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Cochrane Database of Systematic Reviews 2015, Issue 11. Art. No.: CD010431.
DOI: 10.1002/14651858.CD010431.pub2.

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[Intervention Review]

Micro-invasive interventions for managing proximal dental decay in primary and permanent teeth

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Editorial group: Cochrane Oral Health Group.
Publication status and date: New, published in Issue 11, 2015.
Review content assessed as up-to-date: 31 December 2014.

Citation: Dorri M, Dunne SM, Walsh T, Schwendicke F. Micro-invasive interventions for managing proximal dental decay in primary and permanent teeth. *Cochrane Database of Systematic Reviews* 2015, Issue 11. Art. No.: CD010431. DOI: 10.1002/14651858.CD010431.pub2.

ABSTRACT

Background

Proximal dental lesions, limited to dentine, are traditionally treated by invasive (drill and fill) means. Non-invasive alternatives (e.g. fluoride varnish, flossing) might avoid substance loss but their effectiveness depends on patients' adherence. Recently, micro-invasive approaches for treating proximal caries lesions have been tried. These interventions install a barrier either on top (sealing) or within (infiltrating) the lesion. Different methods and materials are currently available for micro-invasive treatments, such as sealing via resin sealants, (polyurethane) patches/tapes, glass ionomer cements (GIC) or resin infiltration.

Objectives

To evaluate the effects of micro-invasive treatments for managing proximal caries lesions in primary and permanent dentition in children and adults.

Search methods

We searched the following databases to 31 December 2014: the Cochrane Oral Health Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE via OVID, EMBASE via OVID, LILACs via BIREME Virtual Health Library, Web of Science Conference Proceedings, ZETOC Conference Proceedings, Proquest Dissertations and Theses, ClinicalTrials.gov, OpenGrey and the World Health Organization (WHO) International Clinical Trials Registry Platform. We searched the metaRegister of Controlled Trials to 1 October 2014. There were no language or date restrictions in the searches of the electronic databases.

Selection criteria

We included randomised controlled trials of at least six months' duration that compared micro-invasive treatments for managing non-cavitated proximal dental decay in primary teeth, permanent teeth or both, versus non-invasive measures, invasive means, no intervention or placebo. We also included studies that compared different types of micro-invasive treatments.

Data collection and analysis

Two review authors independently screened search results, extracted data and assessed the risk of bias. We used standard methodological procedures expected by Cochrane to evaluate risk of bias and synthesise data. We conducted meta-analyses with the random-effects model, using the Becker-Balagtas method to calculate the odds ratio (OR) for lesion progression. We assessed the quality of the evidence using GRADE methods.

Main results

We 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. Studies took place in university or dental public health clinics in Brazil, Colombia, Denmark, Germany, Thailand, Greenland and Chile. 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. Four studies received industry support to carry out the research, with one of them being carried out by inventors of the intervention.

We judged seven studies to be at high overall risk of bias, primarily due to lack of blinding of participants and personnel. We evaluated intervention effects for all micro-invasive therapies and analysed subgroups according to the different treatment methods reported in the included studies.

Our 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).

The four studies that measured adverse events reported no adverse events after micro-invasive treatment. Most studies did not report on any further outcomes.

We assessed the quality of evidence for micro-invasive treatments 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.

Authors' conclusions

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). We can be 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.

PLAIN LANGUAGE SUMMARY

Micro-invasive treatments for managing dental decay on adjacent tooth surfaces in children's and adults' teeth

Review question

The aim of this review is to evaluate the effects of micro-invasive treatments in the management of tooth decay on adjacent (proximal) teeth in children and adults (primary and permanent teeth).

Background

Decay on tooth surfaces that are next to each other (proximal surfaces) is common. Usually it has not progressed into late stages of decay and the tooth surface does not yet have a cavity.

Different methods are used to manage proximal dental decay. A common method is drilling the affected tooth tissue and inserting a plastic or metal filling. However, a lot of sound tissue can be removed in the process and this method is regarded as invasive). Another

non-invasive methods in use include dental practitioners applying fluoride varnish or advising people to floss regularly. These non-invasive methods do not require removing any tooth tissue.

More recent approaches (micro-invasive treatments) involve preparing (conditioning) the tooth surface with an acid and then either placing a sealing (cover) on top of the surface or 'infiltrating' the softer demineralised tissue with resins. These newer methods work by installing a barrier either on the tooth surface or within the demineralised tissue to protect it against acids and avoid the further loss of minerals from within the tooth. This, in theory, should stop the decay. This approach can be performed by a dentist or other dental practitioner and involves the loss of a few micrometers of tooth tissue because of the need to condition the tooth surface with acid.

There is still uncertainty as to how effective micro-invasive treatments are for managing proximal decay. It is also unclear which if any of these techniques are better than others. For example, a stronger acid is needed to infiltrated porous tissue with resin than when the tooth surface is simply sealed or covered. While infiltration might be a more effective method of protecting the tissue than sealing it, the use of a stronger acid also means losing more tissue. The aim of this review was to investigate the best approach for managing such decay in adults and children.

Study characteristics

This review considered evidence that was up to date at 31 December 2014. We found eight relevant trials with 365 participants. These trials involved children and adults whose decay lesions (tooth decay) were randomly assigned to different micro-invasive and non-invasive treatments. There were no studies comparing micro-invasive interventions with invasive treatment (fillings). Four studies received financial support from intervention inventors or manufacturers to carry out the research.

Key results

The current evidence shows that micro-invasive treatments can significantly reduce the likelihood of dental decay progression compared with the described non-invasive methods. There are too few studies to decide which micro-invasive treatment technique is best or the impact of different clinical and patient considerations. No negative side effects were reported; however, only half of the studies measured this outcome and the follow-up time of some of the studies was relatively short.

Quality of the evidence

Although further research could possibly change our findings, the available evidence gives us moderate confidence that micro-invasive treatments are much more effective than non-invasive treatments for stopping tooth decay.