Prescription strength, home-use (0.09% fluoride) gel/paste agents	Caries incidence or increment using surface level data	Not stated
Aim(s)	To assist practitioners with decision-making about the use of topical fluoride caries preventive agents.			
Authors' quality assessment of studies included in review	The guideline group undertook a series of systematic reviews in order to answer 8 specific clinical questions regarding the use of topical fluoride for caries prevention. The guideline outlines the general process undertaken for each review. This general process receives an AMSTAR score of 9. Risk of bias in the included studies was assessed using a system adapted from the US Preventive Service Task Force (USPSTF) system. Limitations in both the evidence and the systematic review process were noted in the guideline.			

Main Findings	Age Group or Dentition Affected									
	Topical Fluoride Agent	Younger than 6 Years (Primary teeth)	6-18 Years (Mixed dentition)	Older than 18 Years (Permanent Teeth)	Adult Root caries					
	Varnish, 2.26% fluoride	Every 3 to 6 months (In Favor)	Every 3 to 6 months (In Favor)	Every 3 to 6 months (Expert Opinion For)	Every 3 to 6 months (Expert opinion For)					
	Varnish, 0.1% fluoride	Not recommended (Against)	Not recommended (Expert Opinion Against)	Not recommended (Expert Opinion Against)	Panel unable to make recommendation					
	Professionally-applied 1.23% fluoride (APF) gel	Not recommended (Expert Opinion Against)	4 [‡] minutes every 3-6 months (In Favor)	4 [‡] minutes every 3 to 6 months (Expert Opinion For)	4 [‡] minutes every 3 to 6 months (Expert Opinion For)					
	Prophylaxis prior to 1.23% fluoride (APF) gel application	Not necessary for caries prevention (Expert Opinion Against)	Not necessary for caries prevention (Against)	Not necessary for caries prevention (Expert Opinion Against)	Panel unable to make recommendation					
	Fluoride foam (1.23% fluoride as APF)	Not recommended (Expert Opinion Against)	Not recommended (Expert Opinion Against)	Not recommended (Expert Opinion Against)	Panel unable to make recommendation					
	Prophylaxis paste containing fluoride	Not recommended for caries prevention (Expert Opinion Against)	Not recommended for caries prevention (Against)	Not recommended for caries prevention (Expert Opinion Against)	Panel unable to make recommendation					
	Prescription-strength (0.5% fluoride), home-use fluoride products (gel, paste)	Not recommended (Expert Opinion Against)	Twice daily (Expert Opinion For)	Twice daily (Expert Opinion For)	Twice daily (Expert Opinion For)					
	Mouthrinse, 0.09% fluoride	Not recommended (Expert Opinion Against)	At least weekly (In Favor)	At least weekly (Expert Opinion For)	Daily (Expert Opinion For)					
[‡] No studies tested APF gel for less than 4 minutes. Table cell color legend.										
<table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 16.6%;"> Strong Evidence strongly supports providing this intervention</td> <td style="width: 16.6%;"> In favor Evidence favors providing this intervention</td> <td style="width: 16.6%;"> Weak Evidence suggests implementing this intervention only after alternatives have been considered</td> <td style="width: 16.6%;"> Expert Opinion For Evidence is lacking; the level of certainty is low. Expert opinion guides this recommendation</td> <td style="width: 16.6%;"> Expert Opinion Against Evidence is lacking; the level of certainty is low. Expert opinion suggests not implementing this intervention</td> <td style="width: 16.6%;"> Against Evidence suggests not implementing this intervention or discontinuing ineffective procedures</td> </tr> </table>					Strong Evidence strongly supports providing this intervention	In favor Evidence favors providing this intervention	Weak Evidence suggests implementing this intervention only after alternatives have been considered	Expert Opinion For Evidence is lacking; the level of certainty is low. Expert opinion guides this recommendation	Expert Opinion Against Evidence is lacking; the level of certainty is low. Expert opinion suggests not implementing this intervention	Against Evidence suggests not implementing this intervention or discontinuing ineffective procedures
Strong Evidence strongly supports providing this intervention	In favor Evidence favors providing this intervention	Weak Evidence suggests implementing this intervention only after alternatives have been considered	Expert Opinion For Evidence is lacking; the level of certainty is low. Expert opinion guides this recommendation	Expert Opinion Against Evidence is lacking; the level of certainty is low. Expert opinion suggests not implementing this intervention	Against Evidence suggests not implementing this intervention or discontinuing ineffective procedures					
Adverse events	None reported if product used as recommended by manufacturers. However, a special case was made for children under 6 regarding the possibility of swallowing excess product and the harm which may result; this influenced recommendations for some types of topical fluoride preparations in this age group.									
Study details / Limitations	SETTINGS: COUNTRIES: FUNDING SOURCES: STUDY LIMITATIONS:									
Reviewers' Comments:	This guideline scores highly for scope and purpose, rigour of development, editorial independence and applicability. There is less confidence in stakeholder involvement and whether the group considered how the recommendations could be implemented in practice. This format of the guideline itself may not be particularly user friendly however the recommendations appear to be robustly evidence based where possible.									

Caries Management Primary and Permanent Teeth

Systematic Review SR4: Tellez et al., 2013¹²

Author: Tellez M, Gomez J, Kaur S, Pretty IA, Ellwood R, Ismail AI Title: Non-surgical management methods of noncavitated carious lesions Citation: Community Dent Oral Epidemiol 2013; 41; 79–96				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 7	TOTAL NO. PATIENTS: Studies on fluoride, 3764; CHX/Xylitol, 451; CPP-ACP, 2928; Sealants/resin infiltration, 267 PATIENT CHARACTERISTICS: Fluorides: 12 studies permanent teeth; 1 study primary	Fluoride Chlorhexidine, xylitol and combination CPP-ACP Sealants/resin infiltration	Various: change in incipient lesions; change in avge fluorescence etc Caries incidence % caries progression	Included: RCTs; enamel only non-cavitated lesions; Excluded many that were 'not commercially available'; artificial lesions; insufficient data.
Aim(s)	To critically appraise all evidence related to the efficacy of nonsurgical caries preventive methods to arrest or reverse the progression of noncavitated carious lesions (NCCIs).			
Authors' quality assessment of studies included in review	More than half of the trials assessed had moderate to high risk of bias or may be categorized as 'poor'. The great majority (65.5%) did not use intention to treat analysis, 21% did not use any blinding techniques, and 41% reported concealment allocation procedures. Slightly more than half of the trials (55%) factored in background exposure to other fluoride sources, and only 41% properly adjusted for potential confounders.			
Main Findings	Fluoride interventions (varnishes, gels, and toothpaste) seem to have the most consistent benefit in decreasing the progression and incidence of NCCIs: 13 studies (5 toothpaste; 3 varnish; 5 gel; 1 mouthrinse. 8/13 studies reported significantly less caries in test from control. Studies using xylitol (1 study), CHX (1 study) alone) are very limited in number and in the majority of the cases did not show a statistically significant reduction. Casein phosphopeptide amorphous calcium phosphate (crème, mouse or gum): 6 studies; only gum 3x daily showed a significant difference at 2 years (this information difficult to confirm from information tabulated). Combination of chlorhexidine/fluoride varnish: 2 studies; significant improvement; high risk of bias. Sealants and resin infiltration studies point to a potential consistent benefit in slowing the progression or reversing NCCIs: 4/2 studies; all but two reported significant differences between sealant/infiltration and control. No difference between these. All had moderate to high risk of bias.			
Adverse events	Not reported			

Study details / Limitations	SETTINGS: COUNTRIES: Europe, South America, North America, Asia FUNDING SOURCES: STUDY LIMITATIONS:
Reviewers' Comments:	Search not restricted to English; various relevant databases; no gray literature; hand checking of review references and hand searching of Caries Research toc. Inclusion criteria applied. Various quality assessments carried out (ADA criteria, Cochrane Risk of Bias; Authors assessment). 103 papers identified and 74 excluded. Combining the results was not attempted.

Systematic Review SR5: Ricketts et al., 2013¹³

Author: Ricketts D, Lamont T, Innes NPT, Kidd E, Clarkson JE. Title: Operative caries management in adults and children. Citation: <i>Cochrane Database of Systematic Reviews</i> 2013, Issue 3. Art. No.: CD003808.				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 10	TOTAL NO. PATIENTS: 934 participants and 1372 teeth PATIENT CHARACTERISTICS: Participants with caries, affecting any tooth surface(s), in unrestored primary and permanent teeth. Stepwise, partial or no dentinal caries removal prior to restoration. The control groups involved complete caries removal. To avoid including dental pulps compromised by previous treatment only teeth with no previous restorations were considered.	There were three comparisons: 1) stepwise caries removal compared to complete one stage caries removal (four trials); partial caries removal compared to complete caries removal (three trials) and no dentinal caries removal compared to complete caries removal (two trials). (One three arm trial compared complete caries removal to both stepwise and partial caries removal.) Four studies investigated primary teeth, three permanent teeth and one included both.	Primary outcomes • Exposure of the dental pulp during caries removal. • Signs or symptoms of pulpal disease. • Progression of caries. • Restoration failure. Secondary outcomes • Health economic measures. • Oral health related quality of life. • Patient/carer and dentist perceptions of treatment. • Patient discomfort during treatment.	Included: Parallel group and split-mouth randomised controlled trials (RCTs), including quasi-randomised trials, that compared stepwise, partial or no dentinal caries removal with complete caries removal, prior to restoration.

Aim(s)	To assess the effects of stepwise, partial or no dentinal caries removal compared with complete caries removal for the management of dentinal caries in previously unrestored primary and permanent teeth.
Authors' quality assessment of studies included in review	All eight of the included trials were assessed at high risk of bias, although the four new trials showed evidence of attempts to minimise bias. Trials had relatively short-term follow up.
Main Findings	<p>Stepwise caries removal resulted in a 56% reduction in incidence of pulp exposure (risk ratio (RR) 0.44, 95% confidence interval (CI) 0.33 to 0.60, $P < 0.00001$, $I^2 = 0\%$) compared to complete caries removal based on moderate quality evidence, with no heterogeneity. In these four studies, the mean incidence of pulp exposure was 34.7% in the complete caries removal group and 15.4% in the stepwise groups. There was also moderate quality evidence of no difference in the outcome of signs and symptoms of pulp disease (RR 0.78, 95% CI 0.39 to 1.58, $P = 0.50$, $I^2 = 0\%$).</p> <p>Partial caries removal reduced incidence of pulp exposure by 77% compared to complete caries removal (RR 0.23, 95% CI 0.08 to 0.69, $P = 0.009$, $I^2 = 0\%$), also based on moderate quality evidence with no evidence of heterogeneity. In these two studies the mean incidence of pulp exposure was 21.9% in the complete caries removal groups and 5% in the partial caries removal groups. There was insufficient evidence to determine whether or not there was a difference in signs and symptoms of pulp disease (RR 0.27, 95% CI 0.05 to 1.60, $P = 0.15$, $I^2 = 0\%$, low quality evidence), or restoration failure (one study showing no difference and another study showing no failures in either group, very low quality evidence).</p> <p>No dentinal caries removal was compared to complete caries removal in two very different studies. There was some moderate evidence of no difference between these techniques for the outcome of signs and symptoms of pulp disease and reduced risk of restoration failure favouring no dentinal caries removal, from one study, and no instances of pulp disease or restoration failure in either group from a second quasi-randomised study. Meta-analysis of these two studies was not performed due to substantial clinical differences between the studies.</p> <p>Stepwise and partial excavation reduced the incidence of pulp exposure in symptomless, vital, carious primary as well as permanent teeth. Therefore these techniques show clinical advantage over complete caries removal in the management of dentinal caries. There was no evidence of a difference in signs or symptoms of pulpal disease between stepwise excavation, and complete caries removal, and insufficient evidence to determine whether or not there was a difference in signs and symptoms of pulp disease between partial caries removal and complete caries removal. When partial caries removal was carried out there was also insufficient evidence to determine whether or not there is a difference in risk of restoration failure. The no dentinal caries removal studies investigating permanent teeth had a similar result with no difference in restoration failure. The other no dentinal caries removal study, which investigated primary teeth, showed a statistically significant difference in restoration failure favouring the intervention.</p>
Adverse events	No evidence that incomplete caries removal is harmful. Rather complete removal is more likely to lead to pulpal exposure.
Study details / Limitations	<p>SETTINGS: Some secondary care, some primary care</p> <p>COUNTRIES: America, Brazil (2), Sweden (2), Scotland, Turkey. Sweden/Denmark</p> <p>FUNDING SOURCES: Funding for these studies was varied and included government and pharmaceutical sources, although for some the funding remained unclear.</p>

	STUDY LIMITATIONS: The different methods of reporting caries lesion depth estimation, reflects the current lack of an accepted standardised measure. What authors termed partial caries removal at the first stage of the stepwise excavation technique varied between studies.
Reviewers' Comments:	Well conducted systematic review with clearly defined protocol, comprehensive search and assessment of study design and quality. Studies assessed to be of moderate quality. Finding are consistent with previous version of this review and other reviews on the same topic: Hayashi M, Fujitani et al. Ways of enhancing pulp preservation by stepwise excavation--a systematic review. <i>J Dent.</i> 2011 Feb;39(2):95-107 and Thompson et al Treatment of deep carious lesions by complete excavation or partial removal: A critical review <i>J Am Dent Assoc.</i> 2008 June ; 139(6): 705–712.

Systematic Review SR6: Schewndicke et al., 2013¹⁴

Author: Schwendicke F, Meyer-Lueckel H, Dörfer C, Paris S.				
Title: Failure of incompletely excavated teeth--a systematic review.				
Citation: <i>J Dent.</i> 2013 Jul;41(7):569-80.				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 8	TOTAL NO. PATIENTS: 2405 teeth from over 1547 patients PATIENT CHARACTERISTICS: Humans with deep primary caries (depth > 1/2 dentine thickness or if pulpal exposure was anticipated) in clinically and/or radiologically vital, primary or permanent teeth requiring a restoration.	One- or two-step incomplete caries removal and subsequent restoration with amalgam, composite, compomer, glass ionomer cement or metal crowns.	Clinical or radiological failure (events or conditions associated with previous treatment of deep caries, which require re-treatment). Pulpal failures included pain, clinical or radiological signs of loss of vitality, or abscess or sinus formation leading to re-treatment. Nonpulpal failures included fracture of the tooth or the restoration, loss of the restoration or its integrity, or secondary as well as progressing residual caries leading to re-treatment. Weighted annual failure rates (AFRs) were used to analyse frequency and mode of failures.	Included randomised and non-randomised, controlled and uncontrolled, pro- and retrospective clinical studies.
Aim(s)	To analyse how incompletely excavated teeth fail, and if certain tooth- or treatment-related factors may influence risk of failure.			

Authors' quality assessment of studies included in review	29 articles reporting 19 trials were included. Twelve studies were RCTs, two studies were nonrandomised but controlled trials, and five studies were case series or retrospective studies. Grading of evidence was performed according to the GRADE network levels. Risk of bias was found very low for only two studies.
Main Findings	<p>Annual failure rates AFR was 3.8 (1.4/4.4)%. Eleven studies reported pulpal complications being the major reason for failure, and only 2 studies found more non-pulpal than pulpal failures. Sub-analyses found significantly lower risk of failure for teeth after one- compared with two-step excavation (Odds ratio [95% CI] = 0.21 [0.08, 0.55]) and teeth with single- compared with multi-surface cavities (0.33 [0.16, 0.67]). Risk of bias differed widely between studies, and evidence levels were graded as very low. Primary teeth seem to show higher risk of failure than permanent teeth after incomplete excavation.</p> <p>Conclusions: After incomplete removal of deep caries, pulpal failure was more common. One- compared with two-step excavation reduces risk of failure, and factors like number of restored surfaces seem to influence failure, but limited evidence permits drawing definitive conclusions. Clinical Significance: Growing evidence indicates that one-step incomplete excavation seems suitable to treat deep caries lesions, and might have advantages compared to two-step incomplete or complete caries removal. However, it is too early to recommend certain clinical strategies.</p>
Adverse events	Not specifically reported.
Study details / Limitations	<p>SETTINGS: Some secondary care (universities), some primary care COUNTRIES: Brazil , Germany, Sweden, Netherlands, Greece, Scotland, Turkey, Sweden/Denmark, Sweden, USA FUNDING SOURCES: Not stated STUDY LIMITATIONS: Only two of 19 studies had low risk of bias. Overall the evidence was graded as very low. Follow up times of included studies was generally rather short (median 24 months)</p>
Reviewers' Comments:	Reasonably well conducted systematic review. Efforts to assess of study design and quality. Authors are cautious about drawing conclusions because although cavity dimensions and treatment steps were identified as relevant factors influencing failure, most studies were not designed to address this.

Systematic Review SR7: Schwendicke et al., 2013¹⁵

Author: Schwendicke F, Dörfer CE, Paris S.				
Title: Incomplete caries removal: a systematic review and meta-analysis.				
Citation: J Dent Res. 2013 Apr;92(4):306-14. Review. Erratum in: J Dent Res. 2013 Aug;92(8):759. PubMed PMID: 23396521.				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review

SR AMSTAR score: 9	TOTAL NO. PATIENTS: 1257 (10 studies) PATIENT CHARACTERISTICS: humans with primary dentin caries in deciduous or permanent teeth requiring a restoration.	Incomplete (one- or two-step excavation, indirect pulp treatment, or capping) and complete caries removal techniques were investigated.	Primary outcomes Pulpal exposure during treatment; post-operative pulpal symptoms (clinical or radiological pulp symptoms requiring treatment, <i>e.g.</i> , pain, irreversible pulpitis, loss of vitality); overall failure (technical or biological complications demanding intervention, <i>e.g.</i> , restorations lost or to be replaced, pulpitis, non-restorable teeth) Secondary outcome caries progression.	Included: Randomised Controlled Trials Studies investigating nonrestorative treatment (remineralization, non-restorative cavity treatment), non-invasive treatment (caries sealing or infiltration), or non-clinical or case studies were excluded. Non-clinical or case studies were excluded.
Aim(s)	To critically summarize and evaluate results of randomized controlled trials (RCTs) investigating one- or two-step incomplete compared with complete caries removal. Studies treating primary and permanent teeth with primary caries lesions requiring a restoration were analyzed.			
Authors' quality assessment of studies included in review	Most of the 10 studies included were found to have considerable risk of bias. For one outcome (pulp exposure), the magnitude of reported effects was consistent and large. This was included within the grading. For one outcome (failure), Funnel plot analysis indicated publication bias. Overall, only pulp exposure effect estimates were graded as "moderate". All other outcomes were graded as "low" or "very low" evidence. Most studies lacked details of randomisation. In all but two studies, neither operator nor examiner was blinded.			
Main Findings	Summary: Meta-analysis showed risk reduction for both pulpal exposure (OR [95% CI] 0.31 [0.19-0.49]) and post-operative pulpal symptoms (OR 0.58 [0.31-1.10]) for teeth treated with one- or two-step incomplete excavation. Risk of failure seemed to be similar for both complete and incomplete excavation, but data for this outcome were of limited quality and inconclusive (OR 0.97 [0.64-1.46]). Based on reviewed studies, incomplete caries removal seems advantageous compared with complete excavation, especially in proximity to the pulp. However, evidence levels are currently insufficient for definitive conclusions because of high risk of bias within studies. Pulpal Exposure Two and five studies with one- and two-step incomplete caries removal reported pulpal exposures, with 1 study reporting results for both methods. Data were analyzed within subgroups (one- and two-step incomplete excavation) as well as pooled for both subgroups. There was a significant overall risk reduction for pulpal exposure (OR [95% CI] 0.31 [0.19-0.49]) for incomplete excavation compared with complete caries removal. Data for one-step incomplete caries removal indicated an even lower risk for this technique (OR 0.20 [0.06-0.61]). For stepwise excavation, only 2 studies reported the visit during which the pulps were exposed. Pulpal exposure was more common during the second excavation step, with 87% and 100% of exposures at this stage. Pulpal Symptoms: Six studies reported post-operative pulpal symptoms. One study reported pulp affection within the intervention group, but it remained unclear if the control group was followed up (pulp were presumably found necrotic when exposed during excavation, thus being unrelated to treatment). The study was therefore excluded for this outcome analysis. For another study, teeth with unclear vitality diagnosis were			

	<p>excluded. Since only 3 studies investigated one-step incomplete excavation, data for one- and two-step treatments were pooled. There was a significant overall risk reduction of pulpal complications after incomplete compared with complete excavation (OR 0.58 [0.31-1.10]).</p> <p>Failure: Five studies investigated the integrity of the restoration and technical complications, with reduced (one study), increased (3 studies), or similar (2 studies) failure rates for incomplete vs. complete excavation. For one study, teeth restored with black copper cement were excluded for further analysis, since black copper cement is not the standard of treatment for incomplete caries removal. Four other studies reported pulpal complications. All nine studies were eventually pooled for failure analysis. Risk of failure was similar for incompletely and completely excavated teeth (OR 0.97 [0.64-1.46]).</p> <p>Caries Progression: In two studies caries was found to progress marginally or under the restoration within the incomplete removal group in 25% (6/24) or 0.6% (1/156) of teeth. For the complete excavation group, one study reported that 9% (7/79) of teeth restored with amalgam showed marginal or occlusal caries. Another study reported significantly more lesions progressing in the complete excavation group. One study found no caries progression in either completely or incompletely excavated teeth. Because of these sparse and contradictory data, meta-analysis was not attempted.</p>
Adverse events	Not specifically reported.
Study details / Limitations	<p>SETTINGS: Some secondary care, some primary care</p> <p>COUNTRIES: Brazil (2) , Germany, Sweden (2), Scotland, Thailand, Turkey, Sweden/Denmark, USA</p> <p>FUNDING SOURCES: Not stated</p> <p>STUDY LIMITATIONS: Dentitions were not analyzed separately, since teeth from both dentitions were mixed within 1 study and only 2 other studies reported data for permanent teeth. The amount of carious tissue removed varied considerably. Furthermore, a range of materials had been used (liners, cements, restorative materials).</p>
Reviewers' Comments:	<p>Reasonably well conducted systematic review. Search was particularly comprehensive. Efforts to assess of study design and quality. Studies assessed to be of moderate quality.</p> <p>Finding are consistent with previous other reviews on a similar topic (based largely on the same studies).</p> <p>Although the authors find that incomplete caries removal seems advantageous compared with complete excavation, especially in proximity to the pulp, they are cautious about making definitive conclusions or recommendations because of high risk of bias within studies.</p>

Systematic Review SR9: Ferreira et al., 2012¹⁶

Author: Ferreira JM, Pinheiro SL, Sampaio FC, de Menezes VA.				
Title: Caries removal in primary teeth--a systematic review.				
Citation: Quintessence Int. 2012 Jan;43(1):e9-15. Review. PubMed PMID: 22259813				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review

SR AMSTAR score: 3 (/11)	TOTAL NO. PATIENTS: 408 PATIENT CHARACTERISTICS: Children age 3-10	Total, partial and/or nonmechanical removal of caries in primary teeth .	Various in included studies (not clearly stated a priori.	Randomised Controlled Trials
Aim(s)	To address what is the ideal limit in removing carious tissue to address a caries lesion in the primary dentition before restoration.			
Authors' quality assessment of studies included in review	Assessed eligibility and quality using an 11 points scale PEDro). Only 3 of 157 identified studies satisfied the criteria of PEDro ≥ 5 . Different clinical methodologies limited comparison between studies.			
Main Findings	<p>Three studies were included. One compared partial caries removal (liner and GIC or GIC) with total removal and found no significant difference in durability. The second trial compared the Hall technique (no caries removal and preformed metal crown restoration) with operator's conventional treatment and found better performance in the Hall group. In the third study partial removal was compared with total removal and no significant differences in the level of microorganism colonisation was found.</p> <p>Author's Conclusions: Although limited published scientific evidence is available to guide clinicians in regard to the ideal limit of removing carious tissue and arresting caries lesions, this systematic review suggests that minimally invasive techniques (partial or nonmechanical removal of carious lesions) and the procedures of choice in the arrest of dental caries in the primary dentition.</p> <p>The author's conclusion that partial or non-mechanical removal of caries is preferable is based on very limited evidence and on the findings that partial removal is no worse than complete in the studies included.</p>			
Adverse events	Not reported.			
Study details / Limitations	<p>SETTINGS: Not stated COUNTRIES: No stated FUNDING SOURCES: Not stated STUDY LIMITATIONS: Literature searching was limited. Quality assessment was limited. Not clear that data extraction was conducted in duplicate.</p>			
Reviewers' Comments:	Review was methodologically weak. Search was limited to Cochrane database and Medline/PubMed, years 2000-2010. Assessment of study quality was limited. Conflict of interests were not stated.			

Systematic Review SR9 Hoefler et al., 2016¹⁷

Author: V Hoefler, H Nagaoka, C Miller

Title: Long-term survival and vitality outcomes of permanent teeth following deep caries treatment with step-wise and partial-caries-removal: A Systematic Review

Citation: Journal of Dentistry 54 (2016) 25–32

Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 6 (/11)	TOTAL NO. PATIENTS: 426 permanent teeth PATIENT CHARACTERISTICS: age 6-53	Partial caries removal Stepwise caries removal	Restorative failures at ≥ 2 years Loss of pulp vitality at ≥ 2 years	Included: Randomized controlled trials, controlled clinical trials, cohort studies, observational and case series. If studies included data on teeth whose pulps were exposed for any reason, those teeth were excluded Gray literature was not evaluated, and unpublished information from authors was not sought after or used.
Aim(s)	To compare the long-term survival of deep dentine caries affected permanent teeth treated with partial-caries-removal (PCR) versus similar teeth treated with stepwise-caries-removal techniques (SWT)			
Authors' quality assessment of studies included in review	Two RCTs were included and the methodological quality (i.e. method for randomization, allocation concealment, blinding of participants and outcome assessment, management of incomplete data, selective reporting, and other sources of bias) was assessed using the Cochrane Collaboration risk of bias assessment tool. One RCT was considered to be at high risk of bias because it was unclear whether investigators were blinded when assessing outcomes. There was also incomplete outcome data, selective reporting of outcomes of interest for this review, vitality assessment methods that may have been inadequate to accurately diagnose pulpal health, and liners for PCR and SWT with disparate adhesive mechanical, and antibacterial properties. The second RCT had unclear randomization, allocation concealment and blinding, as well as incomplete outcome data, selective reporting, and pulp vitality assessment methodology with high risk of bias. Three observational studies were included and assessed to be of low quality using a modified version of the Newcastle-Ottawa scale (NOS).			
Main Findings / Recommendations	For restorative failures, >88% success at two years for both techniques was reported, but the two techniques were not studied together and so comparison is indirect. For loss of pulp vitality, observational studies reported >96% vitality at two years for each technique, while one RCT reported significantly higher vitality ($p < 0.05$) at three years for PCR (96%) compared to SWT (83%). Authors conclusions: Successful vitality and restorative outcomes for both PCR and SWT have been demonstrated at two years and beyond in permanent teeth with deep dentine caries. PCR may result in fewer pulpal complications over a three-year period than SWT, although claims of a therapeutic advantage are based on very few, limited-quality studies.			
Adverse events	Not reported			

Study details / Limitations	SETTINGS: Not stated COUNTRIES: Europe and South America FUNDING SOURCES: not stated STUDY LIMITATIONS: Several limitations, including questionable measures of pulp vitality in included studies, uncertainty about extent of residual caries across studies, only one RCT addressed the primary objective of this systematic review.
Reviewers' Comments:	Very few studies that addressed the review question were found and these were of low quality. Given the diverse study types meta analysis was not appropriate.

Systematic Review SR10: Mickenautsch et al., 2011¹⁸

Author: Mickenautsch S, Yengopal V.				
Title: Absence of carious lesions at margins of glass-ionomer cement and amalgam restorations: An update of systematic review evidence.				
Citation: BMC Res Notes. 2011 Mar 11;4:58.				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 9 (/11)	TOTAL NO. PATIENTS: 2100 PATIENT CHARACTERISTICS: Children (3-16 years old)	Comparison of GIC versus Amalgam	Primary: Recurrent Caries, Caries at Margin, Secondary: Caries progression and regression in approximal tooth surfaces adjacent to restoration surfaces of neighbouring teeth	2-arm clinical prospective study design
Aim(s)	To update the existing evidence provided by a previous article regarding the review question of whether, in the same dentition and same cavity class, glass-ionomer cement (GIC) restored cavities show less recurrent carious lesions on cavity margins than cavities restored with amalgam.			
Authors' quality assessment of studies included in review	10 included trials with 13 datasets for primary outcomes and 4 for secondary. 9 for restoration of primary teeth and 4 for permanent teeth. Study quality was assessed and documented using detailed criteria to determine risk of biases. Randomisation and blinding were not reported for most studies indicating high risk of selection or detection/performance bias. Attrition and publication biases were examined and assessed as acceptable (i.e. unlikely to affect the overall results).			
Main Findings	For permanent teeth, two of four datasets had sufficient clinical homogeneity for meta analysis that showed that margins of single-surface GIC restorations in permanent teeth had a 65% lower chance of developing carious lesions on restoration margins after 6 years than did similar teeth restored with amalgam (RR 0.35; 95% CI 0.19 - 0.65; p = 0.001). No difference was found between single-surface restorations after 1 year (DS 09: RR 0.56; 95% CI 0.25 - 1.24, p = 0.15). For primary teeth, two of nine datasets had sufficient clinical homogeneity for meta analysis that showed no difference between the types of multiple-surface restorations, with regard to the chance of developing carious lesions on margins after 3 years (RR 0.38; 95% CI 0.13 - 1.12; p = 0.08).			

	<p>For secondary outcomes, three datasets reported lower caries progression in surfaces adjacent to GIC with no difference between materials in caries regression after 3 years. Cumulative meta-analysis indicates that further studies in this area may alter this finding.</p> <p>The overall results of the computed datasets suggest that GIC has a higher caries-preventive effect than amalgam for restorations in permanent teeth. No difference was found for restorations in the primary dentition. However, given the high risk of bias further well-designed randomised controlled trials are required to verify these results.</p>
Adverse events	
Study details / Limitations	<p>SETTINGS: Public dental service, University, no stated.</p> <p>COUNTRIES: UK, Sweden (2), Syria (2) Tanzania (2), Lebanon, Denmark, China</p> <p>FUNDING SOURCES: Not stated</p> <p>STUDY LIMITATIONS: Most studies at high risk of bias (selection & detection/performance bias). None of the studies reported on fluoride exposure, which may have confounded results.</p>
Reviewers' Comments:	A fairly well conducted review which investigates sources of bias in detail. Based on thorough literature search with careful consideration of potential bias in included studies.

Systematic Review SR11: Innes et al., 2015¹⁹

<p>Author: Innes NPT, Ricketts D, Chong LY, Keightley AJ, Lamont T, Santamaria RM.</p> <p>Title: Preformed crowns for decayed primary molar teeth.</p> <p>Citation: <i>Cochrane Database of Systematic Reviews</i> 2015, Issue 12. Art. No.: CD005512.</p>				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 10 (/11)	<p>TOTAL NO. PATIENTS: 438 child participants and 693 teeth</p> <p>PATIENT CHARACTERISTICS: Children with caries in primary teeth.</p>	<p>There were three comparisons:</p> <ol style="list-style-type: none"> 1) crowns versus fillings (4 studies) 2) crowns versus non-restorative caries treatment (1 study) 3) Metal crowns versus aesthetic crowns (1 study) 	<p>Primary outcomes</p> <ul style="list-style-type: none"> • Major failure – long term (12 months to 48 months) • Pain – long term (12-24 month) • Satisfaction with treatment <p>Secondary outcomes</p> <ul style="list-style-type: none"> • Time to restoration failure/retreatment • Discomfort with the procedure • Cost • Adverse events 	<p>Inclusion</p> <p>Randomised controlled trials (RCTs) that assessed the effectiveness of crowns compared with fillings, other types of crowns, nonrestorative approaches or no treatment in children with untreated tooth decay in one or more primary molar teeth.</p>
Aim(s)	1. To evaluate the clinical effectiveness and safety of all types of preformed crowns for restoring primary teeth compared with conventional filling materials (such as amalgam, composite, glass ionomer, resin modified glass ionomer and compomers), other types of crowns or methods of crown placement, non-restorative caries treatment or no treatment.			

	2. To explore whether the extent of decay has an effect on the clinical outcome of primary teeth restored with all types of preformed crowns compared with those restored with conventional filling materials.
Authors' quality assessment of studies included in review	<p>Study limitation (risk of bias) was examined in detail and together with consideration of inconsistency, indirectness of evidence, imprecision and publication bias informed an assessment of the overall quality of the evidence for each outcome using the GRADE approach.</p> <p>The authors stated that the evidence was obtained from well conducted randomised controlled trials (split-mouth, and with tooth as unit of randomisation) with a generally low risk of bias for randomisation and allocation concealment. However, the overall risk of bias for the studies was high, due to inadequate blinding and risks in attrition bias. In addition, there was imprecision as the study sizes were relatively small, and therefore large confidence intervals were observed.</p> <p>For the comparisons of crowns against fillings, the authors downgraded all outcomes one level due to the lack of blinding, and gingival bleeding a second level due to imprecision. For the comparison of crowns fitted using the Hall Technique versus non-restorative caries treatment, the authors downgraded outcomes three levels for serious risk of bias and imprecision. The quality of evidence therefore ranged from moderate (we have moderate confidence in the estimate of the effect) to very low (we are very uncertain of the estimate of the effect).</p> <p>Very little information was available for the comparison of metal versus aesthetic crowns, and the authors consider the quality of evidence for all the outcomes in this comparison, which came from only one small study, as very low.</p>
Main Findings	<p>Five studies that evaluated three comparisons were included. Four studies compared crowns with fillings; two of them compared conventional PMCs with open sandwich restorations, and two compared PMCs fitted using the Hall Technique with fillings. One of these studies included a third arm, which allowed the comparison of PMCs (fitted using the Hall Technique) versus non-restorative caries treatment. In the two studies using crowns fitted using the conventional method, all teeth had undergone pulpotomy prior to the crown being placed. The final study compared two different types of crowns: PMCs versus aesthetic stainless steel crowns with white veneers. No RCT evidence was found that compared different methods of fitting preformed metal crowns (i.e. Hall Technique versus conventional technique).</p> <p>Outcomes reported at the dental appointment or within 24 hours of it, and in the short term (less than 12 months) or long term (12 months or more) were considered. Some of our outcomes of interest were not measured in the studies: time to restoration failure or retreatment, patient satisfaction and costs.</p> <p><i>Crowns versus fillings</i></p> <p>All studies in this comparison used PMCs. One study reported outcomes in the short term and found no reports of major failure or pain in either group. There was moderate quality evidence that the risk of major failure was lower in the crowns group in the long term (risk ratio (RR) 0.18, 95% confidence interval (CI) 0.06 to 0.56; 346 teeth in three studies, one conventional and two using Hall Technique). Similarly, there was moderate quality evidence that the risk of pain was lower in the long term for the crown group (RR 0.15, 95% CI 0.04 to 0.67; 312 teeth in two studies).</p> <p>Discomfort associated with the procedure was lower for crowns fitted using the Hall Technique than for fillings (RR 0.56, 95% CI 0.36 to 0.87; 381 teeth) (moderate quality evidence).</p> <p>It is uncertain whether there is a clinically important difference in the risk of gingival bleeding when using crowns rather than fillings, either in the short term (RR 1.69, 95% CI 0.61 to 4.66; 226 teeth) or long term (RR 1.74, 95% CI 0.99 to 3.06; 195 teeth, two studies using PMCs with conventional technique at 12 months) (low quality evidence).</p> <p><i>Crowns versus non-restorative caries treatment</i></p>

	<p>Only one study compared PMCs (fitted with the Hall Technique) with non-restorative caries treatment; the evidence quality was very low and therefore the estimates are uncertain.</p> <p><i>Metal crowns versus aesthetic crowns</i></p> <p>One split-mouth study (11 participants) compared PMCs versus aesthetic crowns (stainless steel with white veneers). It provided very low quality evidence so no conclusions could be drawn.</p> <p>Conclusions: Crowns placed on primary molar teeth with carious lesions, or where pulp treatment has been carried out, are likely to reduce the risk of major failure or pain in the long term compared to fillings. Crowns fitted using the Hall Technique may reduce discomfort at the time of treatment compared to fillings.</p>
Adverse events	The only adverse event recorded for crowns versus fillings was gingival bleeding, though this result was inconclusive and its clinical relevance debatable.
Study details / Limitations	<p>SETTINGS: Some secondary care, some primary care</p> <p>COUNTRIES: Saudia Arabia, USA, UK, Israel and Germany</p> <p>FUNDING SOURCES: No information provided for three studies; government; university.</p> <p>STUDY LIMITATIONS: The overall risk of bias for the studies was high, due to inadequate blinding and risks in attrition bias. In addition, there was imprecision as the study sizes were relatively small, and therefore large confidence intervals were observed.</p>
Reviewers' Comments:	Well conducted systematic review with clearly defined protocol, comprehensive search and assessment of study design and quality. Moderate quality evidence indicates that the likelihood of a major failure or pain in the long term is less when crowns are fitted compared to fillings for primary teeth with caries or after pulp treatment. Moderate quality evidence also indicates that less discomfort is experiences with crowns fitted with the Hall Technique, compared to fillings.

Systematic Review SR12: Dorri et al., 2016²⁰

<p>Author: Dorri M, Dunne SM, Walsh T, Schwendicke F.</p> <p>Title: Micro-invasive interventions for managing proximal dental decay in primary and permanent teeth.</p> <p>Citation: <i>Cochrane Database of Systematic Reviews</i> 2015, Issue 11. Art. No.: CD010431. DOI: 10.1002/14651858.CD010431.pub2.</p>				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score:11 (/11)	<p>TOTAL NO. PATIENTS: 395 (8 Studies)</p> <p>PATIENT CHARACTERISTICS: people with dental decay on proximal surfaces of primary and permanent teeth.</p>	<p>different micro-invasive methods (e.g. resin infiltration, resin sealant, sealant patch and glass ionomer)</p> <p>VS</p>	<p>Caries progression measured by digital subtraction radiography (DSR)</p> <p>> pairwise > visual scoring (12 months to 36 months follow-up)</p>	<p>Randomised Controlled Trials with at least six months follow-up. Both parallel group and split-mouth study designs were eligible for inclusion. The unit of randomisation could be a group (e.g.</p>

		non-invasive treatments (e.g. fluoride varnish, advice to floss)	Change in decayed, missing and filled (DMF/ dmf) figures at surface, tooth and whole mouth level	school, class), an individual, a tooth or lesion, or tooth and lesion pairs.
Aim(s)	To evaluate the effects of micro-invasive treatments for managing proximal caries lesions in primary and permanent dentition in children and adults			
Authors' quality assessment of studies included in review	<p>Thorough Risk of bias assessment including: Sequence Generation, Allocation sequence concealment, blinding of participants and personnel, incomplete outcome data, selective outcome reporting, other sources of bias. Assessment of clinical heterogeneity of studies. And statistical heterogeneity (I^2). Assessment of reporting bias.</p> <p>Risk of bias was summarised overall as Low, Unclear or High. GRADEprofiler software (GRADEpro) was used to provide the overall grading of the quality of evidence for the caries outcomes according to recommendations outlined by the GRADE network.</p>			
Main Findings / Recommendations	<p>Micro-invasive treatments involve conditioning the tooth surface with an acid and then either placing a sealant on top of the surface or 'infiltrating' the softer demineralised tissue with resins to install a barrier either on the tooth surface or within the demineralised tissue. This protects the tooth against acids and avoid the further loss of minerals from within the tooth which, in theory, should stop caries developing.</p> <p>Included eight trials, which randomised 365 participants. The trials all used a split-mouth design, some with more than one pair of lesions treated within the same participant. Six studies evaluated the effects of micro-invasive treatments in the permanent dentition and two studies on the primary dentition, with caries risk ranging from low to high. Investigators measured caries risk in different studies either by caries experience alone or by using the Cariogram programme, which combines eight contributing factors, including caries experience, diet, saliva and other factors related to caries. The follow-up period in the trials ranged from one to three years. All studies used lesion progression as the primary outcome, evaluating it by different methods of reading radiographs. Intervention effects were evaluated for all micro-invasive therapies and analysed subgroups according to the different treatment methods reported in the included studies.</p> <p>The meta-analysis, which pooled the most sensitive set of data (in terms of measurement method) from studies presenting data in a format suitable for meta-analysis, showed that micro-invasive treatment significantly reduced the odds of lesion progression compared with non-invasive treatment (e.g fluoride varnish) or oral hygiene advice (e.g to floss) (OR 0.24, 95% CI 0.14 to 0.41; 602 lesions; seven studies; $I^2 = 32\%$). There was no evidence of subgroup differences ($P = 0.36$).</p> <p>The the quality of evidence for micro-invasive treatments was assessed as moderate. It remains unclear which micro-invasive treatment is more advantageous, or if certain clinical conditions or patient characteristics are better suited for micro-invasive treatments than others.</p> <p>The authors concluded that the available evidence shows that micro-invasive treatment of proximal caries lesions arrests non-cavitated enamel and initial dentinal lesions (limited to outer third of dentine, based on radiograph) and is significantly more effective than non-invasive professional treatment (e.g. fluoride varnish) or advice (e.g. to floss). The authors were moderately confident that further research is unlikely to substantially change the estimate of effect. Due to the small number of studies, it does remain unclear which micro-invasive technique offers the greatest benefit, or whether the effects of micro-invasive treatment confer greater or lesser benefit according to different clinical or patient considerations.</p>			

Adverse events	The four studies that measured adverse events reported no adverse events after micro-invasive treatment. Most studies did not report on any further outcomes.
Study details / Limitations	SETTINGS: Studies took place in university or dental public health clinics COUNTRIES: Brazil, Colombia, Denmark, Germany, Thailand, Greenland and Chile. FUNDING SOURCES: Four studies received industry support to carry out the research, with one of them being carried out by inventors of the intervention. STUDY LIMITATIONS: Seven studies were assessed to be at high overall risk of bias, primarily due to lack of blinding of participants and personnel.
Reviewers' Comments:	These newer micro-invasive techniques are modifications of the well-established pit and fissure sealant technique for application to proximal surfaces. While this review demonstrates that the two main techniques, resin infiltration and resin sealants, can significantly reduce the likelihood of caries progression there is not sufficient evidence at the moment to determine which individual technique is best. However the evidence is sufficient to show that these new methods are more effective than other non-invasive treatments. A concern about the use of these techniques is lack of insight to the applicability, technical feasibility, patient preferences and additional costs (both in terms of time and materials) which should be a consideration when using this evidence to inform recommendations.

Systematic Review SR13: Gao et al., 2016²¹

Author: SS Gao, S Zhang, ML Mei, EC Lo and C Chu Title: Caries remineralisation and arresting effect in children by professionally applied fluoride treatment – a systematic review Citation: <i>BMC Oral Health</i> (2016) 16:12				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 6 (/11) Guideline AGREE score: (7)	TOTAL NO. PATIENTS: early enamel caries: 2069 teeth (627 included in meta-analysis); mainly permanent teeth (2 studies primary teeth) dentine cares: 12,145 teeth (5571 included in meta-analysis); primary and permanent teeth PATIENT CHARACTERISTICS: Children, ages not specified.	Topical fluoride in various forms (silicon tetrafluoride; sodium fluoride gel; acidulated phosphate fluoride gel; silver diamine fluoride, sodium fluoride varnish; nano silver fluoride)	Percentage remineralised early enamel carious lesions or size reduction (EECL Percentage arrest of dentine caries.	Randomised controlled trials Excluded caries prevention trials
Aim(s)	To investigate the clinical efficacy of professional fluoride therapy in remineralising and arresting caries in children			

Authors' quality assessment of studies included in review	While risk of bias assessments were reported using the Cochrane Handbook for Systematic Reviews of interventions recommended method, discussion of the significance of the findings was limited. For some studies, blinding of outcome measurement and allocation concealment were either not achieved or not mentioned by the researchers. The sample size of some studies was small, while some studies didn't report the statistical procedure of sample size calculation or justified the sample size used in their studies. Of the relatively small number of studies that met the inclusion criteria, the methodology and outcome measurement varied between studies, making comparison difficult. Hence, not all selected studies were able to be included in meta-analysis.
Main Findings / Recommendations	Seventeen randomised clinical trials were included. Ten studies investigated the remineralising effect on early enamel caries using silicon tetrafluoride, fluoride gel, silver diamine fluoride or sodium fluoride. Seven studies reported an arresting effect on dentine caries using silver diamine fluoride or nano-silver fluoride. Meta-analysis was performed on four papers using 5 % sodium fluoride varnish to remineralise early enamel caries, and the overall percentage of remineralised enamel caries was 63.6 % (95 % CI: 36.0 % - 91.2 %; $p < 0.001$). Heterogeneity was high. Meta-analysis was also performed on five papers using 38 % silver diamine fluoride to arrest dentine caries and the overall proportion of arrested dentine caries was 65.9 % (95 % CI: 41.2 % - 90.7 %; $p < 0.001$). Results of meta-analysis on four studies showed that 5 % NaF varnish remineralised approximately two-thirds of early enamel caries lesions in children. The frequency of application and follow up period are not clearly stated in the review. Apart from NaF varnish, there is limited evidence to support the benefits of using other professional-applied fluoride agents to treat early enamel lesions. Approximately two-thirds of dentine lesions were arrested using 38% silver diamine fluoride.
Adverse events	Adverse events not reported. Black staining of carious lesions by SDF might be viewed negatively by some children and their parents. The high fluoride concentration in 38% SDF might also be a safety concern though existing literature report no serious adverse effects.
Study details / Limitations	SETTINGS: Not stated COUNTRIES: not stated FUNDING SOURCES: not stated STUDY LIMITATIONS: Limited details of included studies provided. Although the included studies were assessed for risk of bias, the extent to which this was considered in the analysis is unclear. Variation in outcome measures limited the studies that could be included in the meta analysis. Limited to studies reported in English, which might exclude some studies, particularly reporting on use of SDF, which is most commonly used in Asia and South America.
Reviewers' Comments:	Limited reporting restricts interpretation of some aspects. Supports the use of 5% sodium fluoride varnish to remineralise whites spot/early enamel carious lesions. Also supports the use of silver diamine fluoride to arrest dental caries. However, it is noted that SDF is not licensed for caries treatment in the UK.

Systematic Review SR14: Lenzi et al., 2016²²

Author: TL Lenzi, AF Montagner, FZ Soares, R de Oliveira Rocha
Title: Are topical fluorides effective for treating incipient carious lesions?
Citation: *Journal of the American Dental Association*. 2016;147:84-91.e81.

Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 8 (/11)	TOTAL NO. PATIENTS: FV 274; FG 308 PATIENT CHARACTERISTICS: Children mean age 3-12	Fluoride varnish or fluoride gel, varying frequency and number of applications.	Arrest or reversal of incipient carious lesions in primary or permanent teeth	Randomised controlled trials
Aim(s)	To evaluate the effectiveness of professional topical fluoride application (gels or varnishes) on the reversal treatment of incipient enamel carious lesions in primary or permanent dentition.			
Authors' quality assessment of studies included in review	Although the participants were randomly assigned to experimental groups in 2 studies, a clear statement of the randomization method was not observed. A lack of information about the allocation concealment and masking of participants was verified in the studies. Only 1 study reported a sample characteristics imbalance at baseline.			
Main Findings / Recommendations	Five studies were included. Only the three concerning fluoride varnish application were included in the meta analysis. The two studies concerned with fluoride gel and quantitative analysis was not possible. The therapeutic methods ranged considerably regarding the fluoride application protocols. There was a significant trend of effectiveness of fluoride varnish on the reversal of incipient enamel carious lesions (weighted mean difference -2.04 CI: -3.25 to -0.84; P < .05). High heterogeneity was found in the meta-analysis. Fluoride varnish seems to be an effective treatment for the reversal of incipient carious lesions in primary and permanent dentition. However, the preferred protocol for fluoride varnish application has yet to be established.			
Adverse events	None reported			
Study details / Limitations	SETTINGS: No stated COUNTRIES: Fluoride varnish: USA, Brazil, Albania; Fluoride Gel: Brazil (2) FUNDING SOURCES: Not stated STUDY LIMITATIONS: Relatively few studies were found that addressed the review question. There was considerable variation in the topical fluoride application methods across studies and short follow up period in some studies. Included studies had medium to high risk of bias and heterogeneity was high.			
Reviewers' Comments:	Analysis was based on only three relatively small studies examining the effect of fluoride varnish application. Supports the use of 5% fluoride varnish as a treatment to reverse early carious lesions (active white spot lesions) in primary and permanent teeth.			

Guideline G2: Wright et al., 2016⁹ see appraisal form under Caries Prevention - Fissure Sealants

Pulp Therapy in Primary Teeth

Guideline G4: Rodd et al. 2006²³

Author: British Society of Paediatric Dentistry: HD Rodd, PJ Waterhouse, AB Fuks, SA Fayle & MA Moffat Title: The pulp treatment of the primary dentition Available at: https://www.rcseng.ac.uk/-/media/files/rcs/fds/publications/pulptherapy.pdf?la=en Citation: <i>Int J Paed Dent</i> 2006; 116 (Suppl. 1): 15-23				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
Guideline AGREE score: 2 (/7)	TOTAL NO. PATIENTS: N/A PATIENT CHARACTERISTICS: Children with grossly carious primary teeth	Indirect pulp treatment Direct pulp capping Pulpotomy Desensitising pulp therapy Pulpectomy		Not stated
Aim(s)	To encourage improvement in clinical practice and to stimulate research and clinical audit in areas where scientific evidence is inadequate To facilitate good decision-making and evidence-based practice for young patients			
Authors' quality assessment of studies included in review	Studies were assigned a SIGN level of evidence as an indicator of quality, most likely based on study design. Risk of bias in the included studies was not specifically discussed.			
Main Findings	<ul style="list-style-type: none"> • Gives recommendations on various forms of pulp treatment as management strategies for grossly carious primary molar teeth. • Supports the use of Indirect pulp treatment based on >90% clinical success reported in a number of well-designed retrospective descriptive studies. • Recommends against pulp capping due to poor success rate (based on low quality evidence). • Use of the formocresol pulpotomy, the ferric sulphate pulpotomy, electrocautery or pulpectomy are equally successful techniques (based on meta-analysis; randomised controlled trials and other well conducted clinical studies). More recent studies are also reporting good success rates with the use of MTA (grey and white formulations) in pulpotomised primary molars. Long-term success rates for the use of calcium hydroxide in primary molar pulpotomy appear to be lower than for other approaches. Routine use of formocresol pulpotomy is not recommended due to concerns about safety and the availability of alternatives. • Desensitised pulp therapy is only recommended for cases where good anaesthesia cannot be achieved or there is initial poor patient compliance as there is no good quality evidence to support its more general use. • Pulpectomy achievable with practice and appropriate patient selection (86% clinical success at 3 years). One-or two stage procedures may be used. • Regular clinical and radiographic review is essential. • All procedures require good isolation with rubber dam. 			

Adverse events	Not specifically reported
Study details / Limitations	SETTINGS: COUNTRIES: FUNDING SOURCES: STUDY LIMITATIONS:
Reviewers' Comments:	This guideline scores poorly for scope and purpose, stakeholder involvements, rigour of development, editorial independence (as not stated) and applicability. How evidence has been sourced and how comprehensive the search for evidence was is unclear. An assessment of quality is included and does seem to have been taken into account when formulating recommendations. There is generally a lack of clarity about how the guideline has been developed which restricts its use significantly.. That said, the recommended practice is fairly comprehensively described in a procedural style, which some practitioners might find useful. The guideline is now archived on the Royal College of Surgery of England website.

Systematic Review SR15: Anthonappa et al., 2013²⁴

Author: Anthonappa RP, King NM, Martens LC.				
Title: Is there sufficient evidence to support the long-term efficacy of mineral trioxide aggregate (MTA) for endodontic therapy in primary teeth?				
Citation: <i>Int Endod J.</i> 2013 Mar;46(3):198-204.				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 4 (/11)	TOTAL NO. PATIENTS: MTA vs FC 1077 teeth Other vs MTA 487 teeth PATIENT CHARACTERISTICS: Children with extensive decay involving dental pulp in primary teeth. Age range 2.5-12 years	MTA compared to other medicaments - as a pulpotomy medicament in primary teeth were selected Medicaments included: Mineral Trioxide Aggregate (MTA), Formocresol (FC), Ferric Sulfate (FS), Calcium Hydroxide (CH), Portland cement, calcium-enriched mixture cement (CEM), and grey MTA.	Primary outcome 2 primary outcomes: • Clinical success / failure	Included: Only human clinical outcome studies that evaluated the efficacy of MTA as a pulpotomy medicament in primary teeth were selected.
Aim(s)	To evaluate whether the currently available evidence is of an appropriate quality to support the long-term effectiveness of MTA as a pulpotomy medicament in primary molars using the modified version of the standard criteria			

Authors' quality assessment of studies included in review	All the articles were assessed and graded, by two examiners, using the modified standard assessment criteria, for pulpotomy in primary teeth, as proposed by Fuks & Papagiannoulis (2006). Only an overall score and therefore grade was provided. Although a brief description of these criteria was included, how each study matched these criteria was not stated. None of the 22 studies obtained grade A. Amongst the 17 studies that compared MTA with formocresol as one of the groups, two studies attained grade B1, three were graded B2 and 12 received grade C. Furthermore, amongst the five studies that compared MTA with medicaments other than formocresol as one of the groups, two studies attained grade B1, two were graded B2 and one study received grade C. The interobserver agreement was found to be excellent with a score of 1.00 (kappa).
Main Findings	MTA vs FC Amongst the two studies that obtained grade B1, both MTA and formocresol exhibited similar success rates. Although MTA demonstrated a higher success rate compared with formocresol, this did not reach statistical significance. Similarly, amongst the studies that attained grade B2, two studies reported no statistical differences between the two medicaments, whilst one study exhibited a significant difference with MTA being superior to formocresol. MTA vs others: Amongst the two studies that obtained grade B1, one study reported a higher success rate for MTA when compared with ferric sulphate, whilst the other study reported similar success rates for both MTA and Portland cement. Amongst the two studies that obtained grade B2, similar success rates were evident for (i) MTA and CEM and (ii) both white MTA and grey MTA. The authors concluded that, based on the assessment criteria employed, there was no evidence that MTA was better than present materials and techniques as a pulpotomy medicament.
Adverse events	Not reported.
Study details / Limitations	SETTINGS: Not stated COUNTRIES: Egypt, Turkey, Canada, Brazil, Israel, India, Saudi Arabia, USA, Iran, FUNDING SOURCES: Not stated STUDY LIMITATIONS: All studies were small sized. Overall, the risk of bias was unclear.
Reviewers' Comments:	This review is of limited value due to the relatively restricted search strategy employed, the poor description of included studies, lack of statistical data or combination of results. The conclusion that MTA is no better than formocresol or other materials is consistent with another recent review (Smail-Faugeron et al., 2014)

Systematic Review SR16: Smail-Faugeron et al., 2014²⁵

Author: Smail-Faugeron V, Courson F, Durieux P, Muller-Bolla M, Nadin G, Glenny A-M, Fron Chabouis H.				
Title: Pulp treatment for extensive decay in primary teeth.				
Citation: <i>Cochrane database of systematic reviews</i> . 2014;8:CD003220				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review

<p>SR AMSTAR score: 10 (/11)</p>	<p>TOTAL NO. PATIENTS: 3,910 randomised teeth</p> <p>PATIENT CHARACTERISTICS: Children with extensive decay involving dental pulp in primary teeth. Mean age of children was 5.6 years [min-max 2-13 years]</p>	<p>All pulp interventions combining a pulp treatment technique (among pulpotomy, pulpectomy and direct pulp capping) and a medicament (any type of medicament).</p> <p>Medicaments included: Mineral Trioxide Aggregate (MTA) Ferric Sulfate (FS) Formocresol (FC) Calcium Hydroxide (CH) Vitapex Zinc Oxide and Eugenol (ZOE)</p>	<p>Primary outcomes 2 primary outcomes: <ul style="list-style-type: none"> clinical failure radiological failure as defined in primary studies at 6, 12 and 24 months.</p> <p>Secondary outcomes <ul style="list-style-type: none"> overall failure secondary clinical outcomes: pain, soft tissue pathology, pathologic mobility, adjacent tissue inflammation, defective restoration (clinically), secondary caries at the margin (clinically), periodontal pocket formation, dental anxiety/phobia, premature tooth loss, signs of exfoliation, smell secondary radiological outcomes: pathologic radiolucency, pathologic root resorption, pulp canal obliteration, dentine bridge formation, physiological root resorption, defective restoration (radiographically), secondary caries (radiographically), filling material anomaly. All outcomes as reported in trials at 1, 3, 6, 9, 12, 18 and 24 months were analysed.</p>	<p>Included: RCTs comparing different pulp interventions combining a pulp treatment technique and a medicament in primary teeth. Included trials that compared different medicaments for the same pulp treatment technique or different pulp treatment techniques with each other.</p>
<p>Aim(s)</p>	<p>To assess the effects of different pulp treatment techniques (direct pulp capping, pulpotomy, or pulpectomy) and associated medicaments for the treatment of extensive decay in primary teeth.</p>			
<p>Authors' quality assessment of studies included in review</p>	<p>Followed the domain-based evaluation described in the Cochrane Handbook for Systematic Reviews of Interventions 5.1.0 (updated March 2011). 47 RCTs included that examined 53 comparisons, 25 for pulpotomy (in 33 trials), 13 for pulpectomy (8 trials), 13 direct pulp capping (4 trials), and two comparisons between pulpotomy and pulpectomy (2 trials).</p>			

	<p>The overall risk of bias was low for only 1 trial. 20 trials (43%) were at high risk of bias. Risk of bias was unclear for 26 trials (55%) frequently due to lack of information about allocation concealment and blinding of participants and staff. The reporting of trials often did not allow for assessing the risk of bias because many methodological elements were not mentioned. Only 19 trials were included in meta-analyses.</p> <p>Given the high/unclear risk of bias for majority of the studies, imprecision and the potential for publication bias, the quality of evidence regarding pulp treatment for extensive decay in primary teeth is low.</p>
Main Findings	<p>Pulpotomy using alternative medicament/technique:</p> <ul style="list-style-type: none"> • Mineral Trioxide Aggregate (MTA) was compared to Ferric Sulfate (FS) in 3 trials. MTA had statistically significantly fewer clinical, radiological and overall failures at 24 months. This difference was not shown at six or 12 months • MTA was compared to Formocresol (FC) in 14 trials. MTA reduced both clinical and radiological failures at six, 12 and 24 months, although the difference was not statistically significant. MTA also showed favourable results for all secondary outcomes measured, although again, differences between MTA and FC were not statistically significant (with the exception of pathological root resorption at 24 months and dentine bridge formation at six months) • MTA was compared to Calcium Hydroxide (CH) in 2 trials. MTA showed favourable results compared with CH for all outcomes measured, but the difference were not statistically significant (with the exception of radiological failure at 12 months). • FC was compared with CH in seven trials and with FS in seven trials. There was a statistically significant difference in favour of FC for clinical failure at six and 12 months, and radiological failure at six, 12 and 24 months. FC also showed favourable results for all secondary outcomes measured, although differences between FC and CH were not consistently statistically significant across time points. The comparisons between FC and FS showed no statistically significantly difference between the two medicaments for any outcome at any time point. <p>For all other comparisons of medicaments used during pulpotomies, pulpectomies or direct pulp capping, the small numbers of studies and the inconsistency in results limits interpretation.</p> <p>Authors concluded that although no evidence was found to identify one superior pulpotomy medicament and technique clearly, two medicaments, mineral trioxide aggregate (MTA) and ferric sulphate (FS) may be preferable over other agents [e.g. due to concern about potential harm (FC) and greater radiological failure (CH)]. The cost of MTA may preclude its clinical use and therefore FS could be used in such situations.</p>
Adverse events	Formaldehyde (in formocresol) is a carcinogen.
Study details / Limitations	<p>SETTINGS: Paediatric dentistry settings in University or hospital.</p> <p>COUNTRIES: Egypt, Turkey, Canada, Brazil, in the United States, in Israel, Mexico, Germany, Serbia and Montenegro, India, Saudi Arabia, United Kingdom.</p> <p>FUNDING SOURCES: Not stated</p> <p>STUDY LIMITATIONS: All studies were single center and small sized (median number of enrolled patients per trial was 42 [interquartile range 27–71, min–max 15–152], and the median number of treated teeth per trial was 68 [interquartile range 50–100, min–max 30–291]). All trials were short-term, most reporting 6-month outcomes. The risk of bias in most trials was unclear (randomisation, blinding) or high (incomplete outcome data).</p>
Reviewers' Comments:	An update or the 2003 review. The original review was based on three studies, this update is based on 47. Well conducted systematic review with clearly defined protocol, comprehensive search and assessment of study design and quality. Included studies were generally small, there was considerable diversity in the reported outcomes and variation in assessment times. Reporting of many trials limited the assessment of bias. Overall the available evidence was assessed to be of low quality.

	Several available medicaments and techniques are effective for the treatment of extensive dental decay in primary teeth in children, but clear evidence about which are superior is lacking.
--	--

Systematic Review SR17: Asgary et al., 2014²⁶

Author: Asgary S, Shirvani A, Fazlyab M				
Title: MTA and Ferric Sulfate in Pulpotomy Outcomes of Primary Molars: A Systematic Review and Meta-Analysis				
Citation: <i>Journal of clinical pediatric dentistry</i> . 2014;39(1):1-8				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 6 (/11)	TOTAL NO. PATIENTS: not stated for all studies Individual teeth: 266 PATIENT CHARACTERISTICS: Children aged 4-10.	Pulpotomy with MTA VS Pulpotomy with FS	Clinical or radiologic success or failure at 12 and 24 months.	Randomised Controlled Trials
Aim(s)	To compare the treatment outcomes of MTA or FS in primary teeth pulpotomy merely based on RCTs			
Authors' quality assessment of studies included in review	Each article was evaluated according to the modified van Tulder list: appropriate method of randomization; treatment allocation concealment; group similarity at baseline; outcome assessor(s) blinding; care provider(s) blinding; patient(s) blinding; outcome assessor(s) calibration; co-interventions avoidance; adequacy of follow-up period adequate; compliance acceptability; withdrawal and dropout rates acceptability; timing of the outcome assessment; relevance of outcomes; adequate sample size; objectivity of outcome measures; intention-to-treat analysis included.			
Main Findings / Recommendations	From the 620 articles found, 4 RCTs [12-month follow-up: n=3, 24-month follow-up: n=4, in total: 264 teeth] comparing MTA and FS, were selected. It was showed that the 12-month outcome of both materials were similar [RR= 0.642 (CI 95%: 0.225-1.833, P=0.407)], while the two-year follow-up results revealed significant differences in treatment outcome, in favour of MTA [RR was 0.300 (CI 95%: 0.132-0.683, P=0.004)]. Conclusion: MTA demonstrated superior long-term treatment outcomes in pulpotomy of primary molars than FS. Clinical Significance: Considering the advantages of MTA compared to FS and its better clinical results, use of this bioregenerative material in primary molar pulpotomy is recommended. The four included studies collectively were assessed to be at moderate risk of bias.			
Adverse events	Not reported.			
Study details / Limitations	SETTINGS: Unclear COUNTRIES: Turkey (3) Canada FUNDING SOURCES: Not stated STUDY LIMITATIONS: Poor reporting within individual studies e.g of baseline characteristics, blinding.			

Reviewers' Comments:	This is a moderately thorough systematic review with assessment of evidence quality and meta-analysis. Four relatively small studies were included which were poorly reported, which limited the assessment of evidence quality. Overall, MTA is favoured over FS for pulpotomy with better long term outcomes.
-----------------------------	---

Systematic Review SR18: Stringhini Junior et al., 2015²⁷

Author: E. Stringhini Junior, M. E. B. Vitcel, L. B. Oliveira				
Title: Evidence of pulpotomy in primary teeth comparing MTA, calcium hydroxide, ferric sulphate, and electrosurgery with formocresol.				
Citation: <i>Eur Arch Paediatr Dent</i> (2015) 16:303–312				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score: 5 (/11)	TOTAL NO. PATIENTS: unclear PATIENT CHARACTERISTICS: Not stated		Successes and failures after treatment Success = Absence of spontaneous pain, mobility, tenderness to percussion, swelling and fistulas, no evidence of peri/interradicular (furcal) radiolucency and internal/external root resorption Follow up 6-36 month.	Randomised controlled trials
Aim(s)	The purpose of this research was to evaluate MTA, CH, FS, and ES pulpotomy and compare them with FC after a systematic review using a meta-analysis. formocresol (FC), electrosurgery(ES),ferric sulphate (FS)calcium hydroxide (CH), mineral trioxide aggregate (MTA)			
Authors' quality assessment of studies included in review	Quality score criteria for pulpotomy therapy articles (Mickenautsch et al. 2006), considering study setting; sampling, blinding, calibration, reliability. Strong evidence 10–11, good evidence 6–9 and reasonable evidence 0–5			
Main Findings / Recommendations	Analysis was restricted to 30 articles that met inclusion criteria. Due to the homogeneity of the materials tested, four meta-analyses were performed, comparing formocresol with: CH, MTA, SF, and ES. The success rate of CH and FC were 60.5 % and 86.6 %, respectively with statistically significant difference (OR = 4.22; 95 % CI = 2.67–6.67). The results showed that the success of MTA pulpotomy (94.61 %) was higher than that of FC (87.40 %), and showed a statistically significant difference (OR = 0.39; 95 % CI = 0.25–0.62).			

	<p>The FS presented a clinical- radiographic success rate similar to that of FC, and without statistically significant difference (OR = 1.19; 95 % CI = 0.80–1.78).</p> <p>There was no statistically significant difference between ES pulpotomy and FC (OR = 1.81; 95 % CI = 0.68–4.81).</p> <p>Authors' conclude that MTA pulpotomy is better than formocresol pulpotomy since it significantly improved pulpotomy success compared to formocresol. Ferric sulphate and electrosurgery pulpotomy were not significantly different in their pulpotomy success than formocresol. In addition, there is no evidence to support calcium hydroxide for pulpotomies in primary teeth.</p>
Adverse events	Not reported
Study details / Limitations	<p>SETTINGS: Not stated</p> <p>COUNTRIES: Many</p> <p>FUNDING SOURCES: Not stated</p> <p>STUDY LIMITATIONS: Although a quality assessment appears to have been carried out, this is not reported and so there is a lack of information about study limitations.</p>
Reviewers' Comments:	<p>This is a rather poorly reported systematic review resulting in a relatively low quality rating. Although the authors described a method for scoring the quality of the included RCTs, the scores assigned to individual studies is not evident. Similarly although heterogeneity was considered, this is not reported.</p> <p>The conclusion that MTA is more effective than FC, which is similar to FS and ES, and that CH is not supported is consistent with Agary et al (2014) but other systematic reviews found no significant difference for MTA (Smail-Faugeron V, et al. 2014; Anthonappa RP et al. 2013).</p>

Systematic Review SR19: Coll et al 2017²⁸

<p>Author: Coll, J. A., Seale, N. S., Vargas, K., Marghalani, A. A., Al Shamali, S. and Graham, L.</p> <p>Title: Primary Tooth Vital Pulp Therapy: A Systematic Review and Meta-analysis</p> <p>Citation: <i>Pediatric Dentistry</i>. 39 Pages: 16-123 2017</p>				
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
SR AMSTAR score:11 (/11)	<p>TOTAL NO. PATIENTS: 3,709 randomized primary teeth in 2,078 children ranging in age from 2.3 to 12.5 years.</p> <p>PATIENT CHARACTERISTICS: healthy pediatric patients who required vital pulp therapy for deep caries in primary teeth including molars,</p>	Any of the three types of VPT (IPT, DPC, and pulpotomy of any type), and the comparison was to any other VPT	<p>Primary outcome overall success, determined as simultaneous clinical and radiographic success, after a minimum of 12 months.</p> <p>Secondary outcomes – not evaluated as insufficiently described in studies</p>	<p>RCTs only.</p> <p>Included: Only human clinical outcome studies that evaluated the efficacy of MTA as a pulpotomy medicament in primary teeth were selected.</p> <p>Pulpal treatments as a result of</p>

	incisors, and canines, and the tooth was the unit of analysis.			non-carious pulp exposures were excluded.
Aim(s)	To assess outcomes in primary teeth for the vital pulp therapy (VPT) options of indirect pulp therapy (IPT), direct pulp capping (DPC), and pulpotomy after a minimum of 12 months to determine whether one VPT was superior.			
Authors' quality assessment of studies included in review	MEDLINE, EMBASE, CENTRAL, EBSCO, ICTRP, Dissertation abstracts, and grey literature for parallel and split-mouth randomized controlled trials of at least 12 months duration comparing the success of IPT, DPC, and pulpotomy in children with deep caries in primary teeth. (1960 to September 2016). Three authors determined the included RCTs, performed data extraction, and assessed the risk of bias (ROB). Meta-analysis and assignment of quality of evidence by Grading of Recommendations Assessment, Development and Evaluation approach were done. Criteria used included ROB/study limitations, consistency of results, precision, importance, and magnitude of the effect.			
Main Findings	<p>Forty-one articles qualified for meta-analysis (six IPT, four DPC, and 31 pulpotomy) from 322 screened articles. The 24-month success rates were: IPT=94.4 percent, and the liner material (calcium hydroxide [CH]/bonding agents) had no effect on success (P=0.88), based on a moderate quality of evidence; DP =88.8 percent, and the capping agent (CH/alternate agent) did not affect success (P=0.56), based on a low quality of evidence. The combined success rate for all pulpotomies was 82.6 percent based on 1,022 teeth. Mineral trioxide aggregate (MTA) (89.6 percent) and formocresol (FC) (85.0 percent) success rates were the highest of all pulpotomy types and were not significantly different (P=0.15), with a high quality of evidence. MTA's success rate (92.2 percent) was higher than ferric sulfate (FS) (79.3 percent) and approached significance (P=0.06), while FS's success rate (84.8 percent) was not significantly different from FC (87.1 percent), both with a moderate quality of evidence. MTA and FC success rates were significantly better than CH (P=0.0001), with a moderate quality of evidence. At 18 months, sodium hypochlorite (NaOCl) success rate was significantly less than FC (P=0.01) with a low quality of evidence.</p> <p>Authors Conclusions: The highest level of success and quality of evidence supported IPT and the pulpotomy techniques of MTA and FC for the treatment of deep caries in primary teeth after 24-months. DPC showed similar success rates to IPT and MTA or FC pulpotomy, but the quality of the evidence was lower.</p>			
Adverse events	Not reported.			
Study details / Limitations	<p>SETTINGS: They were all single-centre trials except one, which was a multicentre trial. These trials were conducted in paediatric dentistry departments of a university or hospital. All trials were conducted by dentists, residents supervised by paediatric dental faculty, or fifth year dental students.</p> <p>COUNTRIES: Egypt, Turkey (12), Saudi Arabia (2), Iran (2), Brazil (7), Canada, Israel (3), USA (3), Spain (2), India (4), Germany, China, Belgium, UK</p> <p>FUNDING SOURCES: Only stated for two studies.</p> <p>STUDY LIMITATIONS: Some of the studies had only 12 or 18 months observation. Some aspects of risk of bias or data reporting could not be clarified.</p> <p>Unable to assess publication bias due to the limited number of included studies per outcome; however, many of the included studies reported no differences between groups, suggesting limited publication bias.</p> <p>Trials judged as unclear risk of bias (due to poor reporting) were combined with low risk of bias in the analyses due to the relatively small number of trials found in each comparison and the extremely small number of low risk of bias trials.</p>			
Reviewers' Comments:	Thoroughly conducted and reported systematic review that supports IPC, pulpotomy and DPC as treatments for managing a primary tooth with deep caries, the choice being influenced by the amount of caries-affected dentine removed. Lack of direct comparisons between IPT and pulpotomy limit the conclusions that can be drawn about the relative effectiveness of these techniques.			

Behaviour Management/Helping Children Accept Dental Care

Guideline 5: BSPB 2011²⁹

Author: British Society of Paediatric Dentistry: C Campbell, F Soldani, A Busuttill-Naudi and B Chadwick																
Title: Update of Non-pharmacological behaviour management guideline 2011																
Citation: http://bspd.co.uk/Resources/BSPD-Guidelines .																
Study Type / Evidence Level	Patient or Participant characteristics	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review												
Guideline AGREE score: 4 (/7)	TOTAL NO. PATIENTS: N/A PATIENT CHARACTERISTICS: Co-operative and potentially co-operative children (<18 years)	Techniques for dental behaviour management problems (DBMPs) or a non-pharmacological behaviour management technique NPBMT in the paediatric dental population.		Any (included reviews, RCTs, Cohort, non RCT, surveys)												
Aim(s)	To provide guidance on the available non-pharmacological behaviour management techniques for all dental care professionals who provide care to the paediatric dental population															
Authors' quality assessment of studies included in review	Studies were assigned a SIGN level of evidence as an indicator of quality, most likely based on study design. Risk of bias in the included studies was not specifically discussed.															
Main Findings/ Recommendations	<p>Describes factors that influence children's behaviour and anxiety related to dental treatment, with recommendations on relevant history, parental anxiety, styles and presence, child temperament and behaviour of dental staff.</p> <p>Provides recommendations on:</p> <table border="0"> <tr> <td>preparatory information,</td> <td>non-verbal communication,</td> <td>voice control,</td> </tr> <tr> <td>Tell-show-do,</td> <td>enhanced control,</td> <td>behavioural shaping and positive reinforcement,</td> </tr> <tr> <td>modelling,</td> <td>distraction,</td> <td>systematic desensitisation,</td> </tr> <tr> <td>negative reinforcement,</td> <td>empathy,</td> <td>coping strategies,</td> </tr> </table> <p>alternative methods (magic trick, motivational interviewing, memory restructuring strategy, hypnosis, Snoezelen environment, child centred approach).</p> <p>There is limited guidance on factors to consider to inform the choice of various techniques. The introduction states: No one method will be applicable in all situations, rather the appropriate management technique(s) should be chosen based on the individual child's requirements and the individual dentist's experience and expertise in NPBMT.</p>				preparatory information,	non-verbal communication,	voice control,	Tell-show-do,	enhanced control,	behavioural shaping and positive reinforcement,	modelling,	distraction,	systematic desensitisation,	negative reinforcement,	empathy,	coping strategies,
preparatory information,	non-verbal communication,	voice control,														
Tell-show-do,	enhanced control,	behavioural shaping and positive reinforcement,														
modelling,	distraction,	systematic desensitisation,														
negative reinforcement,	empathy,	coping strategies,														
Adverse events	Not specifically reported															

Study details / Limitations	
Reviewers' Comments:	This guideline scores poorly for clarity of presentation, editorial independence (as not stated) and applicability. Evidence has been sourced through a search of Medline, Embase and PsycINFO and an interpretation of quality included. It is acknowledged that further high quality research is needed in the field of NPBM for use in the child population. Mainly due to its style of presentation, busy practitioners may find it difficult to use the guideline. It is otherwise likely to be useful for informing practice, e.g. through incorporation in other guidance.

Guideline 6: AAPD 2015³⁰

Author: American Academy on Pediatric Dentistry Clinical Affairs Committee-Behavior Management, Subcommittee				
Title: Guideline on Behavior Guidance for the Pediatric Dental Patient. 2015				
Citation: <i>Paediatric Dentistry</i> 30: 124-33				
Study Type / Evidence Level	Patient or Participant characteristics:	Interventions or risk factors	Outcomes measured	Types of primary studies included / excluded from review
Guideline AGREE score: 2 (7)	TOTAL NO. PATIENTS: N/A PATIENT CHARACTERISTICS: infants, children, adolescents, and persons with special health care needs	Basic behaviour guidance techniques Advanced behaviour guidance techniques		Not specified
Aim(s)	To educate health care providers, parents, and other interested parties about influences on the behaviour of pediatric dental patients and the many behaviour guidance techniques used in contemporary paediatric dentistry.			
Authors' quality assessment of studies included in review	No indication of assessment of quality of included studies.			
Main Findings/ Recommendations	This guideline contains definitions, objectives, indications, and contraindications for a variety of behaviour guidance techniques commonly taught and used in paediatric dentistry. Dentists are encouraged to utilize behaviour guidance techniques consistent with their level of professional education and clinical experience. Behaviour guidance cases that are beyond the training, experience, and expertise of individual practitioners should be referred to practitioners who can render care more skilfully. Factors that influence the success and use of behaviour guidance are discussed: Predictors of child behaviours (Informed consent; Pain assessment and management; Patient attributes, Parental influences, Orientation to dental environment, patient assessment, Dentist /dental team behaviours); Informed Consent; Pain assessment and management; Documentation; Treatment deferral.			

	<p>Behavior guidance techniques: The guideline highlights that some of the behavior guidance techniques are intended to maintain communication, while others are to extinguish inappropriate behavior and establish communication. Techniques cannot be evaluated on an individual basis as to validity, but must be assessed within the context of the child's total dental experience. Techniques need to be integrated into an overall behavior guidance suited to the individual child.</p> <p>Recommendations:</p> <p>Basic behaviour guidance. Most children can be managed effectively using these techniques.</p> <ul style="list-style-type: none"> • Communication and communicative guidance: by virtue of being a basic element of communication does not require specific consent. All other techniques do. • Positive pre-visit imagery: suitable for any patient • Direct observation: suitable for any patient • Tell-show-do: suitable for any patient • Ask-tell-ask: suitable for any patient able to dialogue • Voice control: suitable for any patient (except hearing impaired) • Non-verbal communication: suitable for any patient • Positive reinforcement and descriptive praise: suitable for any patient • Distraction: suitable for any patient • Memory restructuring: suitable for any patient who has a negative dental visit • Parental presence/absence: suitable for any patient (except when parent unwilling or unable to extend effective support) • Nitrous oxide/oxygen inhalation: most suited to certain patients (e.g. anxious, strong gag reflex, special health care needs) <p>Advanced behaviour guidance Some children present with behaviour considerations for which basic techniques are insufficient, e.g. cannot cooperate due to lack of psychological or emotional maturity and/or mental, physical or medical disability. Dentists considering the use of advanced behaviour guidance techniques should seek additional training through a residency program, a graduate programme, and/or an extensive continuing education course that involves both didactic and experiential mentored training.</p> <ul style="list-style-type: none"> • Protective stabilisation. Indications, contraindications and precautions are described. • Sedation • General anaesthesia
Adverse events	The potential harms of various advanced techniques are described.
Study details / Limitations	
Reviewers' Comments:	<p>This guideline scores poorly for rigour of development, clarity of presentation, stakeholder involvement, editorial independence and applicability. The evidence search is restricted to PubMed, which, given the subject appears particularly inadequate. There is no indication of the type or quality of study included and therefore it is not possible to confirm the validity or strength of any of the recommendations. Instead, the guideline largely comprises a summary of a range of available techniques that may be applicable in provision of dental care for children. The main distinction between techniques is whether they are basic (and broadly suitable for all patients) or advanced. Aimed at a US audience, some of the techniques may not be considered appropriate or acceptable in the UK.</p>

	Note, in 2017, the AAPD recategorised this publication from Guideline to Best Practice.
--	---

Appendix 4 – Summaries of Evidence and Considered Judgements

Evidence summarised and recommendations developed by considered judgements as described in Section 7.

Caries Risk Assessment

<p>Clinical question: What factors should be taken into account to inform an assessment of the risk of a child developing dental caries?</p>
<p>1. Individual studies</p> <p>SIGN guideline 138¹ provided a recommendation on the factors to consider when assessing caries risk which was based on the evidence appraisals carried out for the SIGN guidelines that SIGN 138 replaced (guidelines 47 and 83). For these, evidence was considered for various caries risk indicators, including microbiological and socioeconomic risk factors, previous caries experience and saliva and the influence of parental oral health status to inform a recommendation on the factors to consider when assessing caries risk. New evidence for caries risk assessment tools was also examined but no consensus on a preferred method was identified. AGREE 6/7</p>
<p>2. Summary of evidence</p> <p>The evidence to inform caries risk assessment was taken from some well conducted randomised controlled trials and case-controlled studies or cohort studies in combination with expert opinion. The overall Grade C and D ratings reflects the inclusion of lower quality evidence.</p> <p>SIGN 138 Recommendations: The following factors should be considered when assessing caries risk:</p> <ul style="list-style-type: none"> • clinical evidence of previous disease • dietary habits, especially frequency of sugary food and drink consumption • social history, especially socioeconomic status • use of fluoride • plaque control • saliva • medical history. (Grade C) <p>Specialist child healthcare professionals should consider carrying out a caries risk assessment of children in their first year as part of the child’s overall health assessment. (Grade D)</p> <p>Children whose families live in a deprived area should be considered as at increased risk of early childhood caries when developing preventive programmes. (Grade D)</p> <p>SIGN 138 Good Practice Points:</p>

Clinicians should be aware of individuals with a medical or physical disability for whom the consequences of dental caries could be detrimental to their general health. These patients should receive intensive preventive dental care. A child considered by the healthcare professional to be at high caries risk should be referred to the appropriate health service provider.

3. Considered judgement and guidance recommendations

Although the evidence for individual risk factors and tools for assessing caries risk is low quality, SIGN guideline 138 is supportive of the use of caries risk assessment as a means of identifying those children who may benefit most from more intensive caries preventive interventions. SDCEP Guidance Development Group agreed not to make a key recommendation on only this aspect of the assessment of a child, but, based on SIGN 138, to include within the clinical practice advice points that lower socioeconomic status and previous caries experience should be the primary basis for identifying a child as at increased risk of developing dental caries in the future.

Caries Prevention – Motivation and Action Planning

Clinical question:

Is there any evidence that delivery of dental brief interventions (oral health education) by members of the dental health team in a practice setting lead to health behaviour changes/healthy dental behaviours (e.g. compliance with toothbrushing)?

1. Individual studies

SIGN guideline 138¹ reviewed the evidence for delivery of brief interventions in the practice setting, including the effectiveness and format of dental brief interventions. AGREE 6/7

One more recently published relevant systematic review was identified by GDG members.

Systematic Review:

Gau et al. (2014)⁶ examined the evidence on the effectiveness of Motivational Interviewing (MI), in comparison with Conventional health Education (CE), in improving oral health. They found that when delivered to mothers and other caregivers for preventing early childhood caries, MI outperformed CE in improving at least one outcome in four studies on preventing early childhood caries. However, although promising, the success of MI for improving oral health varied between studies. Heterogeneity of the included studies was high and they concluded that further rigorous research is required. AMSTAR 6/11

2. Summary of evidence

There is evidence of moderate quality in systematic reviews that brief interventions to promote good oral health behaviours including toothbrushing can be effective in preventing caries.¹ There is evidence that theoretically based strategies to encourage

health behaviour change can be effective, with motivational interviewing favoured. However, further research is required to compare interventions.⁶

SIGN 138 Recommendations:

Oral health promotion interventions should facilitate daily toothbrushing with fluoride toothpaste. (Grade B)

Oral health promotion interventions should be based on recognised health behaviour theory and models such as motivational interviewing. (Grade B)

As part of the patient assessment, a social history should be taken which will contribute to dental brief interventions being specific to individuals and tailored to their particular needs and circumstances. (Grade C)

SIGN 138 Good Practice Point:

Dental health professionals should take a common risk factor approach supporting a variety of topic based brief interventions and when possible provide support to colleagues to expand the delivery of brief interventions across other appropriate settings.

3. Considered judgement and guidance recommendations

SIGN guideline 138 supports use of oral health promotion strategies to facilitate daily toothbrushing with fluoride toothpaste.¹ These should be based on recognised oral health behaviour theory and models such as motivational interviewing and should be specific to individuals, and tailored to their particular needs and circumstances.

SDCEP Key Recommendation:

Provide all children with personalised oral health promotion advice.

This is strong recommendation based on moderate quality evidence.

Caries Prevention – Toothbrushing

Clinical question:

For SIGN guideline 138, there were seven key questions related to toothbrushing/fluoride toothpaste that formed the basis for systematic literature searching, evidence appraisal and development of recommendations. These are encompassed within this clinical question:

What factors influence the effectiveness of toothbrushing for the prevention of dental caries in children?

1. Individual studies

SIGN guideline 138¹ extensively reviewed the evidence related to toothbrushing including the benefits and harms of the use of fluoride toothpaste, fluoride concentration in toothpaste, toothpaste composition, frequency and duration of brushing, age of commencement of brushing and toothbrushing practice (including, post-brushing rinsing, timing of toothbrushing, type of toothbrush, frequency of brush replacement) and other

toothcleaning methods. Recommendations for toothbrushing based on high quality evidence were made. AGREE 6/7

2. Summary of evidence

Use of fluoride toothpaste

In SIGN guideline 138, high quality evidence from systematic reviews indicates that there is a dose-response relationship between toothpaste fluoride concentration and level of caries reduction.³¹⁻³⁹ Toothbrushing with fluoride toothpaste can also arrest early carious lesions.¹²

SIGN 138 Good Practice Point:

To reduce the risk of mild fluorosis and reinforce good oral health, the amount of toothpaste used by children up to the age of three years should be supervised.

SIGN 138 Recommendations:

Following risk assessment, children and young people up to the age of 18 years who are at standard risk of developing dental caries should be advised to use toothpastes in the range 1,000 to 1,500 ppmF. (Grade A)

Following risk assessment, children aged from 10 to 16 years who are at increased risk of developing dental caries should be advised to use toothpastes at a concentration of 2,800 ppmF. (Grade A)

SIGN 138 Good Practice Point:

Following risk assessment, children up to the age of 10 years who are at increased risk of developing dental caries should be advised to use toothpastes at 1,500 ppmF.

Frequency and duration of brushing

Although there is evidence to support twice daily brushing with a fluoride toothpaste,³² there is insufficient evidence to recommend a specific duration for each episode of toothbrushing.¹

SIGN 138 Recommendation:

Toothbrushing with fluoride toothpaste should take place at least twice daily. (Grade A)

Age at commencement of brushing

Brushing should start as soon as the first tooth erupts, should be supervised and the amount of toothpaste restricted, particularly in children under the age of three years.

SIGN 138 Recommendation:

Supervision of toothbrushing with fluoride toothpaste is recommended as an effective caries prevention measure. (Grade A)

SIGN 138 Good Practice Points:

Children who are unable to brush their teeth unaided should be assisted to do so.

Children should be assisted to brush their teeth as soon as they erupt.

Toothbrushing practice

Rinsing with water after brushing reduces the caries-preventive effect of fluoride and can increase caries incidence.

SIGN 138 Recommendation:

Children should be encouraged to spit out excess toothpaste and not rinse with water after brushing. (Grade A)

Timing of toothbrushing

SIGN 138 Good Practice Point:

Children's teeth should be brushed last thing at night before bedtime and on at least one other occasion.

Use of powered versus manual toothbrushes

SIGN 138 Good Practice Point:

Children's teeth can be brushed with either manual or powered toothbrushes as an effective means of administering fluoride.

The evidence for the use of floss in addition to toothbrushing is insufficient to support its use.¹

3. Considered judgement and guidance recommendations

Toothbrushing with fluoride toothpaste is one of the most effective methods of preventing caries. For standard prevention, toothpastes in the range 1000 to 1500 ppm fluoride are recommended for use by children up to the age of 18 years. Higher dose toothpaste may be beneficial for older children at increased caries risk.

The amount of toothpaste should be appropriate to the age of the child – a smear if under the age of three years, a pea size amount for children over three years of age. Brushing should be supervised. Professionals often advise brushing for two minutes, though the main point is to ensure that sufficient time is taken for all tooth surfaces to be cleaned effectively.

SDCEP Key Recommendation:

Encourage and support all children to brush their teeth, or to have their teeth brushed for them, at least twice a day with fluoride toothpaste.

This is a strong recommendation, based on high quality evidence.

Caries Prevention – Dietary Advice

Clinical question:

What evidence is there for the effectiveness of giving dietary advice for the prevention of dental caries in children?

1. Individual studies

SIGN guideline 138¹ did not consider the optimum diet for preventing dental caries nor the effects of foods on the development of dental decay, but instead refers to NHS Health Scotland's Oral Health and Nutrition Guidance (2012).⁴⁰ Two more recently published relevant systematic reviews were identified by GDG members.

Systematic Reviews:

Moynihan and Kelly (2014)⁷ found consistent evidence of moderate quality supporting a relationship between the amount of sugars consumed and dental caries development. There is evidence of moderate quality to show that dental caries is lower when free-sugars intake is < 10% Energy (E.). They propose that there may be benefit in limiting sugars to < 5% E to minimize the risk of dental caries throughout the life course. AMSTAR 8/11

Harris et al (2012)⁸ examined the effectiveness of one-to-one dietary interventions for all ages carried out in a dental care setting in changing dietary behaviour, oral health and general health. They concluded that there is tentative (low quality) evidence that one-to-one dietary interventions delivered in a dental setting aimed at promoting general rather than oral health, are effective at changing dietary behaviour (but not specifically sugar consumption). AMSTAR 10/11

2. Summary of evidence

Background: Since the 1980s epidemiological data has noted an association between sugar consumption and level of dental caries. Countries with sugar consumption of less than 18 kg/person per year have consistently low disease levels.^{41,42} A survey of sugar intake of 1,700 Scottish children published in 2008⁴³ found the average non-milk extrinsic sugars (NMES) consumption was 17.4% of calorie intake. NMES intakes were higher in older children; sugar consumption was 15.8% of calories in three to seven year olds and up to 19.1% in 12 to 17 year olds.

A systematic review⁷ was conducted to inform a new World Health Organization (WHO) guideline on dietary recommendations for populations. The review concluded that there was evidence of moderate quality to show that dental caries is lower when free-sugars intake is less than 10%.

Reflecting recommendations from the independent Scientific Advisory Committee on nutrition (SACN) in 2015, revised Scottish dietary targets were issued in 2016, indicating that free sugars, (also known as NMES) should not exceed 5% of total energy adults and children over two years.⁴⁴

A Cochrane systematic review found low quality evidence that one-to-one dietary interventions delivered in a dental setting aimed at promoting general rather than oral health, are effective at changing dietary behaviour.⁸

NHS Health Scotland's *Oral Health and Nutrition Guidance* (2012)⁴⁰ gives oral health and nutrition advice for the whole population with a focus on under fives. The guidance includes advice on: diet and nutrition (a healthy balanced diet); diet and tooth decay (sugars; non-milk extrinsic sugars; labelling); oral health advice (key oral health messages; diet/sugar; dental visits; dental erosion); oral health and between-meals snacks and drinks

as a reference to enable professionals to give practical, consistent advice to all age groups. More recent UK-wide guidance on healthy eating is provided in the *Eatwell Guide* (2016).⁴⁵

3. Considered judgement and guidance recommendations

NHS Health Scotland's *Oral Health and Nutrition Guidance* (2012) gives oral health and nutrition advice for the whole population with a focus on under fives. This should be updated with the more recent UK-wide guidance in the *Eatwell Guide* (2016) and recommendations should support current national dietary targets. Although there is limited evidence of the effectiveness of dietary advice for the prevention of caries, the association between sugar and caries incidence and the national drive to reduce the consumption of sugar justifies a strong recommendation to encourage children to eat a healthy diet and restrict sugar intake in food and drinks.

SDCEP Key Recommendation:

Advise all children and their parent/carers about how a healthy diet can help prevent caries, at intervals determined by their risk of developing dental caries.

This is a strong recommendation based on moderate quality evidence.

Caries Prevention – Fissure Sealants

Clinical question:

What is the evidence for effectiveness of sealants in preventing dental caries in children?

1. Individual studies

SIGN guideline 138¹ extensively reviewed the evidence related to the use of fissure sealants for the prevention of dental caries in children, identifying one well conducted systematic review that informed a recommendation on the use of resin-based fissure sealants. AGREE 6/7

More recently, the American Dental Association and the American Academy of Pediatric Dentistry carried out a thorough systematic review and used this to inform recommendations within a clinical practice guideline for the use of pit-and-fissure sealants.^{9,10} AGREE 6/7

2. Summary of evidence

Fissure sealants have been shown to reduce pit and fissure caries in primary and permanent teeth⁴⁶ and are more effective in reducing decay in occlusal surfaces than fluoride varnish.⁴⁷ Both resin-based and glass ionomer sealants are effective (moderate and low to very low quality evidence respectively). There is no clear evidence to suggest which sealant material is more effective at preventing caries but resin-based sealants have been shown to be better retained than glass ionomer sealants.⁴⁶ This is consistent with

the most recent systematic review and recommendations of the American Dental Association.^{9,10}

Fissure sealants are also discussed below under Caries Management.

SIGN 138 Recommendation:

Resin-based fissure sealants should be applied to the permanent molars of all children as early after eruption as possible. (Grade A)

SIGN 138 Good Practice Point:

Glass ionomer sealants may be considered if the application of a resin-based sealant is not possible.

In making the recommendation in SIGN 138, the relatively high level of disease in Scotland and the low rate of application of fissure sealants were important considerations.

Note, SIGN guideline 138 cited an earlier version of reference⁴⁶ that was published in 2013. Both the 2013 and 2017 versions reached the same conclusion regarding the efficacy of pit and fissure sealants in preventing caries in occlusal surfaces. However, unlike the earlier version, the 2017 version did not conclude that the effectiveness of sealants is limited to children at high risk of caries.

Note, SIGN guideline 138 cited an earlier version of reference⁴⁷ that was published in 2010. Both the 2010 and 2016 versions reached the same conclusion regarding the relative efficacy of pit and fissure sealants and fluoride varnish application.

3. Considered judgement and guidance recommendations

The evidence from two Cochrane systematic reviews and a systematic review by the American Dental Association supports the use of fissure sealants for the prevention of dental caries in children. Resin-based sealants may be preferable based on their superior retention. However, glass ionomer sealants are effective and may be particularly useful for application to newly erupted teeth. In agreement with SIGN guideline 138, recommending the application of fissure sealants to the permanent molars of all children in Scotland to prevent dental caries is considered likely to be beneficial. Some children may also benefit from sealant application to other teeth.

SDCEP Key Recommendation:

For all children, place fissure sealants on the permanent molars as early as possible after eruption.

This is a strong recommendation, based on moderate quality evidence.

Caries Prevention – Topical Fluoride

Clinical question:

What is the evidence for effectiveness of topical fluoride interventions in preventing dental caries in children and what are the adverse effects (e.g. risk of fluorosis)?

1. Individual studies

SIGN guideline 138¹ extensively reviewed the evidence related to the use topical fluoride interventions for the prevention of dental caries in children, identifying several well conducted systematic reviews that informed a recommendation on the use of fluoride varnish only. AGREE 6/7

The American Dental Association has also updated its clinical practice guideline for the use of topical fluoride for caries prevention based on a systematic review of the evidence and strongly recommends the periodic application of fluoride varnish in children and young people.¹¹ AGREE 5/7

2. Summary of evidence

In addition to fluoride toothpaste, there is a range of topical fluoride delivery systems that can be used to help prevent caries in children. There is moderate quality evidence reported in a Cochrane systematic review that fluoride varnish is the most effective additional topical fluoride agent and that it significantly reduces caries increment in both primary and permanent teeth.⁴⁸

There is little evidence that other topical fluoride delivery systems (gels, beads, drops, tablets, lozenges) are effective,¹ although fluoride mouthwash may be useful as an alternative to or in addition to varnish,^{49,50} for example for those who are at risk of an allergic reaction or for enhanced protection for those at increased risk of caries.

SIGN 138 Recommendation:

Fluoride varnish should be applied at least twice yearly in all children. (Grade A)

Note, SIGN guideline 138 cited an earlier version of reference⁵⁰ that was published in 2003. Both the 2003 and 2016 versions reached the same conclusion regarding fluoride mouth rinses.

3. Considered judgement and guidance recommendations

In agreement with SIGN guideline 138, all children should receive fluoride varnish application at least twice a year as part of standard prevention. More frequent applications of fluoride varnish to children assessed at higher risk of caries is also recommended.

SDCEP Key Recommendation:

For all children aged 2 years and over, apply sodium fluoride varnish at least twice per year.

This is a strong recommendation based on moderate quality evidence.

Caries Management

Clinical questions:

In children, what evidence is there for the effectiveness of various methods for the treatment or management of caries in **primary** teeth?

In children and adolescents, what evidence is there for the effectiveness of various methods for the treatment or management of caries in the **permanent** teeth?

1. Individual studies

Systematic Reviews:

Tellez et al (2013)¹² focussed on non-surgical caries prevention methods to arrest or reverse the progression of non-cavitated carious lesions in **permanent** or **primary** teeth. They found that fluoride interventions (varnishes, gels, and toothpaste) have the most consistent benefit. In the few studies that examine Xylitol, CHX, and CPP-ACP vehicles alone or in combination with fluoride, most did not show a statistically significant reduction. Sealants and resin infiltration studies point to a potential consistent benefit in slowing the progression or reversing NCCIs. More than half of the studies were assessed as at moderate to high risk of bias and categorised as 'poor'. AMSTAR 7/11

Ricketts et al (2013)¹³ assessed the effects of stepwise, partial or no dentinal caries removal compared with complete caries removal in previously unrestored **permanent** and **primary** teeth. Studies were of moderate quality with newer trials having lower risks of bias. The results were consistent with a previous version of this review. They concluded that, in symptomless, vital, carious primary or permanent teeth, stepwise and partial caries removal reduces the incidence of pulp exposure and these are therefore favoured over complete caries removal. Regarding symptoms of pulp disease, these were similar with stepwise and complete caries removal but there was insufficient evidence to determine the effect of partial caries removal. Regarding restoration failure, there was insufficient evidence about the effect of partial caries removal while no caries removal in permanent teeth was similar to complete caries removal. In primary teeth, one study found a statistically significant difference in restoration failure in favour of no caries removal compared to no caries removal. AMSTAR 10/11

Schwendicke et al (2013)¹⁴ attempted to analyse how incompletely excavated **primary** or **permanent** teeth fail, and if certain tooth- or treatment-related factors may influence risk of failure. Pulpal failures (pain, signs of loss of vitality, abscess or sinus formation) are more common than non-pulpal failures. Pulpal failures are less in one- than two-step excavations and in teeth with single- compared to multi-surface cavities. After incomplete excavation, primary teeth are at higher risk of failure than permanent teeth. Evidence in this systematic review was graded very low making it impossible to draw definitive conclusions. AMSTAR 8/11

Schwendicke et al (2013)¹⁵ reviewed one-and two-step incomplete caries removal compared to complete caries removal in **primary** and **permanent** teeth. Incomplete caries removal (one- or two-step) reduces the risk of both pulpal exposure and post-

operative pulpal symptoms. The high risk of bias within studies limit greatly the conclusions that can be made AMSTAR 9/11

Ferreira (2012)¹⁶ attempted to address what is the ideal limit in removing carious tissue in **primary** teeth and given the limited evidence available, concluded that partial removal was no worse than complete removal. This systematic review was methodologically poor. AMSTAR 3/11

Hoefler et al (2016)¹⁷ attempted to compare partial caries removal and stepwise caries removal for clinical outcomes at least two years after treatment. Both techniques were found to be effective in the treatment of **permanent** teeth with deep dentinal caries. Partial caries removal might result in fewer pulpal complications. However, the very few studies included in this review were of low quality. AMSTAR 6/11

Mickenautsch S, Yengopal V (2011)¹⁸ investigated carious lesions on margins of cavities restored with glass ionomer cement (GIC) and amalgam. This review included 10 trials but meta-analysis was limited to subsets of these because of heterogeneity. The risk of selection and detection/performance bias was assessed as high. The overall results of the computed datasets suggest that GIC has a higher caries-preventive effect than amalgam for restorations in **permanent** teeth. No difference was found for restorations in the **primary** dentition. AMSTAR 9/11

Innes et al., (2015)¹⁹ evaluated the clinical effectiveness and safety of all types of preformed crowns for restoring **primary** teeth compared with conventional filling materials. In five included randomised controlled trials, they found moderate quality evidence that crowns placed on primary molar teeth with carious lesions, or where pulp treatment has been carried out, are likely to reduce the risk of major failure or pain in the long term compared to fillings. Crowns fitted using the Hall Technique may reduce discomfort at the time of treatment compared to fillings. There was insufficient reporting for the effect of the extent of decay on clinical outcomes. AMSTAR 10/11

Dorri et al., 2016²⁰ evaluated the effects of micro-invasive treatments for managing proximal caries lesions in **primary** and **permanent** dentition in children and adults. From the eight included studies there was moderate quality evidence that resin infiltration and resin sealants are significantly better at preventing caries progression than non-invasive methods alone, such as fluoride varnish application. There was insufficient evidence to indicate which micro-invasive technique is the more effective. AMSTAR 11/11

Gao et a., 2016²¹ evaluated the caries remineralising and arresting effect of professionally applied topical fluorides in **primary** and **permanent** teeth in children and concluded that 5% NaF varnish remineralised approximately two-thirds of early enamel caries lesions in children and 38% silver diamine fluoride arrested approximately two thirds of dentine carious lesions. Analysis was based on relatively few studies, application protocols and follow up periods were not clear and included studies were at moderate to high risk of bias and highly heterogenous. AMSTAR 6/11

Lenzi et al 2016²² assessed the effectiveness of fluoride varnish and fluoride gel for treating incipient carious lesions in **primary** and **permanent** teeth. Only five studies met the inclusion criteria and of these only three that considered fluoride varnish application

were included in the meta-analysis which indicated that 5% fluoride varnish application is effective in reversing incipient caries. Overall the evidence was at high risk of bias and heterogeneity was high. AMSTAR 8/11

American Dental Association and the American Academy of Pediatric Dentistry carried out a thorough systematic review and used this to inform recommendations within a clinical practice guideline for the use of pit-and-fissure sealants both for prevention of caries and for treatment on non-cavitated occlusal carious lesions.^{9,10} AGREE 6/7

2. Summary of evidence

Most of the included studies concerned caries management in children. The results of these studies were considered to be applicable to children in Scotland. Avoidance of pain with minimal intervention are likely to be a priority for patients.

Primary Teeth

Six systematic reviews address various aspects of operative management of caries in primary teeth.^{13-16,18,19}

In the systematic reviews that examined the extent of caries removal before restoration, much of the evidence is considered to be of low quality. However, the Cochrane systematic review,¹³ which included studies assessed as of moderate quality, concluded that stepwise and selective/partial caries removal are preferred to complete caries removal in vital symptom-free primary or permanent teeth. This is consistent with earlier systematic reviews, though these marginally favoured one-step partial caries removal.^{15,16} In primary teeth, the evidence available does not indicate a preferred restorative material.¹⁸ However, there is moderate quality evidence that crowns placed on primary molar teeth with carious lesions or following pulp treatment reduce the risk of pain or infection in the long term compared to restorations.¹⁹

In addition, although limited, the available evidence does support no caries removal and sealing with a stainless steel crown in primary teeth.^{13,19}

The American Dental Association (ADA) has made clinical recommendations for use of pit and fissure sealants on occlusal surfaces that are based on a recent systematic review of 23 studies, all but one of which focussed on permanent teeth.¹⁰ Based on this, the ADA recommends use of fissure sealants on noncavitated occlusal lesions to prevent their progression in both children and adolescents.⁹ An earlier systematic review¹² also supports the use of fissure sealants to slow the progress or reverse noncavitated carious lesions. Of the six studies included, one evaluated lesions on primary teeth; this was of moderate quality and found that progression of fissure sealed lesions on first primary molars was significantly reduced.

A recent Cochrane systematic review examined the effectiveness of microinvasive interventions (lesion sealing or infiltration) for managing proximal enamel and initial dentinal caries lesions and found moderate quality evidence that these techniques are more effective in reducing lesion progression than non-invasive methods or no treatment.²⁰ Although only two of the eight included studies focussed on the primary dentition, this review is supportive of the consideration of these emerging techniques

when managing noncavitated proximal lesions in primary teeth, taking into account clinical indications and the feasibility of different techniques.

One systematic review¹² focussed on various non-surgical caries prevention methods to arrest or reverse the progression of noncavitated carious lesions in primary and permanent teeth. Evidence was generally of low quality. This review found that fluoride interventions (varnishes, gels, and toothpaste) seem to have the most consistent benefit in decreasing the progression and incidence of noncavitated lesions, though only one of the thirteen studies assessed primary teeth and this was of low quality. Two more recent systematic reviews found that professionally applied 5% sodium fluoride varnish can arrest and reverse/remineralise early enamel caries in primary and permanent teeth, though the quality of evidence was low.^{21,22}

A European regulation, which aims to limit the use of mercury, states “from 1 July 2018, dental amalgam shall not be used for dental treatment of deciduous teeth...except where deemed strictly necessary by the dental practitioner based on the specific medical needs of the patient”.⁵¹

Permanent Teeth

Five systematic reviews^{13-15,17,18} address various aspects of operative management of caries in permanent teeth.

In the systematic reviews that examined the extent of caries removal before restoration, much of the evidence is considered to be of low quality. However, the Cochrane systematic review,¹³ which included studies assessed as of moderate quality, concluded that stepwise and selective caries removal are preferred to complete caries removal in vital symptom-free primary or permanent teeth. This is consistent with two other systematic reviews.^{15,17} One systematic review reported that glass ionomer cement has a higher caries-preventive effect than amalgam for restoration of permanent teeth.¹⁸

The American Dental Association (ADA) has made clinical recommendations for use of pit and fissure sealants that are based on a recent systematic review of 23 studies, all but one of which were concerned with permanent teeth.¹⁰ The ADA recommends use of fissure sealants on noncavitated occlusal lesions to prevent their progression in both children and adolescents.⁹ An earlier systematic review¹² also supports the use of sealing to slow the progress or reverse noncavitated carious lesions. Of the six studies included, four assessed fissure sealants and two assessed resin infiltration.

A recent systematic review based on eight studies (six for permanent teeth) examined the effectiveness of microinvasive interventions (lesion sealing or infiltration) for managing proximal enamel and initial dentinal caries lesions and found moderate quality evidence that these techniques are more effective in reducing lesion progression than non-invasive methods or no treatment.²⁰ Although there is insufficient evidence to favour a particular technique, this review is supportive of the consideration of these emerging techniques when managing noncavitated proximal lesions in permanent and primary teeth, taking into account clinical indications and the feasibility of different techniques.

One systematic review¹² focussed on various non-surgical caries prevention methods to arrest or reverse the progression of noncavitated carious lesions in primary and permanent

teeth. Evidence was generally of low quality. This review found that fluoride interventions (varnishes, gels, and toothpaste) seem to have the most consistent benefit. Two more recent systematic reviews found that professionally applied 5% sodium fluoride varnish can arrest and reverse/remineralise early enamel caries in primary and permanent teeth, though the quality of evidence was low.^{21,22}

A European regulation, which aims to limit the use of mercury, states “from 1 July 2018, dental amalgam shall not be used for dental treatment of deciduous teeth, of children under 15 years...except where deemed strictly necessary by the dental practitioner based on the specific medical needs of the patient”.⁵¹

3. Considered judgement and guidance recommendations

Primary Teeth

There are several options for managing caries in primary teeth, including complete, selective or stepwise caries removal and restoration, sealing over caries using the Hall Technique, sealant or infiltration and preventive only interventions. There is evidence to indicate that the less invasive approaches, which are based on altering the environment of the caries/plaque biofilm, can be effective and although the evidence from studies of primary teeth is relatively scarce, it is believed reasonable to consider applying these methods to primary teeth. Use of dental amalgam should be avoided in primary teeth.

Unlike permanent teeth, pulpal health and restoration survival are not a major priority for primary teeth. Consequently, although stepwise caries removal has been shown to be successful in primary teeth, this method offers no advantage over selective caries removal and is not recommended.

If there is no dentine involvement, it is recommended that site-specific prevention (application of fluoride varnish, oral hygiene instruction, brushing with fluoride toothpaste) is provided or that caries is not removed but is treated with a fissure sealant or resin infiltration.

If there is dentine involvement, the recommended treatment for an occlusal lesion is selective caries removal and restoration and for a proximal lesion, sealing using the Hall Technique. Complete caries removal is an alternative, less preferred option. For anterior teeth, the recommended treatment options are selective or complete caries removal or non-restorative cavity control.

A variety of factors specific to primary teeth need to be taken account when determining a suitable management strategy for each carious lesion.

SDCEP Key Recommendation:

For a child with a carious lesion in a primary tooth, choose the least invasive feasible caries management strategy, taking into account: the time to exfoliation, the site and extent of the lesion, the risk of pain or infection, the absence or presence of infection, preservation of tooth structure, the number of teeth affected, avoidance of treatment-induced anxiety.

Although based on low quality evidence, this is a strong recommendation because almost all patients would be expected to prefer less invasive treatment.

Permanent Teeth

There are several options for managing caries in permanent teeth, including complete caries removal, selective or stepwise caries removal and restoration, sealing over caries with sealant or infiltration and preventive interventions only. There is evidence to indicate that the less invasive approaches that are based on altering the environment of the caries/plaque biofilm can be effective in permanent teeth. Use of dental amalgam should be avoided in the permanent teeth of a child or young person under 15 years of age unless exceptional circumstances can be justified.

In permanent teeth, stepwise caries removal and selective caries removal are clearly supported by evidence for deep lesions with risk of pulp involvement. For less deep lesions, selective caries removal or complete caries removal are preferable. Complete caries removal is also the preferred option for anterior teeth although in some circumstances selective caries removal may be achievable.

If there is no cavitation, it is recommended that caries is not removed but is either sealed with a fissure sealant or resin infiltration or, for a proximal lesion or a lesion on an anterior tooth, site-specific prevention (application of fluoride varnish, oral hygiene instruction, brushing with fluoride toothpaste) may be provided.

A variety of factors specific to permanent teeth need to be taken account when determining a suitable management strategy for each carious lesion.

SDCEP Key Recommendation:

For a child with a carious lesion in a permanent tooth, choose the least invasive feasible caries management strategy taking into account: the site and extent of the lesion, the risk of pain or infection, preservation of tooth structure and the health of the dental pulp, avoidance of treatment-induced anxiety, lifetime prognosis, orthodontic considerations and occlusal development.

Although based on low quality evidence, this is a strong recommendation because almost all patients would be expected to prefer less invasive treatment.

Pulp Therapy in Primary Teeth

Clinical question:

In children, what evidence is there for the effectiveness of specific methods for pulp therapy for primary teeth? Consider: Mineral trioxide aggregate/formocresol/ferric sulphate; Preformed metal/stainless steel crown.

1. Individual studies

A British Society of Paediatric dentistry (BSPD) guideline and five systematic reviews were identified and appraised.

The BSPD guideline by Rodd et al (2006)²³ gives recommendations on various forms of pulp treatment as management strategies for grossly carious primary molar teeth. The

evidence-base and how evidence has informed recommendations is not clearly stated. This guideline supports the use of indirect pulp treatment, pulpotomy and pulpectomy and recommends against direct pulp capping. For all procedures it recommends the use of rubber dam. It reports similar success with various pulpotomy medicaments, including MTA. Calcium hydroxide is not recommended due to lower long-term success rates and caution is advised for use of formocresol. Desensitising pulp therapy is only recommended for cases where good anaesthesia cannot be achieved or with poor patient compliance. AGREE 2/7 Note that this guideline is now over ten years old and is archived on the Royal College of Surgeons website.

Systematic Reviews:

Anthonappa et al (2013)²⁴ compared Mineral Trioxide Aggregate (MTA) with other pulpotomy medicaments. When compared with Formocresol (FC), MTA performed better, but not significantly statistically. MTA was superior to Ferric sulphate (FS) in one study. The authors concluded that there was no evidence that MTA was better than other medicaments and techniques. AMSTAR 4/10

Smaïl-Faugeron et al (2014)²⁵ is an update of a 2003 Cochrane review of pulp treatment techniques in primary teeth that included 47 studies (original included only three). Included studies were assessed to be of low quality. Medicaments included: Mineral Trioxide Aggregate (MTA), Ferric Sulfate (FS), Formocresol (FC), Calcium Hydroxide (CH), Vitapex, Zinc Oxide and Eugenol (ZOE). No evidence was found of statistically significant differences between pulpotomy medicaments and techniques. Limited evidence suggests that pulpotomy with MTA may be superior to other medicaments to achieve clinical and radiological success in the short-term. However, Ferric Sulphate performs almost as well and given the cost of MTA, FS might be preferable. There was insufficient evidence to indicate a preferred material for pulpectomy or direct pulp capping. AMSTAR 9/11

Asgary et al. (2015)²⁶ compared the treatment outcomes of MTA or FS in primary teeth pulpotomy in four relatively small studies with overall moderate risk of bias and concluded that there were better the long term outcomes for MTA. AMSTAR 6/11

Stringhini Jr et al. (2015)²⁷ compared the effectiveness of MTA, CH, FS, and ES pulpotomy and compare them with FC, concluding that MTA is superior. However, the assessment of the quality of the evidence was unclear. AMSTAR 5/11

Coll et al (2017)²⁸ assessed the outcomes for various forms of vital pulp therapies for treatment of deep carious lesions in primary teeth and found highest success after 24 months was achieved using indirect pulp therapy (IPT) (moderate quality evidence) and pulpotomy using either MTA or FC (high quality evidence). No studies directly comparing IPT and pulpotomy were reported. Pulpotomy success rates at 24 months for MTA, FC and FS were all significantly better than CH with moderate to low quality evidence. Restoration type and use of rubber dam made no significant difference to pulp therapy success. AMSTAR 11/11. Based on this systematic review, the American Association of Paediatric Dentistry provided a new guideline on pulp therapy for primary teeth with deep caries.⁵² Owing to the lack of studies directly comparing techniques, this does not recommend a

particular type of pulp therapy for these lesions but does strongly recommend either MTA or FC for pulpotomy.

Lower quality ratings for several of these reviews was due to poor reporting and limits the reliability of their conclusions alone.

2. Summary of evidence

The evidence comprises one guideline from the British Society of Paediatric Dentistry (BSPD)²³ and five recent systematic reviews.²⁴⁻²⁸

The evidence base and the way that evidence informed recommendations within the BSPD guideline is not clearly stated. The guideline is supportive of the use of indirect pulp treatment, pulpotomy and, with sufficient experience and appropriate patient selection, pulpectomy.

The Cochrane systematic review²⁵ included 47 studies assessed overall to be of low quality. It reported no significant differences between a variety of pulpotomy medicaments, though favoured ferric sulphate (FS) or mineral trioxide aggregate (MTA) due to concern about potential harms and significantly greater radiological failure with other agents. While this is consistent with the review by Anthonappa *et al.*²⁴ and the BSPD recommendations, other less well conducted reviews found that the long-term outcomes using MTA were better than for FS in pulpotomy of primary molars.^{26,27} A more recent and thorough systematic review supports the use of several pulpotomy medicaments with MTA and FC giving the highest success based on high quality evidence.²⁸

3. Considered judgement and guidance recommendations

Extraction of carious primary teeth can be distressing for the child and has the potential to cause treatment-induced anxiety. To avoid the need for an extraction, various pulp therapies are available. The evidence indicates that these can be successful but does not provide clear insight into which technique is preferred. However, pulpotomy is the most reported to date for treating deep carious lesions in primary teeth that are still vital and pulpectomy for those that are non-vital. It is recommended that pulp therapy is considered to preserve primary teeth in cases of pulpal involvement or dental infection.

SDCEP Key Recommendation:

For a child in pain due to pulpitis in a vital primary tooth with irreversible symptoms with no evidence of dental abscess, consider carrying out a pulpotomy to preserve the tooth and to avoid the need for an extraction.

This is a conditional recommendation because it is based on low quality evidence and a significant minority of patients might not prefer pulpotomy for pulpitis with irreversible symptoms.

Behaviour Management/Helping Children Accept Dental Care

Clinical question:

In children and adolescents, what evidence is there for the effectiveness of specific methods for the management of behaviour or anxiety to enable dental care? Consider non-pharmacological methods

1. Individual studies

Despite the broad search used, only, two guidelines were identified that specifically addressed behaviour management techniques for the provision of dental care^{29,30}. One Cochrane systematic review on use of hypnosis was identified but had subsequently been withdrawn from publication to be replaced by an updated version in development.

BSPD (2011) guideline²⁹ is an update of a previous guideline on non-pharmacological behaviour management. Based on an updated literature search, this guideline gives recommendations on factors that influence children's behaviour and anxiety related to dental treatment. It then gives recommendations on a variety of behaviour management techniques and their application. AGREE 4/7

AAPD (2015) guideline³⁰ is the latest version of a regularly updated guideline on behaviour guidance techniques. It also describes factors that influence success of these techniques and then gives recommendations on basic techniques, suitable for most children, and advanced techniques that include sedation and general anaesthesia. AGREE 2/7.

Note that since its publication the AAPD guideline has been recategorised as best practice by AAPD.

2. Summary of evidence

The BSPD guideline is based on a fairly thorough evidence search and assessment of study quality. The recommendations about techniques that are likely to be acceptable in the UK are generally descriptive of the technique and indications for its use. It is acknowledged that choice of method is dictated by an assessment of the individual child and limited by the clinician's experience and expertise. The AAPD guideline is based on a rather limited evidence search with no description of the studies on which recommendations are based. Generally, the methodology used to develop this guideline appears weak. The guideline is also largely descriptive with little guidance on choosing from the range of basic techniques. Sedation and GA are beyond the scope of the SDCEP PMDCC guidance.

Influencing factors that the two guidelines have in common are: Parent influence; behaviour of dental team and dentist.

Techniques that both guidelines recommend include: Non-verbal communication; voice control; Tell-show-do; positive reinforcement; distraction.

3. Considered judgement and guidance recommendations

Evidence to inform recommendations on behavior management of children receiving dental care is lacking and although a range of methods are available, the choice of

method depends greatly on an assessment of the individual child and the clinician’s skills and acceptability in the UK. Therefore, rather than present any key recommendations, Section 4 of the guidance provides a description of the variety of techniques and circumstances in which they might be suitable as a means of informing users of the guidance about approaches to behaviour management that may be employed. This is based on the BSPD guideline only, to which users are referred for additional detail.

Providing Additional Support

Clinical question:

What indicators of dental neglect should the dental team be aware of and what actions should they take to ensure the wellbeing of the child?

1. Individual studies

In Scotland, *Getting it right for every child (GIRFEC)*⁵³ is a national approach that involves practitioners of all disciplines working together to promote, support and safeguard the wellbeing of children and young people.

*Child Protection and the Dental Team*⁵⁴ (CPDT) is an educational resource that was first developed in 2006 with extensive external review. It was subsequently fully updated as a website in 2013.

2. Summary of evidence

GIRFEC describes the overarching principles and practical application of current national policy. CPDT is a widely accepted and utilized resource that provides advice on managing dental neglect.

3. Considered judgement and guidance recommendations

The dental team’s important role and obligation to act in the area of providing additional support and child protection is well established. Rather than present any key recommendations, it was agreed that the SDCEP guidance should describe the evolving overall national model of a child-focused integrated multiagency approach to oral health improvement and the principles behind it, such as the common risk factor and the GIRFEC principles. This will be a means of informing dental teams about how improvement in oral health is being addressed beyond what is done through clinical dental services.

The guidance should also describe the dental team’s role, remit and requirement for ensuring dental wellbeing [i.e. latest GDC standards; child protection guidelines; Getting it right for every child] within the national child focused integrated multiagency approach to oral health improvement being implemented. In order to provide a consistent message, advice on child protection actions should be based on the well-established CPDT resource.

It is acknowledged that the organisation of services to provide additional support for children differs significantly outside Scotland and that this section of the guidance may require considerable adaptation for other areas.

References

1. Scottish Intercollegiate Guideline Network. Dental interventions to prevent caries in children 2014; www.sign.ac.uk/assets/sign138.pdf. Accessed 16 April 2018.
2. Clarkson JE, Ramsay CR, Eccles MP, et al. The translation research in a dental setting (TRiaDS) programme protocol. *Implementation Science*. 2010;5:57.
3. Templeton AR, Young L, Bish A, et al. Patient-, organization-, and system-level barriers and facilitators to preventive oral health care: a convergent mixed-methods study in primary dental care. *Implementation Science* 12 2016;11:5.
4. Elouafkaoui P, Bonetti D, Clarkson J, Stirling D, Young L, Cassie H. Is further intervention required to translate caries prevention and management recommendations into practice? *British Dental Journal*. 2015;218(1):E1.
5. Shea BJ, Bouter LM, Peterson J, et al. External validation of a measurement tool to assess systematic reviews (AMSTAR). *PloS One*. 2007;2(12):e1350.
6. Gao X, Lo EC, Kot SC, Chan KC. Motivational interviewing in improving oral health: a systematic review of randomized controlled trials. *Journal of Periodontology*. 2014;85:426-437.
7. Moynihan PJ, Kelly SA. Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. *Journal of Dental Research*. 2014;93:8-18.
8. Harris R, Gamboa A, Dailey Y, Ashcroft A. One-to-one dietary interventions undertaken in a dental setting to change dietary behaviour. *The Cochrane Database of Systematic Reviews*. 2012;3:CD006540.
9. 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*. Aug 2016;147(8):672-682 e612.
10. Wright JT, Tampi MP, Graham L, et al. Sealants for preventing and arresting pit-and-fissure occlusal caries in primary and permanent molars: A systematic review of randomized controlled trials-a report of the American Dental Association and the American Academy of Pediatric Dentistry. *Journal of the American Dental Association*. Aug 2016;147:631-645 e618.
11. Weyant RJ, Tracy SL, Anselmo TT, et al. Topical fluoride for caries prevention: full report of the updated clinical recommendations and supporting systematic review. 2013; http://ebd.ada.org/~media/EBD/Files/Topical_fluoride_for_caries_prevention_2013_update.pdf?la=en. Accessed 23 December 2016.
[Also reported in Weyant et al. Topical fluoride for caries prevention: Executive summary of the updated clinical recommendations and supporting systematic review. *Journal of the American Dental Association*. 2013; 144:1279-91.]

12. Tellez M, Gomez J, Kaur S, Pretty IA, Ellwood R, Ismail AI. Non-surgical management methods of noncavitated carious lesions. *Community Dentistry and Oral Epidemiology*. 2013;41:79-96.
13. Ricketts D, Lamont T, Innes NP, Kidd E, Clarkson JE. Operative caries management in adults and children. *The Cochrane Database of Systematic Reviews*. 2013;3:CD003808.
14. Schwendicke F, Meyer-Lueckel H, Dorfer C, Paris S. Failure of incompletely excavated teeth--a systematic review. *Journal of Dentistry*. 2013;41:569-580.
15. Schwendicke F, Dorfer CE, Paris S. Incomplete caries removal: a systematic review and meta-analysis. *Journal of Dental Research*. 2013;92:306-314.
16. Ferreira JM, Pinheiro SL, Sampaio FC, de Menezes VA. Caries removal in primary teeth--a systematic review. *Quintessence International*. 2012;43:e9-15.
17. Hoefler V, Nagaoka H, Miller CS. Long-term survival and vitality outcomes of permanent teeth following deep caries treatment with step-wise and partial-caries-removal: A Systematic Review. *Journal of Dentistry*. 2016;54:25-32.
18. Mickenautsch S, Yengopal V. Absence of carious lesions at margins of glass-ionomer cement and amalgam restorations: An update of systematic review evidence. *BMC Research Notes*. 2011;4:58.
19. Innes NP, Ricketts D, Chong LY, Keightley AJ, Lamont T, Santamaria RM. Preformed crowns for decayed primary molar teeth. *The Cochrane Database of Systematic Reviews*. Dec 31 2015(12):CD005512.
20. Dorri M, Dunne SM, Walsh T, Schwendicke F. Micro-invasive interventions for managing proximal dental decay in primary and permanent teeth. *The Cochrane Database of Systematic Reviews*. 2015;11:CD010431.
21. Gao SS, Zhang S, Mei ML, Lo EC, Chu CH. Caries remineralisation and arresting effect in children by professionally applied fluoride treatment - a systematic review. *BMC Oral Health*. 2016;16:12.
22. Lenzi TL, Montagner AF, Soares FZ, de Oliveira Rocha R. Are topical fluorides effective for treating incipient carious lesions?: A systematic review and meta-analysis. *Journal of the American Dental Association*. 2016;147:84-91.e81.
23. Rodd H, Waterhouse P, Fuks AB, Fayle SA, Moffat MA. Pulp therapy for primary molars Available at <https://www.rcseng.ac.uk/-/media/files/rcs/fds/publications/pulptherapy.pdf?la=en>. *International Journal of Paediatric Dentistry*. 2006;16 Suppl 1:15-23. Accessed 18 March 2018.
24. Anthonappa RP, King NM, Martens LC. Is there sufficient evidence to support the long-term efficacy of mineral trioxide aggregate (MTA) for endodontic therapy in primary teeth? *International Endodontic Journal*. 2013;46:198-204.
25. Smail-Faugeron V, Courson F, Durieux P, Muller-Bolla M, Glenny AM, Fron Chabouis H. Pulp treatment for extensive decay in primary teeth. *The Cochrane Database of Systematic Reviews*. 2014;8:CD003220.

26. Asgary S, Shirvani A, Fazlyab M. MTA and ferric sulfate in pulpotomy outcomes of primary molars: a systematic review and meta-analysis. *Journal of clinical pediatric dentistry*. 2014;39:1-8.
27. Stringhini Junior E, Vitcel ME, Oliveira LB. Evidence of pulpotomy in primary teeth comparing MTA, calcium hydroxide, ferric sulphate, and electrosurgery with formocresol. *European Archives of Paediatric Dentistry: Official Journal of the European Academy of Paediatric Dentistry*. 2015;16:303-312.
28. Coll JA, Seale NS, Vargas K, Marghalani AA, Al Shamali S, Graham L. Primary Tooth Vital Pulp Therapy: A Systematic Review and Meta-analysis. *Pediatric Dentistry*. 2017;39:16-123.
29. Campbell C, Soldani F, Busuttill-Naudi A, Chadwick B. Non-pharmacological behaviour management. 2011; <http://bspd.co.uk/Resources/BSPD-Guidelines>. Accessed 16 April 2018.
30. Clinical Affairs Committee-Behavior Management Subcommittee AAoPD. Guideline on Behavior Guidance for the Pediatric Dental Patient. *Pediatric dentistry*. 2015;37:57-70.
31. Marinho VC, Higgins JP, Logan S, Sheiham A. Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents. *The Cochrane Database of Systematic Reviews*.. 2003:CD002782.
32. Marinho VC, Higgins JP, Sheiham A, Logan S. Fluoride toothpastes for preventing dental caries in children and adolescents. *The Cochrane Database of Systematic Reviews*. 2003(1):CD002278.
33. Wong MC, Glenny AM, Tsang BW, Lo EC, Worthington HV, Marinho VC. Topical fluoride as a cause of dental fluorosis in children. *The Cochrane Database of Systematic Reviews*. 2010(1):CD007693.
34. Twetman S. Caries prevention with fluoride toothpaste in children: an update. *European Archives of Paediatric Dentistry: Official Journal of the European Academy of Paediatric Dentistry*. Sep 2009;10:162-167.
35. Twetman S, Axelsson S, Dahlgren H, et al. Caries-preventive effect of fluoride toothpaste: a systematic review. *Acta Odontologica Scandinavica*. 2003;61:347-355.
36. Walsh T, Worthington HV, Glenny AM, Appelbe P, Marinho VC, Shi X. Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents. *The Cochrane Database of Systematic Reviews*. 2010(1):CD007868.
37. Steiner M, Helfenstein U, Menghini G. Effect of 1000 ppm relative to 250 ppm fluoride toothpaste. A meta-analysis. *American Journal of Dentistry*. 2004;17:85-88.
38. dos Santos AP, Nadanovsky P, de Oliveira BH. A systematic review and meta-analysis of the effects of fluoride toothpastes on the prevention of dental caries in the primary dentition of preschool children. *Community Dentistry and Oral Epidemiology*. 2013;41:1-12.
39. Twetman S. Prevention of early childhood caries (ECC): review of the literature published 1998-2007. *European Archives of Paediatric Dentistry*. 2007;9:12-18.

40. Scotland NH. Oral Health and Nutrition Guidance for Professionals. 2012; <http://www.healthscotland.com/documents/5885.aspx>. Accessed 21 December 2017.
41. Sreebny LM. Sugar availability, sugar consumption and dental caries. *Community Dentistry and Oral Epidemiology*. 1982;10:1-7.
42. Woodward M, Walker AR. Sugar consumption and dental caries: evidence from 90 countries. *British Dental Journal*. 23 1994;176:297-302.
43. Sheehy C, McNeill G, Masson L, et al. Survey of sugar intake among children in Scotland Summary report. 2008; http://www.foodstandards.gov.scot/sites/default/files/607-1-1098_sugarintakescot2008summ.pdf. Accessed 21 December 2017.
44. Government S. Revised Dietary Goals for Scotland. 2016; <http://www.gov.scot/Resource/0049/00497558.pdf>. Accessed 21 December 2017.
45. Public Health England in association with the Welsh Government FSSatFSA, Ireland iN. The Eatwell Guide. 2016; <http://www.foodstandards.gov.scot/consumers/healthy-eating/nutrition/eatwell>. Accessed 8 May 2018.
46. Ahovuo-Saloranta A, Forss H, Walsh T, et al. Sealants for preventing dental decay in the permanent teeth. *The Cochrane Database of Systematic Reviews*. 2013(3):CD001830. *
47. Ahovuo-Saloranta A, Forss H, Hiiri A, Nordblad A, Makela M. Pit and fissure sealants versus fluoride varnishes for preventing dental decay in the permanent teeth of children and adolescents. *The Cochrane Database of Systematic Reviews*. 2016;1:CD003067. *
48. Marinho VC, Worthington HV, Walsh T, Clarkson JE. Fluoride varnishes for preventing dental caries in children and adolescents. *The Cochrane Database of Systematic Reviews*. 2013;7:CD002279.
49. Twetman S, Petersson L, Axelsson S, et al. Caries-preventive effect of sodium fluoride mouthrinses: a systematic review of controlled clinical trials. *Acta odontologica Scandinavica*. 2004;62:223-230.
50. Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride mouthrinses for preventing dental caries in children and adolescents. *The Cochrane Database of Systematic Reviews*. 2003(3):CD002284. *
51. Council of the European Union EP. Regulation (EU) 2017/852 of the European Parliament and of the Council of 17 May 2017 on mercury, and repealing Regulation (EC) No 1102/2008 (Text with EEA relevance.) 2017; <https://publications.europa.eu/en/publication-detail/-/publication/687ef0ed-4045-11e7-a9b0-01aa75ed71a1/language-en>. Accessed 21 December 2017, 2017.
52. Dhar V, Marghalani AA, Crystal YO, et al. Use of Vital Pulp Therapies in Primary Teeth with Deep Caries Lesions. *Pediatric dentistry*. 2017;39:146-159.
53. Government S. Getting it right for every child (GIRFEC). 2017; <http://www.gov.scot/Topics/People/Young-People/gettingitright>. Accessed 16 April 2018, 2016.

54. Harris J, Sidebotham P, Welbury R. Child Protection and the Dental Team. 2013; <https://www.bda.org/childprotection>. Accessed 16 April 2018.

* Note that previous versions of references 46, 47 and 50 were cited in SIGN guideline 138. These systematic reviews have since been updated and the most recent versions are listed here.