

# Implant Supported Fixed Restorations versus Implant Supported Removable Overdentures: A Systematic Review

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## Abstract

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**Keywords:** fixed restoration; removable over denture; all on four; systematic review; implant supported restorations.

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**AIM:** The aim of this study is to systematically evaluate and compare implant retained fixed restoration versus implant retained over denture.

**MATERIAL AND METHODS:** Search was made in 2 databases including PubMed and PubMed Central. Title and abstract were screened to select studies comparing implant retained fixed restorations versus implant retained removable overdentures. Articles which did not follow the inclusion criteria were excluded. Included papers were then read carefully for a second stage filter, this was followed by manual searching of bibliography of selected articles.

**RESULTS:** The search resulted in 5 included papers. One study evaluated the masticatory function, while the other 4 evaluated the patient satisfaction. Two of them used Visual Analogue Scale (VAS) as a measurement tool, while the other two used VAS and Categorical Scales (CAT). Stability, ability to chew, ability to clean, ability to speak and esthetics were the main outcomes of the 4 included papers.

**CONCLUSION:** Conflicting results was observed between the fixed and removable restorations.

## Introduction

Being without teeth is a disability, and the main target of implant placement is to add support of fixed prostheses or to maintain complete dentures in the edentulous arch [1]. Difficulties are faced by edentulous patients using their traditional complete dentures due to lack of fit, support and security, adding to that the related compromise in mastication function [2].

Implant supported restorative restorations show high success rates [3, 4]. Reconstruction by implant-supported single-unit crowns or fixed bridges represents a valid tool to rehabilitate partially edentulous patients [5-7]. Furthermore, long-term data of implant-supported fixed prostheses or overdentures in edentulous jaws are available and presents a reliable treatment [8].

Overdenture is a removable dental prosthesis that covers and rests on one or more remaining

natural teeth, the roots of natural teeth, and/or dental implants [9]. Overdentures resting on implants have been shown to provide a successful long-term end result, particularly when used to rehabilitate edentulous jaws [10, 11]. High Implant survival rates and patient satisfaction has been reached with this treatment option [12].

Fixed-implant prostheses in the edentulous jaw are also a scientifically justified treatment option [13]. Two fixation methods are used for fixed implant-supported restorations. They can be attached to implants with screws, or they can be cemented to abutments which are attached to implants [14]. Despite their high survival rates, patients concerns have been reported periodically for implant supported fixed bridges, resulting in low patient comfort [15].

When selecting between a fixed or a removable restoration: the available bone quantity and quality, the number, location and implant distribution, the available inter-arch distance and maxilla-mandibular relationship, the nature of the opposing

occlusion, the expenses as well as the time frame required to assemble and maintain the prosthesis, are all considered crucial factors prior to treatment planning [2, 16].

The aim of this study was to systemically evaluate & compare the implant retained fixed prosthesis and implant retained removable overdentures, for the completely edentulous patients.

## Materials and Methods

### Search Strategy

An Electronic Search of the literature was performed on PubMed and CENTRAL, using the following search terms: 1- Edentulous Jaw; 2- Edentulous Mouth; 3- Edentulous Jaws; 4- Edentulous Mouths; 5- Completely Edentulous; 6- Complete Edentulism; 7- Edentul\*; 8- 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7; 9- Implant Supported Dental Prosthesis; 10- Overlay Denture; 11- Overdent\*; 12- Screw Retained Prosthesis; 13- Hybrid Prosthesis; 14- Removable Implant Overdenture; 15- Implant Overdenture; 16- All On Four; 17- 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16; 18- 8 AND 17.

A hand search was done on the bibliography of the included papers. Last hand search was performed on the 25<sup>th</sup> of April – 2016.

### Selection criteria

Clinical trials comparing the screw retained prostheses and the removable overdentures, for the completely edentulous patients were selected according to the following inclusion criteria: human studies; studies comparing fixed prostheses with removable prostheses with no surgical intervention prior to implant placement; minimum of four implants placed per arch; complete edentulism.

### Study Selection

Retrieved titles were all screened, and all papers that met the inclusion criteria were selected. Abstracts of all headings chosen were screened and obtained for inclusion criteria. After abstracts were screened, full-text studies were retrieved for the selected papers. In case both the heading and the abstract of an article wasn't enough to obtain data needed to make a decision regarding inclusion criteria, full texts were retrieved. Full-text papers meeting inclusion criteria were screened upon their methodology and results. Two reviewers performed the screening procedure.

## Critical appraisal

The risk of bias was assessed according to Cochrane handbook of systematic reviews. Six criteria were evaluated which included: study design, selection randomization, allocation concealment, addressing inclusion/exclusion criteria, patient's attrition (reporting of lost follow-up) and objective/numerical evaluation of the results (Table 1).

Table 1: Risk of Bias

Study	Type of Study	Selection Randomization	Allocation Concealment	Inclusion/Exclusion criteria	Patient's Attrition	Objective/Numerical Evaluation	Risk of Bias
Feine et al, 1994	Prospective	NO	NO	YES	NO	YES	HIGH
Grandmont et al, 1994	Prospective	NO	NO	YES	NO	YES	HIGH
Feine, et al, 1994	Prospective	NO	NO	YES	YES	YES	HIGH
Heydecke et al, 2002	Prospective	NO	NO	YES	YES	YES	HIGH
Heydecke et al, 2004	Prospective	NO	NO	YES	YES	YES	HIGH

## Results

A total of 504 titles were identified by the electronic search. After initial titles and abstracts screening, 495 irrelevant articles were excluded and a total of 9 articles were selected for full-text screening. No additional articles were found through hand searching. After a full-text screening, 5 articles [17-21] were included in the present analysis. Jacobs et al, the study [22], was excluded as the overdenture group was supported by only two implants which didn't match the inclusion criteria. Ferrigno et al, the study [23] were excluded as the study had surgical procedures before implant placement. Katsoulis et, al study [24], was excluded as patients had natural teeth, while Feine et al, study full text was not available [25] (Fig. 1).

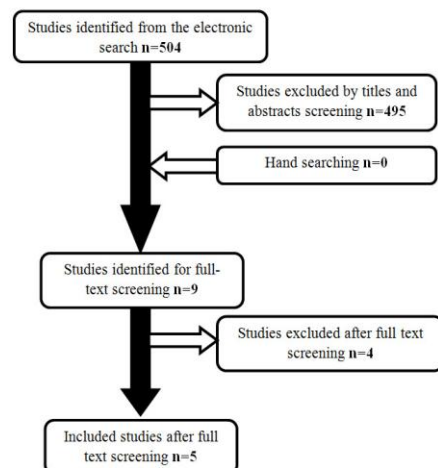


Figure 1: Flow diagram of study selection process

**Table 2: Included studies**

Study	Arch	Number of patients			Gender		Age (years)	Number of implants/Arch		Outcome
		Total	Fixed	Overdenture	Male	Female		Fixed	Overdenture	
Feine et al, 1994 [17]	Mandible	15	8	7	N	N	30-62	4-5	4-5	- Masticatory Time - Cycle duration - Vertical Amplitude
Grandmont et al, 1994 [18]	Mandible	15	8	7	N	N	30-62	4-5	4-5	- G. Satisfaction - Esthetics - Ability to speak - Fit/Retention - Function
Feine et al, 1994 [19]	Mandible	15	8	7	N	N	30-62	4-5	4-5	- Stability - Ability to clean - Ability to chew - Ability to speak - Esthetics
Heydecke et al, 2002 [20]	Maxilla	13	8	5	6	7	45.1	4-6	4-6	- G. Satisfaction - Choice of Prosthesis
Heydecke et al, 2004 [21]	Maxilla	30	15	15	N	N	30-60	6	4	- Speech Analysis - Ability to speak

The 5 articles included in this study were published in a period ranging from 1994 to 2004. They differed widely with respect to methodology, study designs and outcomes. So the possibility of attempting a meta-analysis was eliminated. In all studies, patients were divided into a fixed restoration group and another removable group except Grandmont et al, study [18], which had an extra group of conventional complete denture under investigation. Three studies [17-19] used the same settings while reporting three different outcomes in each, where all implants were placed in the mandible. The other two studies [20, 21] used the maxilla as the arch of interest (Table 2).

### **Speech analysis**

Four studies [18-21] evaluated the ability to speak within the comparison of two groups of patients. A 100 scale VAS (mm) was used to assess the ability to speak for all the four studies. No significant difference between both groups was reported regarding the ability to speak in Grandmont, Feine and Heydecke studies [18, 19, 21]. In those studies, VAS records were higher for the fixed group in studies [18, 19], while in Heydecke study [21], VAS records were higher for the removable group. While a significant difference in favour of the removable group was reported in a study [20].

A single study [21] has reported into depth the speech quality & errors by using a fixed prosthesis in one trial and a removable prosthesis in another trial. This study tested stops, fricatives & vowels between both the removable and fixed groups. The study revealed a statistically significant difference in the favour of the removable group in case of correctly produced sounds, especially for stops & fricatives. While non-significant difference was observed for vowels, with higher means for the removable prosthesis.

### **Patient satisfaction**

Four studies [18-21] reported the patient satisfaction with different reporting methods and

outcomes. Two studies [18, 20] out of four used a 100 mm VAS (Visual Analogue Scale) and CAT (Categorical Scales), to assess the patients' own words in describing their satisfaction about the prosthesis in different aspects. While the other two [19, 21] only used VAS (Table 3).

In studies [18-20] using the VAS, the significant difference was obvious between the treatment groups regarding ease of cleaning in favour of the removable denture restoration. While non-significant difference between both groups was reported regarding the esthetics, where Grandmont and Feine studies [18, 19] recorded higher means for the fixed group, opposed by Heydecke's study [20] where the removable group had higher means for esthetics. Chewing ability was significantly better for the fixed group in studies [18, 19]. On the contrary, it was significantly better in favour of the removable prosthesis in a study [17]. While no significant difference was noticed in study [20] between both groups.

A contradicting outcome evaluating the general satisfaction between the two groups, gave a significant difference for the removable group in the study [20] while reporting no significant difference between studied groups in a study [18], with higher VAS means for the fixed group. Grandmont et al study [18] which used CAT scale has mentioned that regarding fit, retention, function & quality of life, there was no difference between both types of implant-supported groups. While Heydecke et al study [20] have reported a significant difference regarding embarrassment at work and avoiding conversations, both for the favour of the removable group.

### **Choice of prosthesis**

Feine and Heydecke Studies [19, 20] reported the number of patients who chose either a fixed or a removable prosthesis at the end of the trial. Eight patients chose the fixed solution in a study [19], while only four patients in a study [20]. For the removable prosthesis, seven patients chose that type in a study [19], while only four patients in a study [20].

**Table 3 - Patient satisfaction**

Study	Measurement Tool	Stability		Ability to chew		Ability to clean		Ability to speak		Esthetics		Occlusion		Comfort		General Satisfaction		General Satisfaction vs. natural teeth		
		F	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	F	R	
Grandmont et al 1994 [18]	VAS (mm)	N	N	N	N	N	N	90.1	86.0	85.3	85.2	N	N	N	N	N	N	N	N	N
Feine et al, 1994 [19]	VAS (mm)	94.4	79.0	92.7	79.3	71.4	85.6	89.3	83.4	82.7	76.5	N	N	N	N	N	N	N	N	N
Heydecke et al, 2002 [20]	VAS (mm)	84.3	96.4	86.7	95.8	36.5	86.0	61.7	94.0	76.8	94.6	86.7	95.8	76.7	96.5	48.5	89.2	49.1	94.2	
Heydecke et al, 2004 [21]	VAS (mm)	N	N	N	N	N	N	79.2	88.6	N	N	N	N	N	N	N	N	N	N	N

VAS = Visual Analog Scale , F= Fixed Restoration , R=Removable Overdenture , N=Not reported.

### **Masticatory function**

A single study [17] has evaluated the efficiency of mastication between both the fixed and removable prostheses. Jaw mastication muscles and mandibular movements were recorded using an electromyographic activity. Three measurements were considered: Mastication time, vertical amplitude & cycle duration. The study showed higher cycle duration with the removable denture group while for the vertical amplitude, results were less. Mastication time was found to be faster for certain types of food when the patient used the overdenture.

### **Discussion**

Edentulism is often correlated with functional and esthetic concerns for the patient and is related to psychological problems possibly affecting routine activities [26]. Tooth absence can severely affect a patient's psychosocial status, even for patients who seem to adapt well to a conventional complete denture [27].

Restorations supported by implants offer multiple advantages over ordinary removable prostheses. Efficient retention and stability are simply achieved by creating a fixed restoration, or at least by using overdenture attachment instead of counting on the weak physical ways used with regular dentures [28].

Commonly used abutment types connecting over dentures include magnets, balls and bars [29]. The anatomic configuration of the jaws must be taken into consideration when selecting the convenient type [30]. In our included studies, the bar type was the attachment type used for the removable dentures, due to its superiority in better force distribution amongst the implants. That is mainly due to its primary splinting effect, load splitting, better fit and the least after insertion maintenance [31].

When evaluating the end result of implant therapy, it is important to consider both the clinicians' and the patients' opinions [32]. For the clinician: implant success, prosthesis long-term durability, and the rate of complications are the most important measures. On the contrary, the patient's degree of satisfaction depends on aspects such as function, comfort, aesthetics, taste sensation, speech difficulties, and personal confidence [33]. Patient's preference may be the chief controlling factor for selecting the prosthesis design [34]. Dental implants studies generally target the success and failure from a biological point of view, whereas fewer investigations have been carried out on patient satisfaction [35].

More than one type of scale is used to measure patient's satisfaction. Out of those is the OHIP (Oral Health Impact Profile) which is meant to provide information about perceptions of oral health. However, the complete 49 item version is not always applicable in a clinical study because its time consuming. This led to the development of a simplified version, the OHIP-14 [36]. This questionnaire includes 14 items, two from each domain, selected because they have been shown to be the most frequently reported. The OHIP questionnaire includes seven main scopes [37]. Another type is the Visual analogue scales (VAS) and categorical scales (CAT) which are known to be predictable assessment tools [38]. VAS is frequently used to measure subjective perceptions, while CAT questions are used to collect information about the patients' physical, psychological function and general health. Patients are asked to choose a word from a four-point scale that best described their response. Our included studies used a VAS scale from 0 to 100, other authors have used VAS with scores from 0 to 10 or from 1 to 5 [39]. The need for multidimensional evaluation of implant therapy, using consistent instruments and valid tools when available, has been displayed in literature for many years [40].

According to Jacobs et al, complete edentulism can affect speech quality. That is interpreted by the absence of the periodontal ligaments which is responsible for speech sensation [41]. In our study, the ability to speak was for the

favour of the removable group in two studies [20, 21]. That could be explained that the gap between soft tissue and fixed prostheses is thought to be a dominant cause of speech flaws [15]. Removable overdentures are similar to the pattern of the complete dentures previously used by patients, whereas the bases of fixed prostheses are generally narrower, which could explain the cause of speech adaptation problems encountered by patients [20].

Significant results were observed for an ability to speak especially in the studies using the maxilla as the arch of interest [20, 21]. One must be aware that although rehabilitation for soft and hard tissue deficits can be adequately provided with fixed implant prostheses in the mandible, but in case of a resorbed maxilla, a prosthesis design may cause detrimental effects on phonetics [42] and with the fact that more sounds are produced with the tongue approximating the maxilla, than the mandible [43]. In the other two studies [18, 19], fixed restorations showed higher VAS scores for the ability to speak than that of the removable prosthesis. While it is well known that the slot between the soft tissue and prosthesis could cause speech problems, it's also documented that when the palate of a patient is covered, the pronunciation of consonants is often atypical, even after long periods of adaptation [44].

For the cleaning efficiency, higher VAS scores were favouring the removable group in two studies [19, 20]. Patients receiving oral implant therapy are usually well motivated to practice enough oral hygiene. But also they found that overdentures are to be more hygiene friendly than the fixed prostheses, which were described as very complicated to clean [45]. Moreover, it has been noted that an increase in the number of implants involves a greater hygiene difficulty, in comparison with the natural teeth and traditional dentures [46]. That was presented by Heydecke et al study [20] with the highest number of implants placed per arch compared to the rest of the studies.

Since the ability to clean the prosthesis had the most influence on choice for the removable group [19], it may aid in treatment planning if the clinician can determine which patients consider cleanliness as a crucial factor. After having worn conventional dentures for many years, candidates may be unconscious of the problems related to preserving oral hygiene around implants [19].

A conflict in results was for the esthetics. In Heydecke et al study [20], where patients chose the removable solution that was mainly because of the lip support sustained by this type [47]. While for patients choosing the fixed solution as for better esthetics, possible reasons may include their dissatisfaction of flanges appearance of the overdenture, or excessive tooth display as a result of the additional bulk of components required to fabricate a long bar overdenture [47].

Stability and chewing ability had higher scores for the fixed prosthesis than the removable in the lower jaw. Patients often need a fixed prosthesis to feel teeth integrity as a part of their mouth which cannot be provided through a removable prosthesis. Such enhancement has a positive dramatic effect on improving masticatory efficiency [34]. Adding to that, its documented that full lower-jaw prostheses seem to provide lower satisfaction, probably due to the centrifugal resorption pattern of the mandible that affects the osteomucosal support of the residual ridge, which frequently results in flat ridges [48].

In our review, stability and chewing ability were linked together in their scores, where higher scores were observed for the fixed group in the mandible, while better scores for the removable group in the maxilla. A homogenous VAS scores for the ease of cleaning regardless the jaw under investigation were observed in favour of the removable overdenture. A controversy was noted for the esthetics & ability to speak results. For esthetics, higher scores were for the removable restoration in the maxilla, while for speaking ability, patients chose the fixed solution when mandible was tested, while a removable one when maxilla was the arch of interest [18-21].

Conflicting results in our systematic review is mainly due to lack of randomization in all of the included studies [18-21], outcomes vary obviously when true randomization takes place, rather than a patient-centred protocol, in the matter of directing patients to a specific treatment group. Follow up period wasn't enough to judge satisfaction scores, only two months were given for patients to test their perception. Only five studies were included in our review, which isn't a valid number to synthesise a definitive conclusion about the treatment options. In two studies [19, 21] only a single scale measurement (VAS) was used, while its recommended to use more than one assessment tool for more reliable outcome results. The degree of patient satisfaction is the result of a complicated interaction between psychological and physiological factors [49]. Even though, up till now, there is no any accurate scale or a questionnaire with items related to personal behavioural habits, which might be relevant for motivating the patient to shift their choices towards a specific prosthesis design, keeping in mind conservation of the oral tissues functions [50].

In conclusion, this study clarified that fixed prostheses showed higher scores in the mandible regarding stability, ability to chew, aesthetics and ability to speak. While removable prostheses showed higher scores in the maxilla. On the other hand, an ability to clean showed higher scores for the removable group in both mandible and maxilla. Unfortunately, this conclusion is based on a limited number of articles, indicating the need for more clinically controlled randomised studies.

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