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[Intervention Review]

Metal-free materials for fixed prosthodontic restorations

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ABSTRACT

Background

Fixed prosthodontic treatment (crowns, fixed dental prostheses (FDPs), complete arch prostheses) involves the use of several different materials to replace missing tooth structure. Traditionally full metal or metal frameworks veneered with ceramic (metal-ceramic (MC)) have been used. In recent years several different metal-free systems have become available to clinicians and patients. In general, metal-free restorations should allow practitioners to better reproduce natural tooth colour, avoiding shortcomings of MC restorations. The comparative in service clinical performance of fixed prosthodontic treatments of different materials is unclear.

Objectives

To assess the effects of metal-free materials for prosthodontic restorations compared to metal-ceramic or other conventional all-metal materials.

Search methods

Cochrane Oral Health's Information Specialist searched the following databases: Cochrane Oral Health's Trials Register (searched 3 May 2017), Cochrane Central Register of Controlled Trials (CENTRAL; 2017, Issue 4) in the Cochrane Library (searched 3 May 2017), MEDLINE Ovid (1946 to 3 May 2017), and Embase Ovid (1980 to 3 May 2017). The US National Institutes of Health Trials Registry (ClinicalTrials.gov) and the World Health Organization International Clinical Trials Registry Platform were searched for ongoing trials (searched 3 May 2017). No restrictions were placed on the language or date of publication when searching the electronic databases.

Selection criteria

Randomised controlled trials (RCTs) in which the clinical performance of metal-free fixed prosthodontic restorations was compared with metal-ceramic (MC) or other conventional restorations in adult patients requiring prosthodontic treatment. RCTs in which the clinical performance of different kinds of metal-free systems were compared among themselves were also considered.

Data collection and analysis

We used standard methodological procedures expected by Cochrane. Screening of eligible studies, assessment of the methodological quality of the trials and data extraction were conducted independently and in duplicate. Trial authors were contacted for missing information. Available results for the outcomes of interest of the systematic review of the studies included were tabulated as they could not be included in a formal meta-analysis.

Main results

Nine trials involving a total of 448 participants were included. We judged two trials to be at unclear risk of bias and seven to be at high risk of bias. The majority of items of risk of bias were evaluated to be at unclear or high risk level in more than 50% of the included trials. Each trial except two was addressing a different type of intervention. All evidence was rated as being of very low quality due to problems with risk of bias and imprecision of results, the latter being due to very small sample sizes, low event rates, 95% confidence intervals including the possibility of benefit for both the test and control groups, or combinations of these problems. This means that we are very uncertain about all of the results presented in this review.

One trial compared metal-free single crowns (full contour zirconia) to cast gold single crowns in 224 participants and found insufficient evidence of a difference in failure rate after one year, but after five years there was some evidence of a benefit for the gold crowns. There was insufficient evidence of a difference for crown complications at either time of assessment.

One trial compared three-unit metal-free FDPs (lithium disilicate) to three-unit metal-ceramic FDPs in 37 participants. There was insufficient evidence of a difference in bridge failure at one and six years, but some evidence of a benefit for the lithium disilicate group in terms of bridge complications at six years. One trial compared zirconia-ceramic FDPs to metal-ceramic FDPs in 34 participants but found insufficient evidence of a difference in bridge failures (i.e. no failures in either treatment group), bridge complications or patients' aesthetic evaluation at any time of assessment up to three years.

One trial compared metal-free cantilevered FDPs to metal-ceramic cantilevered FDPs in 21 participants. There was insufficient evidence of a difference for any primary outcome: bridge failures (i.e. no failures in either treatment group), bridge complications, or patients' aesthetic evaluation at any time of assessment up to three years.

One trial compared metal-free implant-supported screw retained single crowns (zirconia veneered with feldspathic ceramic) to metal-ceramic implant-supported screw-retained single crowns in 20 participants. There was insufficient evidence of a difference for any primary outcome: crown failures (i.e. no failures in either treatment group), crown complications, or satisfaction/aesthetic evaluation at any time of assessment up to two years.

Two trials compared metal-free implant abutments (zirconia) to metal implant abutments both supporting single crowns in 50 participants. There was insufficient evidence of a difference in abutment failure at one year.

One trial compared metal-free implant-supported FDPs made of two different types of zirconia ceramic in 18 participants. There was insufficient evidence of a difference in failures at any time of assessment up to 10 years (i.e. no failures in either treatment group). There was some evidence of a benefit for the zirconia-toughened alumina group in terms of complications (chipping).

One trial compared metal-free tooth-supported FDPs made with two different veneering techniques (pressed versus layered) in 40 participants. There was insufficient evidence of a difference for failures (i.e. no failures in either treatment group) or complications at any time of assessment up to three years.

Authors' conclusions

There is insufficient evidence to support or refute the effectiveness of metal-free materials for fixed prosthodontic treatment over metal-ceramic or other type of standard restorations. The overall quality of existing evidence was very low, therefore great caution should be exercised when generalising the results of the included trials. Until more evidence becomes available clinicians should continue to base decisions on which material to use for fixed prosthodontic treatment on their own clinical experience, whilst taking into consideration the individual circumstances and preferences of their patients. There is urgent need of properly designed RCTs.

PLAIN LANGUAGE SUMMARY

Metal-free materials for making crowns and bridges

Review question

To compare the effects of metal-free materials to metal-ceramic or other conventional all-metal materials for prosthodontic treatments aimed to restore severely damaged teeth or to replace missing teeth.

Background

Fixed prosthodontic treatment is a routine dental procedure in which one or more missing or severely damaged teeth are replaced by artificial substitutes. The material used to make the prosthesis may be made of a metal framework with a veneering of an aesthetic material (ceramic) or entirely in metal or it can be made with different non-metal structures (metal-free materials). There is still uncertainty regarding metal-free long-term performance compared to metal-based crowns and bridges.

Study characteristics

This review of existing studies was carried out by Cochrane Oral Health authors and the evidence is current up to 3 May 2017. We searched scientific databases for randomised controlled trials (studies where people are randomly put into one of two or more treatment groups) comparing different types of materials for prosthodontic treatment in people who were followed up for at least one year.

Of the nine included trials three were conducted in Germany, one in Sweden, one in Spain, one in Switzerland and the USA, one in Denmark, one in Italy, and one in Switzerland. All the included trials were single-centre conducted at university dental clinics and had a parallel-group study design. All the included trials received support from industry.

Key results

The review included nine studies with 448 participants in which a total of 224 crowns and 132 bridges on natural teeth, and a total of 74 crowns and 25 bridges on implants were used. Each trial was addressing a different type of intervention. The studies had durations up to 10 years but included very small numbers of participants and were assessed as at unclear or high risk of bias. Based on these studies, there is currently insufficient reliable evidence to support which of these materials are more effective.

Quality of the evidence

Two trials were at unclear risk of bias and seven were at high risk of bias. The overall quality of evidence was very low, therefore caution should be exercised when generalising the results of the included trials. Future research should aim to provide more reliable information which can help clinicians to decide on appropriate materials for fixed prosthodontic treatment whilst taking into consideration the individual circumstances and preferences of their patients.