TITLE: Metal versus Plastic Partial Dentures for Patients with Periodontal Disease: A Review of the Clinical Effectiveness and Safety

DATE: 8 April 2015

CONTEXT AND POLICY ISSUES

The structures and tissues (periodontium) that surround and support the teeth, the gums, the periodontal ligaments, and the alveolar bones of the jaw, are susceptible both to disease and to injury from the body’s inflammatory defense mechanisms.\(^1,2\) Periodontal disease is one of the major causes of loss of teeth, along with caries (cavities) and trauma. The Oral Health component of the 2007-2009 Canadian Health Measures Survey found that 16% of Canadian adults had moderate periodontal disease, and 4% had severe disease, according to clinical measurements of changes in the gum and ligaments.\(^3\) These measures of physical damage, however, do not directly detect active periodontal disease. When loss of tooth attachment was measured by the extent to which the periodontal ligament has retreated from its usual position in healthy young adults, 6% of adults with teeth have loss of attachment severe enough to put them at risk of losing one or more teeth.\(^3\) Another 6% of adults had no natural teeth remaining.\(^3\) These proportions increase by age. Loss of teeth has functional, nutritional and social consequences for the patient, and affects quality of life.\(^3\) Associations between periodontal disease and cardiovascular disease or perinatal outcomes have been explored but are so far unproven.\(^1,2\)

Treatment for periodontal disease involves the establishment of a dental hygiene regimen, with mechanical removal of plaque and calculus, and, in severe cases, topical antiseptics, systemic antibiotics and/or oral surgery.\(^1,2\) Chewing ability can be restored using any or a combination of strategies, including fixed or partial dentures, or implants. Numerous designs for appliances and biocompatible materials have been developed. For removable partial dentures, metal frames are thought preferable, but they may not be suitable for patients with periodontal disease, where progressive changes to the mouth, including tooth loss, may lead to the need for further modifications of the appliance. Acrylic (plastic) dentures are more readily modified than metal.

This report reviews the clinical effectiveness and safety of acrylic removable partial dentures compared with metal removable partial dentures in patients with periodontal disease.
RESEARCH QUESTIONS

1. What is the clinical effectiveness and safety of metal partial dentures for patients with periodontal disease?
2. What is the clinical effectiveness and safety of plastic partial dentures for patients with periodontal disease?
3. What is the comparative clinical effectiveness and safety of metal versus plastic partial dentures for patients with periodontal disease?

KEY FINDINGS

We did not identify any studies as providing the information needed to compare metal and plastic (acrylic) dentures in patients with periodontal disease. There were no randomized clinical trials, and observational studies tended not to report periodontal status and/or denture material. Therefore, the question of the clinical comparability of metal versus plastic partial dentures cannot be answered at this time.

METHODS

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, The Cochrane Library (2015, Issue 3), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2005 and March 11, 2015.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Selection Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
</tr>
<tr>
<td>Patients with periodontal disease requiring partial dentures</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
</tr>
<tr>
<td>Q1: Partial dentures made of metal</td>
</tr>
<tr>
<td>Q2: Partial dentures made of plastic (acrylic)</td>
</tr>
<tr>
<td>Q3: Partial dentures made of metal</td>
</tr>
<tr>
<td><strong>Comparator</strong></td>
</tr>
<tr>
<td>Q1+Q2: Any comparator or no comparator</td>
</tr>
<tr>
<td>Q3: Partial dentures made of plastic (acrylic)</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
</tr>
<tr>
<td>Q1: Clinical effectiveness, clinical harm</td>
</tr>
<tr>
<td>Q2: Comparative clinical effectiveness</td>
</tr>
<tr>
<td><strong>Study Designs</strong></td>
</tr>
<tr>
<td>HTA, systematic review/meta-analysis, randomized controlled trials, and non-randomized studies</td>
</tr>
</tbody>
</table>
Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, or were published prior to 2005. Articles were also excluded if they exclusively concerned bridges, implants or fixed partial dentures.

Critical Appraisal of Individual Studies

Critical appraisal was not done, as no studies were identified as meeting the inclusion criteria.

SUMMARY OF EVIDENCE

Quantity of Research Available

A total of 417 citations were identified in the literature search. Following screening of titles and abstracts, 385 citations were excluded and 32 potentially relevant reports from the electronic search were retrieved for full-text review. Four potentially relevant publications were retrieved from the grey literature search. None of these publications met the inclusion criteria. The majority were excluded because they did not provide detail on baseline periodontal disease status of the patients and/or the material used in the dentures. Appendix 1 describes the PRISMA flowchart of the study selection.

References of potential interest are discussed in Appendix 2.

Summary of Study Characteristics

No studies were identified as meeting the inclusion criteria for any of the three questions.

Summary of Critical Appraisal

No studies were identified as meeting the inclusion criteria for any of the three questions.

Summary of Findings

No studies were identified as meeting the inclusion criteria for any of the three questions.

Limitations

No studies were identified as meeting the inclusion criteria for any of the three questions.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

We did not identify any studies as providing the information needed to compare metal and plastic (acrylic) partial dentures in patients with periodontal disease. A randomized clinical trial comparing cobalt-chromium with thermoplastic removable partial dentures in older adults has been registered, but its current status is unknown. Overall, randomized studies of removable partial dentures were few, and tended to restrict inclusion to patients with successfully treated periodontal disease. Non-randomized studies did not report the periodontal disease status of the patients, or if they did, omitted the material used in constructing the dentures. The question
of the clinical comparability of metal versus plastic partial dentures, therefore, cannot be answered at this time.

PREPARED BY:
Canadian Agency for Drugs and Technologies in Health
Tel: 1-866-898-8439
www.cadth.ca
REFERENCES


APPENDIX 1: Selection of Included Studies

417 citations identified from electronic literature search and screened

→ 385 citations excluded

32 potentially relevant articles retrieved for scrutiny (full text, if available)

→ 4 potentially relevant reports retrieved from other sources (grey literature, hand search)

36 potentially relevant reports

→ 36 reports excluded:
  - periodontal disease status not identified (21)
  - patients with periodontal disease excluded (5)
  - material not reported (1)
  - non-clinical outcomes (5)
  - irrelevant patient group (1)
  - other (3)

→ 0 reports included in review
APPENDIX 2: Additional References of Potential Interest

Studies excluded because they did not report periodontal disease subgroup or status


A 2012 Cochrane review on “Interventions for replacing missing teeth: partially absent dentition”, which selected randomized clinical trials with clinical outcomes, identified five trials that evaluated removable partial dentures. Of these, one trial of 38 patients published in 2000 compared different materials (titanium framework versus cobalt-chromium framework, with an acrylic base). The reviewers considered this trial to be at high risk of bias because of unclear information on randomization and allocation concealment and high loss to follow-up. In addition, some patients received multiple dentures, and it was unclear whether the analysis accounted for clustering. The Cochrane reviewers concluded there was insufficient data to reach conclusions regarding materials. The planned subgroup analyses for the review included one of congenital versus acquired absence of teeth (which would have included periodontal disease), but they did not have enough data to carry it out.


A 2012 systematic review on the association between denture stomatitis and partial removable dentures found one 2001 non-randomized study comparing metal to acrylic dentures. The study reported that acrylic resin and mucosal partial dentures was significantly related to denture stomatitis. The reviewers did not report any conclusions regarding materials.


The Shortened Dental Arch study was a randomized trial that recruited patients with healthy gums or successfully treated periodontal disease who had complete molar loss in one jaw. Patients were randomized to restoration to a shortened dental arch (complete premolar dentition) by implants and fixed bridges, or to restoration to full dentition with a metal removable partial denture. Study follow-up on 132 patients has reached 5 years, with results reported on tooth loss and periodontal outcomes. Thirty-eight patients experienced further tooth loss, with no significant differences between
study groups. Reasons given for extraction were endodontic, caries, fracture, and periodontal disease. Pocket depth and bleeding on probing were assessed for inclusion into a multivariate model, but neither they nor any of the other baseline covariates were significantly associated. In a separate paper, periodontal outcomes were assessed by the plaque index according to Silness and Löe, vertical clinical attachment loss, probing pocket depth and bleeding with probing. The results suggested slightly poorer outcomes with the removable partial denture as opposed to the shortened dental arch alone, but the differences were small.

Studies excluded because they did not report material for denture construction


A retrospective non-randomized study of long-term tooth loss in a military cohort who had been successfully treated but were periodontally compromised compared fixed partial dentures, removable partial dentures and no prosthodontic treatment. The average observation period was 9.7 ± 4.1 years. Removable partial dentures and aggressive periodontitis were associated with higher risk of overall tooth loss, but not with loss of abutment teeth. Material for denture construction was not reported.