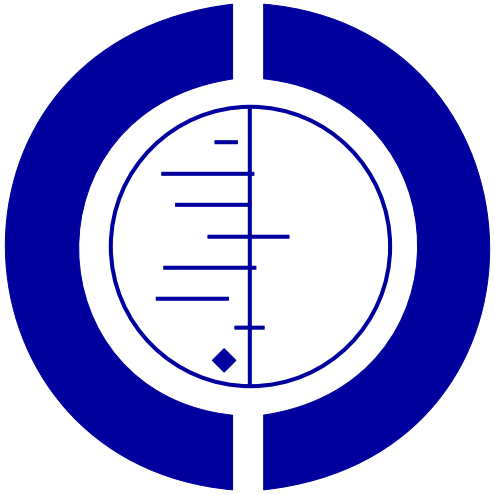
Interventions for replacing missing teeth: preprosthetic surgery versus dental implants (Review)

Coulthard P, Esposito M, Worthington HV, Jokstad A



This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2005, Issue 4

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This record should be cited as:
Coulthard P, Esposito M, Worthington HV, Jokstad A. Interventions for replacing missing teeth: preprosthetic surgery versus dental implants. *The Cochrane Database of Systematic Reviews* 2002, Issue 4. Art. No.: CD003604. DOI: 10.1002/14651858.CD003604.

This version first published online: 21 October 2002 in Issue 4, 2002.
Date of most recent substantive amendment: 09 July 2002

ABSTRACT

Background
Preprosthetic surgery refers to the surgical procedures that can modify the oral anatomy to facilitate the retention of conventional dentures. Osseointegrated implants offer an alternative treatment to improve denture retention. A denture may be connected by special attachments to implants placed into the jaw.

Objectives
To test the null hypothesis of no difference in the success (patient satisfaction and morbidity) and cost effectiveness between conventional prostheses that require preprosthetic surgery (PPS) and implant retained prostheses (IRO) that do not require preprosthetic surgery, against the alternative hypothesis of a difference.

Search strategy
The Cochrane Oral Health Group (OHG) Specialised Register (May 2002), the Cochrane Controlled Trials Register (Issue 2, 2002), MEDLINE and EMBASE (May 2002) were searched. In addition, 55 implant companies were contacted and the bibliographies of review articles were checked for studies outside the hand searched journals and personal references were searched.

Selection criteria
Randomised controlled trials comparing preprosthetic surgery and implant retained dentures for improving denture retention.

Data collection and analysis
Data were independently extracted, in duplicate, by two reviewers (HW, PC). Authors were contacted for details of randomisation and withdrawals and a quality assessment was carried out (ME, PC). The Cochrane OHG's statistical guidelines were followed.

Main results
One study, containing 60 participants, reported in four articles was identified for inclusion in this review. No studies were excluded. There was a statistically significant difference between mean patient satisfaction scores with patients in the IRO group being more satisfied in general at both year one (WMD = -0.66(95% CI; -1.28 to -0.04)) and five years (WMD = -0.90(95%CI; -1.74 to -0.06). Altered sensation of the lower lip and chin was measured at one year and five years. There was no statistically significant difference at either time point and no patients had altered sensation at five years.

Authors' conclusions
There is weak evidence from the results of one randomised controlled trial including 60 subjects that patients are generally less satisfied with preprosthetic surgery and a conventional denture than with an implant retained denture. There is a need for more well designed trials comparing the success and cost-effectiveness of preprosthetic surgery and implant supported dentures. Such trials should be reported according to the CONSORT guidelines (http://www.consort-statement.org/). However, since preprosthetic surgery is considered to be an obsolete treatment nowadays, almost completely replaced by dental implants, it may be that new RCTs on this topic will not be designed.

SYNOPSIS

There is weak evidence that patients are generally less satisfied with a conventional denture made after oral surgery to improve the retention of the denture than with a denture retained by implants.

More evidence needed to compare mouth surgery and dental implants to help retain dentures for people who cannot keep dentures in place easily

Some people who need dentures will have trouble keeping them in place because of the shape of their gums and jaws, or muscle structure in the mouth. Surgery can be done to try and improve denture retention (preprosthetic surgery). Another option is an implant retained overdenture, where dentures are attached to dental implants that go into the jaw. The review found that there is not enough evidence from trials to show which surgical techniques, types of implant or types of denture may have better results. However, there is some evidence to suggest that people may prefer implants to conventional surgery.

BACKGROUND

Missing teeth and supporting oral tissues have traditionally been replaced with dentures or bridges permitting restoration of chewing function, speech and aesthetics. Surgery may sometimes be a part of the overall treatment to provide dentures for a patient, when denture retention is a problem because of unfavourable oral anatomy. Dental implants now offer an alternative and may provide improved retention compared to conventional dentures. Implants are inserted into the jaw bones to support a denture and are retained because of the intimacy of bone growth onto their surface. This direct structural and functional connection between living bone and implant surface, termed osseointegration, was first described by (Branemark 1977) and has undoubtedly been one of the most significant scientific breakthroughs in dentistry over the past 30 years. Teeth may have been lost through dental disease or trauma or be congenitally absent.

Preprosthetic surgery refers to the surgical procedures that can be used to modify the oral anatomy to facilitate the construction of retentive conventional dentures. Preprosthetic surgical techniques include the following:

- Muscle attachments

Prominent muscle attachments from the facial muscles or tongue can displace a denture when they contract. Surgical procedures allow these muscles to be stripped from their bony insertions. The word 'fraenoplasty' is used for the removal of muscle attachments for preprosthetic purposes

- Alveolar ridge augmentation

Resorbed and defective alveolar ridges of the jaws may be built up with bone grafts and bone substitutes, such as hydroxyapatite granules, to facilitate the construction of dentures.

- Sulcus deepening

Inadequate alveolar ridge height of the jaws can be treated by deepening the sulcus (space between ridge and cheeks, lips or tongue) by a 'vestibuloplasty' procedure rather than by augmenting the ridge. Such procedures may leave a raw area of soft tissue which can be covered by a skin or mucosal graft. The major problem with these techniques is the significant postoperative wound contracture that can reduce the sulcus height again. Many variants of this surgical procedure have therefore been developed in an attempt to improve the long-term results.

This review aims to compare conventional prostheses that have required preprosthetic surgery and implant retained prostheses to improve their retention.

OBJECTIVES

To test the null hypothesis of no difference in the success (patient satisfaction and morbidity) and cost-effectiveness between conventional prostheses that require preprosthetic surgery and implant retained prostheses that do not require preprosthetic surgery, against the alternative hypothesis of a difference.

CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies

Randomised controlled trials have been included.

Types of participants

Edentulous patients who require either preprosthetic surgery and conventional denture construction, or construction of an implant retained denture.

Types of intervention

Preprosthetic surgery for conventional dentures or implant retained denture.

Types of outcome measures

Outcome measures of interest were:

- morbidity (including pain, infection, nerve damage) (binary)
- patient satisfaction (including overall satisfaction, denture retention, appearance, eating and speech) (both binary and continuous on VAS scale)
- cost-effectiveness (continuous)

SEARCH STRATEGY FOR IDENTIFICATION OF STUDIES

See: Oral Health Group search strategy

To identify studies for inclusion or consideration in this review a detailed search strategy was developed for each database searched. These were based on the search strategy developed for MEDLINE but revised appropriately for each database. The search strategy combined a sensitive search strategy for RCTs revised from phases 1 and 2 of the Cochrane Sensitive Search Strategy for RCTs (as published in Appendix C in the Cochrane Reviewers' Handbook). The subject search used a combination of controlled vocabulary and free text terms based on the following search strategy for searching MEDLINE (OVID):

#1 randomised controlled trial.pt.
#2 controlled clinical trial.pt.
#3 randomised controlled trials.sh.
#4 random allocation.sh.
#5 double blind method.sh.
#6 single blind method.sh.
#7 latin square.ti,ab.
#8 crossover.ti,ab.
#9 (split adj (mouth or plot)).ti,ab.
#10 or/1-9
#11 (ANIMAL not HUMAN).sh.
#12 10 not 11
#13 clinical trial.pt.
#14 exp clinical trials/
#15 (clin$ adj25 trial$).ti,ab.
#16 ((singl$ or doubl$ or trebl$ or tripl$) adj25 (blind$ or mask$)).ti,ab.
#17 placebos.sh.
#18 placebo$.ti,ab.
#19 random$.ti,ab.
#20 research design.sh.
#21 or/13-20
#22 21 not 11
#23 22 not 12
#24 12 or 22
#25 exp Dental Implants/
#26 exp Dental Implantation/ or dental implantation.mp.
#27 exp Dental Prosthesis, Implant-Supported/
#28 ((osseointegrated adj implant$) and (dental or oral)).mp. [mp=title, abstract, registry number word, mesh subject heading]
#29 dental implant$.mp. [mp=title, abstract, registry number word, mesh subject heading]
#30 (implant$ adj5 dent$).mp. [mp=title, abstract, registry number word, mesh subject heading]
#31 dental-implant$.mp. [mp=title, abstract, registry number word, mesh subject heading]
#32 (((overdenture$ or crown$ or bridge$ or prosthesis or restoration$) adj5 (Dental or oral)) and implant$).mp. [mp=title, abstract, registry number word, mesh subject heading]
#33 "implant supported dental prosthe*".mp. [mp=title, abstract, registry number word, mesh subject heading]
#34 ("blade implant$" and (dental or oral)).mp. [mp=title, abstract, registry number word, mesh subject heading]
#35 ((endosseous adj5 implant$) and (dental or oral)).mp. [mp=title, abstract, registry number word, mesh subject heading]
#36 ((dental or oral) adj5 implant$).mp. [mp=title, abstract, registry number word, mesh subject heading]
#37 25 - 36
#38 24 and 37

DATABASES SEARCHED

Cochrane Oral Health Group Specialised Trials Register: May 2002
The Cochrane Controlled Trials Register: Cochrane Library Issue 2, 2002
MEDLINE: 1966 - May 2002
EMBASE: 1974 - May 2002
The bibliographies of papers and review articles were checked for studies outside the hand searched journals. Personal references were also searched.

LANGUAGE

There were no language restrictions.

UNPUBLISHED STUDIES

First named authors of RCTs identified were written to in order to obtain further information about the trial and to attempt to identify unpublished or ongoing studies. In addition, 55 implant companies were contacted.

HANDSEARCHING

Several journals relevant to this review are being handsearched as part of the Oral Health Group strategy. The list of the dental journals handsearched by the Cochrane Collaboration can be found at http\:www.cochrane-oral.man.ac.uk. The following journals were identified as being important to be handsearched for this review: British Journal of Oral and Maxillofacial Surgery, Clinical Implant Dentistry and Related Research, Clinical Oral Implants Research, Implant Dentistry, International Journal of Oral and Maxillofacial Implants, International Journal of Oral and Maxillofacial Surgery, International Journal of Periodontics and Restorative Dentistry, International Journal of Prosthodontics, Journal of the American Dental Association,

Journal of Biomedical Materials Research, Journal of Clinical Periodontology, Journal of Dental Research, Journal of Oral Implantology, Journal of Oral and Maxillofacial Surgery, Journal of Periodontology, Journal of Prosthetic Dentistry. Where these had not already been searched as part of the Cochrane Journal Handsearching Programme, the journals were handsearched by the reviewers.

METHODS OF THE REVIEW

STUDY SELECTION

The titles and abstracts (when available) of all reports identified through the electronic searches were scanned independently by two reviewers (PC, ME). For studies appearing to meet the inclusion criteria, or for which there is insufficient data in the title and abstract to make a clear decision, the full report was obtained. The full reports obtained from all the electronic and other methods of searching were assessed independently by two reviewers to establish whether the studies met the inclusion criteria or not (PC, ME). Any disagreements were resolved by discussion. A third reviewer was to be consulted if there was unresolved disagreement. All studies meeting the inclusion criteria then underwent a validity assessment and data extraction. Any studies to be rejected at this or subsequent stages were to be recorded in the table of excluded studies, and reasons for exclusion recorded.

QUALITY ASSESSMENT

The quality assessment of the included trials was undertaken independently and in duplicate by two reviewers as part of the data extraction process (PC, ME).
Two main quality criteria were considered;
1) Allocation concealment, recorded as;
(A) Adequate
(B) Unclear
(C) Inadequate
(D) Not used
as described in the Cochrane Reviewers' Handbook.
2) Completeness of follow-up
Further quality assessment was carried out to assess definition of exclusion/inclusion criteria, adequate definition of success criteria and comparability of control and treatment groups at entry.
The quality assessment criteria were pilot tested using several articles from a similar review. The agreement between the quality assessments was to be measured using the Kappa statistic.

DATA EXTRACTION

Data were extracted by two reviewers (HW, PC) independently using specially designed data extraction forms. The data extraction forms were piloted on several papers in similar reviews and modified as required before use. Any disagreement was discussed and a third reviewer consulted where necessary. Authors were contacted for clarification or missing information.

For each trial the following data were recorded:
Date of the study, year of publication, country of origin and source of study funding.
Details of the participants including demographic characteristics, source of recruitment, and inclusion criteria.
Details on the type of intervention.
Details of the outcomes reported, including method of assessment (where measurement scales were used it was recorded whether or not they had been validated), and time intervals.

DATA SYNTHESIS

For dichotomous outcomes, the estimate of effect of an intervention was expressed as relative risks together with 95% confidence intervals (CI). For continuous outcomes, means and standard deviations were used to summarise the data for each group using mean differences and 95% CI.

No data synthesis was possible as only one study was identified. We intended to follow the methods below and will do so in further updates of the review as more trials become available.

Clinical heterogeneity was to be assessed by examining the types of participants, interventions and for all outcomes in each study if more studies had been included. Only if there were studies of similar comparisons reporting the same outcome measures was meta-analysis to be attempted. Relative risks were to be combined for dichotomous data, and weighted or standardised mean differences for continuous data, using a random effects model. The significance of any discrepancies in the estimates of the treatment effects from the different trials were to be assessed by means of Cochran's test for heterogeneity and any significant heterogeneity ($P<0.1$) investigated.

Sensitivity analyses were to be undertaken to examine the effect of randomisation and allocation concealment on the overall estimates of effect. In addition, the effect of including unpublished literature on the review's findings was to be examined. We had planned subgroup analyses in respect of the type of preprosthetic surgery and type of implant retained denture.

DESCRIPTION OF STUDIES

Summary details are given in the 'Characteristics of included studies' table. No studies were excluded. Only one study was eligible and included in this review (Raghoebar 2000) although this study was reported in four trial reports (Boerrigter 1995; Bouma 1997; Van der Wijk 1998). The study, independently funded, was conducted in the Netherlands at a University Hospital and reported patient satisfaction, altered sensation of the lower lip and chin, and cost-effectiveness. A group undergoing preprosthetic surgery (PPS) to facilitate improved denture retention was compared with an implant retained overdenture (IRO) group. A third group of conventional denture patients without surgery was included in this

study and as this was not within the scope of the review we have disregarded this group. The PPS group underwent an interforaminal vestibuloplasty and lowering of the floor of the mouth procedure carried out under general anaesthesia. The patient's relined lower denture was fixed with perimandibular silk ligatures for one week. The IRO group had two mandibular implants (Branemark or IMZ) placed under local anaesthesia and allowed a healing period of three months prior to connecting via a metal clip system to an overdenture. After one year, patients in the PPS group who were not satisfied had the opportunity to have implant treatment as per the IRO group.

METHODOLOGICAL QUALITY

Both assessors scored the concealment of allocation as unclear (B), however this was changed to clearly concealed (A) after contacting the author. It was not possible for the patients or outcome assessors to be blind. Both assessors scored the reasons for withdrawals described by study group as not clearly explained, however we have been advised by the authors of these reasons (not by study group) and these are described in the 'Characteristics of included studies' table.

After one year, patients of the PPS group who were not satisfied had the opportunity to receive an implant retained overdenture (IRO). The five year data were therefore subject to an intention-to-treat analysis and there was a clear statement about this. Clear statements or evidence of intention-to-treat analysis are not commonly presented in trial reports.

An a priori calculation for the determination of the sample size was not presented for the trial.

RESULTS

There did not appear to be any baseline imbalance between the PPS and IRO groups as regards overall denture satisfaction.

PATIENT SATISFACTION (outcomes 01-07)

There was a statistically significant difference between mean patient satisfaction scores with patients in the IRO group being more satisfied in general at both one year (WMD = -0.66, 95% CI; -1.28 to -0.04)) and five years (WMD = -0.90, 95%CI; -1.74 to -0.06) (outcome 01). This was also presented as a binary assessment at one year, although the difference in satisfaction failed to reach significance (outcome 02). Please note that four patients in the PPS group who were not satisfied were allowed to have implant treatment as per the IRO group after one year and this will have affected the five year satisfaction results underestimating the difference between groups. None of the following were found to be significantly different between the two groups at one year: dissatisfied with lower denture (outcome 03); dissatisfied with appearance of denture (outcome 04); dissatisfied with retention of denture (outcome 05); dissatisfied eating with denture (outcome 06); and dissatisfied with speech with denture (outcome 07).

MORBIDITY OUTCOMES (outcome 08)

Altered sensation of the lower lip and chin was measured at one year and five years. There was no statistically significant difference at either time point and no patients had altered sensation at five years.

COST-EFFECTIVENESS (outcome 09)

The cost-effectiveness data could not be extracted from the report as it was combined with a separate trial.

DISCUSSION

It has not been possible to fully achieve the objectives of this review as there are a lack of trials in this area. The overall number of randomised trials (one) comparing preprosthetic surgery and conventional dentures and implant supported dentures and crucially the number of participants (60), are too few to address the question of which is preferable. Small numbers of patients result in greater potential for random error and/or chance findings. Awareness of this is important for this review. Furthermore, no conclusions can be made about which preprosthetic surgical technique may be preferable or which type of implant overdenture is preferable as there were no trials comparing these. The cost effectiveness data could not be extracted for inclusion in this review.

In the light of insufficient numbers, it may be tempting to consider including prospective but non-randomised controlled trials, but we would urge caution. There are few robust methods for reviewing studies other than randomised trials. There are numerous studies of preprosthetic surgery and implant retained overdentures in the medical and dental literature. However, in the light of the potential for serious bias for assessing treatment interventions in uncontrolled patient series, retrospectively controlled studies and specifically patient selection bias in prospective but non-randomised controlled studies, we included only randomised controlled trials in this review. Two main issues arise from this. Firstly, whether we succeeded in finding all relevant trials and secondly, the potential for bias, both systematic and random, in this approach and in the included trial. Whilst we have endeavoured, by use of a fairly comprehensive search strategy, to locate all of the randomised controlled trials using preprosthetic surgery for conventional dentures and implant supported dentures, some trials may have been missed through inadequate reporting of trial methodology as well as mis-indexing in electronic databases.

The methodology of the study included was not clearly presented. Allocation concealment was not described in the articles although after contacting the authors, this was confirmed to have been adequately carried out. The prevention of selection bias, via ran-

dom selection and allocation concealment, is the key rationale for choosing randomised trials. Patient satisfaction is rarely mentioned in trials but this study did focus on this as an important outcome measure. It will be helpful for future trials to include patient satisfaction outcomes and for trials to use validated instruments. This study also included data for complications from treatment, that is, altered sensation of the lower lip and chin. Damage to the inferior alveolar nerve or mental nerve may occur during the implant treatment or preprosthetic surgery. It would be useful for future studies to also include pain and infection. The overall follow-up should be five years to adequately assess long-term outcomes. Information about operator expertise and experience would also be helpful. It was noted that the patients in this study required general anaesthesia for preprosthetic surgery whilst the implant treatment was provided under local anaesthesia.

After one year, four patients in the PPS group were dissatisfied and were given the treatment for the other group (implants). However, an intention-to-treat analysis was carried out at five years where their data was analysed according to their original PPS group. The difference between the two groups was therefore an underestimate of the true difference in satisfaction between the two procedures. The reviewers question the use of intention-to-treat analysis in studies of this type.

Blinding of patients and treatment providers is impractical for trials testing the surgical interventions eligible for inclusion in this review. However, it is possible to make some attempt at blinding by having an independent outcome assessor to score morbidity.

The available evidence from randomised trials of preprosthetic surgery and conventional dentures and implant supported dentures is limited in scope and quality, and is of uncertain validity. Nonetheless, there is some evidence that patients are generally more satisfied with an implant retained overdenture than preprosthetic surgery and a conventional denture, and that there is no significant difference in the nerve damage associated with these treatments. This finding must be viewed in the context of the incomplete and unsatisfactory evidence for other outcomes. Also, unclear are the resource implications for the alternative interventions. Information on resource use and costs was not available in a suitable form for extraction and therefore it is difficult to draw any conclusions.

AUTHORS' CONCLUSIONS

Implications for practice

Only a few and provisional conclusions relating to treatment choices can be drawn from the available randomised controlled trial, which does not provide either robust or sufficient evidence for most of the decisions necessary to manage patients. There is weak evidence from the results of one randomised controlled trial including 60 subjects that patients are generally less satisfied with preprosthetic surgery and a conventional denture than with an implant retained overdenture. There was no evidence of any difference in morbidity between the two groups. No conclusions can be drawn about cost-effectiveness.

Implications for research

A deeper understanding is required of patient preferences regarding outcomes of treatment, and any trade off between benefits and adverse effects of the various methods of providing a prosthesis for patients with retention problems. This would inform debate about the most cost-effective method of managing this common problem. There needs to be consensus about which patient satisfaction measures are preferable for these types of studies and a range of morbidity variables ought to be included. It would be helpful to also have further studies investigating the cost effectiveness of these two treatment options. In summary there is a need for more and well designed trials comparing the success and cost-effectiveness of preprosthetic surgery and conventional dentures and implant supported dentures. Such trials should be reported according the CONSORT guidelines (http://www.consort-statement.org/). However, since preprosthetic surgery is considered to be an obsolete treatment nowadays, almost completely replaced by dental implant treatment, it may be that new RCTs on this topic will not be designed.

POTENTIAL CONFLICT OF INTEREST

None known.

ACKNOWLEDGEMENTS

We wish to thank Sylvia Bickley (Cochrane Oral Health Group) for her assistance with literature searching and Emma Tavender (Cochrane Oral Health Group) for her help with the preparation of this review.

SOURCES OF SUPPORT

External sources of support

- The PPP Foundation UK
- Swedish Medical Research Council (9495) SWEDEN
- Jubileumsfonden (The Sahlgrenska Academy at Goteborg University) SWEDEN

Internal sources of support

- University Dental Hospital of Manchester UK

- The Sahlgrenska Academy at Goteborg University SWEDEN
- University of Oslo NORWAY

REFERENCES

References to studies included in this review

Raghoebar 2000 *{published and unpublished data}*

Boerrigter EM, Stegenga B, Raghoebar GM, Boering G. Patient satisfaction and chewing ability with implant-retained mandibular overdentures: a comparison with new complete dentures with or without preprosthetic surgery. *Journal of Oral and Maxillofacial Surgery* 1995; **53**:1167–73.

Bouma J, Boerrigter LB, Oort RP van, Sonderen E van, Boering G. Psychological effects of implant-retained overdentures. *International Journal of Oral and Maxillofacial Implants* 1997;**12**:515–22.

* Raghoebar GM, Meijer HJA, Stegenga B, Hof MA van't, Oort RP van, Vissink A. Effectiveness of three treatment modalities for the edentulous mandible. A five-year randomised clinical trial. *Clinical Oral Implants Research* 2000;**11**:195–201.

Van der Wijk P, Bouma J, Waas MAJ van, Oort RP van, Rutten FFH. The cost of dental implants as compared to that of conventional strategies. *International Journal of Oral and Maxillofacial Implants* 1998;**13**:546–53.

Additional references

Branemark 1977

Branemark PI, Hansson BO, Adell R, Breine U, Lindstrom J, Hallen O, Ohman, A. *Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year period*. Stockholm: Almqvist and Wiksell Int, 1997.

* *Indicates the major publication for the study*

TABLES

Characteristics of included studies

Study	Raghoebar 2000
Methods	Parallel group randomised 5 year trial recruiting patients to 3 groups. 4 patients lost over the first year (2 in PPS, 2 in CD and 0 in IRO group), a further 8 patients lost over subsequent 4 years (2 in PPS, 5 in DC and 1 in the IRO group). All drop outs were thought to be unrelated to treatment group. After contacting the authors we were still unsure whether 'patients could not be traced' was related to treatment.
Participants	The criteria for inclusion were an edentulous period of at least 1 year; a mandibular height in the symphysis of 15 to 25 mm and persistent problems wearing conventional complete dentures due to reduced stability and insufficient retention. Patients previously treated with preprosthetic surgery or dental implants were excluded. The study was undertaken in a University Hospital in the Netherlands recruiting 90 patients,

Characteristics of included studies (*Continued*)

	32, 28, 30 allocated to IRO, PPS and CD groups respectively. After 1 year evaluation, 8 patients from the CD group and 4 patients from the PPS group chose to switch to the IRO group. The analysis presented in reports for the 5 year data was intention-to-treat (ITT) in that these patients were included in their original allocation group.
Interventions	PPS - PreProsthetic Surgery to improve denture retention IRO - Implant Retained Overdenture CD - Conventional denture* * only the comparison between PPS and IRO was included in this review.
Outcomes	Patient satisfaction: overall denture satisfaction (1-10 scale) at 1 and 5 years and the following binary outcome variables at 1 year; general satisfaction, satisfaction with lower denture, satisfied with appearance of denture, satisfied with retention of denture, eating with denture and speech with denture. Morbidity; altered sensation of lower lip and chin at 1 and 5 years. Cost effectiveness: at 1 year.
Notes	
Allocation concealment	A

GRAPHS

Comparison 01. PPS versus IRO

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Overall denture satisfaction (0-10 scale)			Weighted Mean Difference (Fixed) 95% CI	Totals not selected
02 Overall denture satisfaction (binary) - one year data	1	58	Relative Risk (Fixed) 95% CI	16.03 [0.96, 268.37]
03 Dissatisfied with lower denture - one year data	1	58	Relative Risk (Fixed) 95% CI	3.75 [0.85, 16.55]
04 Dissatisfied with appearance of denture - one year data	1	58	Relative Risk (Fixed) 95% CI	1.43 [0.35, 5.83]
05 Dissatisfied with retention of denture - one year data	1	58	Relative Risk (Fixed) 95% CI	2.41 [0.84, 6.95]
06 Dissatisfied with eating with denture - one year data	1	58	Relative Risk (Fixed) 95% CI	5.36 [0.67, 43.07]
07 Dissatisfied with speech with denture - one year data	1	58	Relative Risk (Fixed) 95% CI	7.50 [0.98, 57.17]
08 Morbidity: altered lower lip and chin sensation			Relative Risk (Fixed) 95% CI	Totals not selected

INDEX TERMS

Medical Subject Headings (MeSH)

Dental Implantation; Mouth, Edentulous [surgery]; Oral Surgical Procedures, Preprosthetic; Patient Satisfaction

Medical MeSH check words

Humans

COVER SHEET

Title Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Authors	Coulthard P, Esposito M, Worthington HV, Jokstad A
Contribution of author(s)	Conceiving, designing and coordinating the review (PC) Developing search strategy and undertaking searches (ME, AJ, PC) Screening search results and retrieved papers against inclusion criteria (ME, PC) Appraising quality and extracting data from papers (HW, ME, PC) Writing to authors for additional information (HW, ME, PC) Data management for the review and entering data into RevMan (HW, PC) Analysis and interpretation of data (HW, PC) Writing the review (PC) Providing general advice on the review (ME, HW, AJ) Performing previous work that was the foundation of current study (ME, AJ, HW, PC)
Issue protocol first published	2002/2
Review first published	2002/4
Date of most recent amendment	24 February 2005
Date of most recent SUBSTANTIVE amendment	09 July 2002
What's New	Information not supplied by author
Date new studies sought but none found	Information not supplied by author
Date new studies found but not yet included/excluded	Information not supplied by author
Date new studies found and included/excluded	Information not supplied by author
Date authors' conclusions section amended	Information not supplied by author
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DOI	10.1002/14651858.CD003604
Cochrane Library number	CD003604
Editorial group	Cochrane Oral Health Group
Editorial group code	HM-ORAL

GRAPHS AND OTHER TABLES

Fig. 1. Comparison 01. PPS versus IRO

01.01 Overall denture satisfaction (0-10 scale)

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 01 Overall denture satisfaction (0-10 scale)

Study	Treatment		Control		Weighted Mean Difference (Fixed)	Weighted Mean Difference (Fixed)
	N	Mean(SD)	N	Mean(SD)	95% CI	95% CI
01 year 1						
Raghoebar 2000	28	7.54 (1.35)	30	8.20 (1.03)		-0.66 [-1.28, -0.04]
02 year 5						
Raghoebar 2000	26	6.40 (1.80)	29	7.30 (1.30)		-0.90 [-1.74, -0.06]

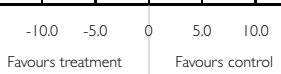

Fig. 2. Comparison 01. PPS versus IRO

01.02 Overall denture satisfaction (binary) - one year data

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 02 Overall denture satisfaction (binary) - one year data

Study	Treatment	Control	Relative Risk (Fixed)	Weight	Relative Risk (Fixed)
	n/N	n/N	95% CI	(%)	95% CI
Raghoebar 2000	7/28	0/30		100.0	16.03 [0.96, 268.36]
Total (95% CI)	28	30		100.0	16.03 [0.96, 268.36]
Total events: 7 (Treatment), 0 (Control)					
Test for heterogeneity: not applicable					
Test for overall effect z=1.93 p=0.05					

Fig. 3. Comparison 01. PPS versus IRO

01.03 Dissatisfied with lower denture - one year data

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 03 Dissatisfied with lower denture - one year data

Study	Treatment n/N	Control n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Raghoebar 2000	7/28	2/30		100.0	3.75 [0.85, 16.55]
Total (95% CI)	28	30		100.0	3.75 [0.85, 16.55]
Total events: 7 (Treatment), 2 (Control)					
Test for heterogeneity: not applicable					
Test for overall effect z=1.74 p=0.08					

Fig. 4. Comparison 01. PPS versus IRO

01.04 Dissatisfied with appearance of denture - one year data

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 04 Dissatisfied with appearance of denture - one year data

Study	Treatment n/N	Control n/N	Relative Risk (Fixed) 95% CI	Weight (%)	Relative Risk (Fixed) 95% CI
Raghoebar 2000	4/28	3/30		100.0	1.43 [0.35, 5.83]
Total (95% CI)	28	30		100.0	1.43 [0.35, 5.83]
Total events: 4 (Treatment), 3 (Control)					
Test for heterogeneity: not applicable					
Test for overall effect z=0.50 p=0.6					

Fig. 5. Comparison 01. PPS versus IRO

01.05 Dissatisfied with retention of denture - one year data

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 05 Dissatisfied with retention of denture - one year data

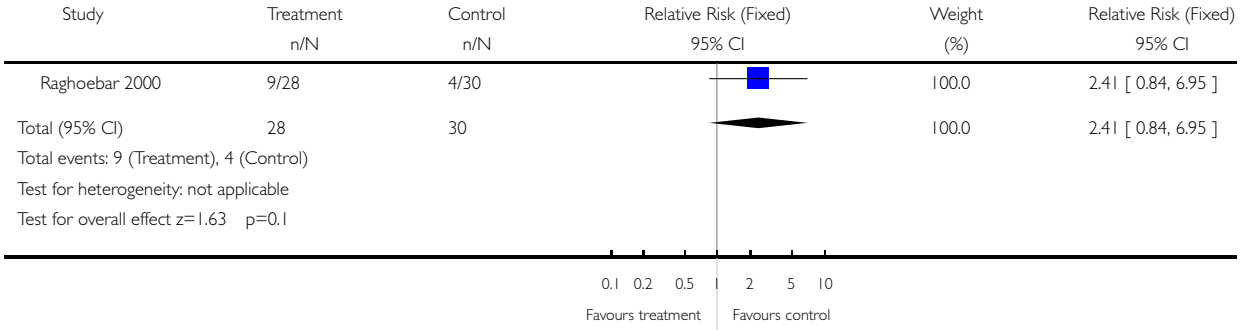

Fig. 6. Comparison 01. PPS versus IRO

01.06 Dissatisfied with eating with denture - one year data

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 06 Dissatisfied with eating with denture - one year data

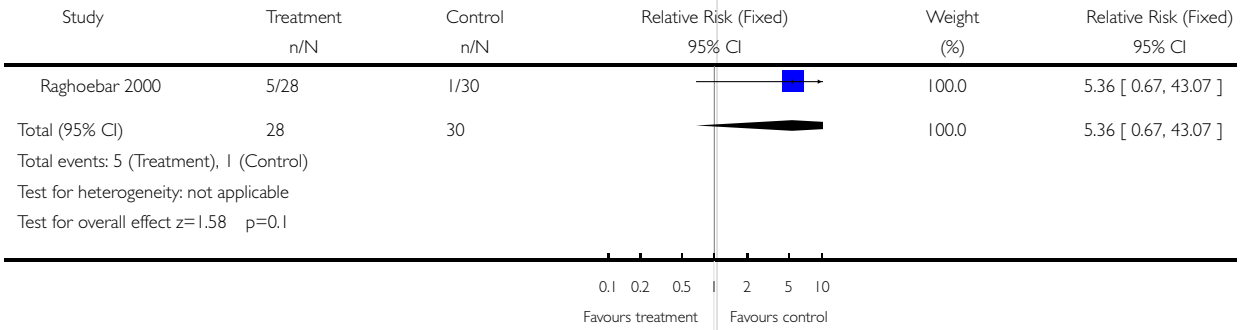

Fig. 7. Comparison 01. PPS versus IRO

01.07 Dissatisfied with speech with denture - one year data

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 07 Dissatisfied with speech with denture - one year data

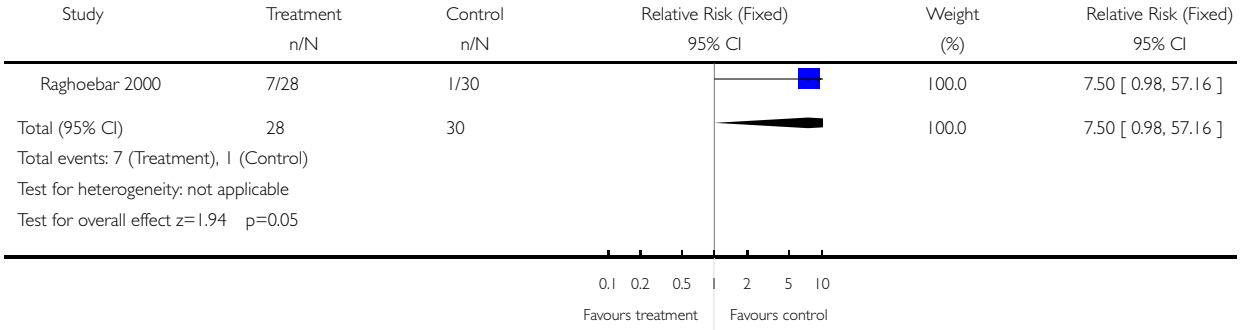

Fig. 8. Comparison 01. PPS versus IRO

01.08 Morbidity: altered lower lip and chin sensation

Review: Interventions for replacing missing teeth: preprosthetic surgery versus dental implants

Comparison: 01 PPS versus IRO

Outcome: 08 Morbidity: altered lower lip and chin sensation