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[Intervention Review]

Operative caries management in adults and children

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ABSTRACT

Background

The management of dental caries has traditionally involved removal of all soft demineralised dentine before a filling is placed. However, the benefits of complete caries removal have been questioned because of concerns about the possible adverse effects of removing all soft dentine from the tooth. Three groups of studies have also challenged the doctrine of complete caries removal by sealing caries into teeth using three different techniques. The first technique removes caries in stages over two visits some months apart, allowing the dental pulp time to lay down reparative dentine (the stepwise excavation technique). The second removes part of the dentinal caries and seals the residual caries into the tooth permanently (partial caries removal) and the third technique removes no dentinal caries prior to sealing or restoring (no dentinal caries removal). This is an update of a Cochrane review first published in 2006.

Objectives

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.

Search methods

The following electronic databases were searched: the Cochrane Oral Health Group's Trials Register (to 12 December 2012), the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2012, Issue 11), MEDLINE via OVID (1946 to 12 December 2012) and EMBASE via OVID (1980 to 12 December 2012). There were no restrictions regarding language or date of publication.

Selection criteria

Parallel group and split-mouth randomised and quasi-randomised controlled trials comparing stepwise, partial or no dentinal caries removal with complete caries removal, in unrestored primary and permanent teeth were included.

Data collection and analysis

Three review authors extracted data independently and in triplicate and assessed risk of bias. Trial authors were contacted where possible for information. We used standard methodological procedures exacted by The Cochrane Collaboration.

Main results

In this updated review, four new trials were included bringing the total to eight trials with 934 participants and 1372 teeth. There were three comparisons: 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. All of the trials were assessed at high risk of bias, although the new trials showed evidence of attempts to minimise bias.

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%).

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).

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.

Authors' conclusions

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.

Due to the short term follow-up in most of the included studies and the high risk of bias, further high quality, long term clinical trials are still required to assess the most effective intervention. However, it should be noted that in studies of this nature, complete elimination of risk of bias may not necessarily be possible. Future research should also investigate patient centred outcomes.

PLAIN LANGUAGE SUMMARY

Techniques for managing decay in teeth

Tooth decay (dental caries) is a common problem around the world. It can cost a lot of money to treat and causes infection, pain and the loss of teeth. Tooth decay can be controlled by what are known as 'non-operative' methods which include cleaning plaque from teeth thoroughly, advising a healthy diet and using fluoride to prevent the decay getting worse. If the decay progresses these 'non-operative' techniques may need to be combined with 'operative' management which involves filling and restoring teeth where the holes caused by decay prevent cleaning. The fillings will improve the appearance of the teeth and allow the patient to clean them.

Traditionally dentists have removed all of the decay with a dental drill or instruments before a filling is placed. However, removal of all the decay has some disadvantages, including damage to the nerve of the tooth, toothache and possibly weakening of the tooth structure. This method is known as one step complete caries removal.

Despite the large number of fillings and restorations placed worldwide on a daily basis, dentists remain uncertain as to which is the best 'operative management' strategy for tooth decay. This review has been carried out by researchers from the Cochrane Oral Health Group to assess the most effective ways of treating and managing tooth decay (dental caries) when operative methods are used in first and permanent teeth.

The most recent search of relevant studies for this review was carried out on 12^{th} December 2012. Eight studies with 934 patients (1372 teeth) were included.

Three alternative operative caries management interventions were assessed by comparing them with the traditional treatment of removing all the decay in one go (complete caries removal). These interventions were.

- Stepwise excavation - this technique removes caries in stages over two visits some months apart, allowing the dental pulp time to repair itself and lay down dentine.

- Partial caries removal - the dentist removes part of the dentinal caries and seals what is left into the tooth permanently.

- No dentinal caries removal - no dentinal caries is removed before sealing or restoring.

It was found that when the complete caries removal technique was compared with stepwise excavation, the pulp or nerve of the tooth would have been exposed in 347 of every 1000 teeth treated with complete caries removal, whereas when the stepwise excavation technique was used, this would have occurred in only 154 teeth per 1000.

When the partial caries removal technique was used, it was found that the pulp or nerve would have been exposed in 50 teeth out of 1000 treated. However, when the complete caries removal technique was used this figure would have been 219 teeth per 1000 treated.

There was less nerve damage when part of, or all of the decay, was left behind, for both baby and adult teeth. There was no difference in the number of teeth with toothache with any of the techniques. One of the no dentinal caries removal techniques needed fewer replacement fillings, although there was no difference found when comparing any of the rest of the techniques to complete caries removal.

In the included studies, the fillings were mostly placed by specialist dentists and the teeth were followed up for a relatively short time (1 year). More studies are needed to help answer further questions. Future studies should be carried out by non-specialist dentists to check whether the results would be similar. These studies should follow the patients for a longer time, and check if there are any differences in toothache, further decay and filling replacements. They should also check which techniques patients prefer and if there is a long term difference in cost.