Impact of Thermoplastic Acrylic Denture Base Versus Conventional Base on the Patient Satisfaction in Implant Supported Mandibular Overdenture: A Systematic Review

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Abstract

Objective: The aim of this systematic review was to study the impact of thermoplastic acrylic denture base on the patient satisfaction in implant supported mandibular overdenture. **Methods:** Two electronic databases and hand searching were performed through May 2016 without limitations. The scientific terms: "Dental prosthesis", "Implant supported", "Denture bases", "Overdenture", "Thermoplastic acrylic resin", "Acrylic bases' and "Flexible acrylic resin" were used in this study. Initially, screening was performed for the retrieved articles through title and abstract after that, a full-text assessment was done to those articles that fulfilled the inclusion criteria. **Findings:** Sixty one potentially eligible studies were retrieved from the database search, after duplicate removal the studies became thirty-two. Titles and abstracts that fulfilled the inclusion criteria were selected for full-text assessment. Finally, one study met the inclusion criteria, and so its references were also screened. **Applications/Improvements:** This study would increase the application of the versacrylic resin to the denture base as a new material to utilize all its merits to improve the patient satisfaction.

Keywords: Flexible Acrylic Resin, Implant Supported, Overdenture

1. Introduction

Implant-Supported Overdentures (ISODs) is considered the first treatment option over the conventional denture in completely edentulous ridges^{1,2}. Superior in denture stability, denture retention, more efficient masticatory muscle function and increased patient satisfaction compared to complete denture³.

The heat-cured conventional acrylic resin is the traditional denture base material, a flexible acrylic resin can be act as a cushion during functional movements to distribute forces and enhance denture retention by close adaptation to the supporting tissues and engagement of undercuts^{4.5}.

The previous data lead to the formulation of a search strategy (study) question and a PICO worksheet.

1.1 Search Strategy (study) Question

Does the versacrylic denture base have more shock absorbing effect thereby maintaining and improving patient satisfaction in mandibular implant-supported overdenture cases in compared with the conventional acrylic denture base?

1.2 PICO Worksheet

Population: Mandibular complete implant supported overdenture.

Intervention: Thermo-plastic acrylic mandibular overdenture (Versacryl).

Control: Conventional acrylic mandibular over-denture.

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Outcome(s)

- Patient satisfaction.
- Implant failure.

1.3 Rational of the Study

To systematically review the literature about the superiority of using the veracryle over the conventional heat cured acrylic resin in studying the patient satisfaction.

2. Materials and Methods

2.1 The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) reporting template was used. (Figure 1)



Figure 1. PRISMA 2009 flow diagram.

2.1.1 Data collection

A systematic search of electronic databases was conducted using Pubmed (Table 1) and Cochrane library (Table 2) and hand searching through May 2016 with no limits.

2.1.2 Criteria for Selection of Studies

Screening of all retrieved titles was done according to the following criteria

2.1.2.1 Inclusion Criteria

- Completely implant supported mandibular overdentures.
- Opposed maxillary complete dentures.

Table 1. Search strategy Pubmed search through May 2016Search, Query, Items found, Time

Search	Add to builder	Query	Item found
#41	add	(#39 AND #40)	30
#40	add	Search (((randomized controlled trial[Publication Type]) OR (controlled clinical trial[Publication Type]) OR (clinical trials as topic[MeSH Terms:noexp]) OR (randomized[Title/Abstract]) OR (placebo[Title/Abstract]) OR (randomly[Title/ Abstract]) OR (trial[Title])) NOT (animals[mh] NOT humans[mh]))	949030
#39	add	(#38 AND #34)	420
#34	add	(#28 OR #11 OR #12 OR #14 OR #16)	37978
#16	add	"thermoplastic acrylic resin[Text Word]",	5
#14	add	flexible acrylic resin[Text Word]",	3
#12	add	versacryl[Text Word]",	2
#11	add	Acrylic Resins[MeSH Terms]",	36446
#28	add	Denture Bases[MeSH Terms]",	3156
#38	add	(#4 OR #7)"	7687
#7	add	overdent*[Text Word]",	2423
#4	add	Dental Prosthesis, Implant- Supported[MeSH Terms	6457

N.P: We used the RCT filter described in the Cochrane handbook.

2.1.2.2 Exclusion criteria

- In vitro studies.
- Different languages other than English.

Two independent reviewers performed primary screening of titles/abstracts, in order to assess all studies. In cases of discrepancies, a consensus agreement between the two reviewers was pursued. Potentially relevant articles were then retrieved in full text. An attempt was made to retrieve full articles of all abstracts that were already published; every effort was performed by direct and electronic contact of the authors when the difficulty of obtaining full text occurred, and those abstracts that were published in books or conferences were excluded due to insufficiently detailed test method.

2.1.3 Data Extraction

Testing methodologies of the studies were analyzed regarding implant failure, Effect of flexible acrylic resin on masseter muscle activity, Effect of flexible acrylic resin on temporalis muscle activity, Effect of time on masseter muscle activity and Effect of time on temporalis muscle activity (Table 3).

2.2 Methodological Data among the Selected Studies

Methodologies of the selected study were described in Table 3.

3. Results

3.1 Study Selection

One study was included in this systematic review according to the inclusion criteria, among the 32 studies that were screened through the title and abstract.

3.2 Study Characteristics

The selected study was published at 2016.

3.3 Risk of Bias within Studies

This article although it has no attrition or reporting bias, but it still has low risk of bias due to might has selection and performance bias because of missing information about the randomization technique and allocation concealment

Table 2.Search strategy

Cochrane search through May 2016 through the link below:

Cochrane Library	Trusted evidence. Informed decisions. Better health.		My Profile Ins	Logged In: miran sultan stitutional Login 也 Log Out
Search	Search Manager	Medical Terms (MeSH)		Browse
To search an exact word(s) use quotation marks, e.g	g. "hospital" finds hospital; hospital (no quotation ma	rks) finds hospital and hospitals; pay finds paid, p	ays, paying, payed)	
Add to top				View fewer lines
	scriptor: [Dental Prosthesis, Implant-Supporte	d] explode all trees	m	648
	ti,ab,kw (Word variations have been searche	d)	S	374
─ Edit ⊕ #3 #1 or #.	2		TH	790
	scriptor: [Denture Bases] explode all trees		m	50
	#5 MeSH descriptor: [Acrylic Resins] explode all trees			
- + #6 "thermople	astic acrylic resin":ti,ab,kw (Word variations h	ave been searched)	S	1
─ Edit	5 or #6		111	1310
─ Edit + #8 #3 and	#7		TH	23

Table 3.Methodology table

Author, Year	Sample no.	Effect of flexible acrylic resin on masseter muscle activity	Effect of flexible acrylic resin on temporalis muscle activity,	Effect of time on masseter muscle activity	Effect of time on temporalis muscle activity	implant failure
12	12	N/A	N/A	N/A	N/A	0

according to Cochrane Collaboration's tool for assessing risk of bias and when contact the author through email to clarify the enquiry, I got no answer.

3.4 Results of Individual Studies (Table 3)

Implant Supported Overdentures

4. Discussion

4.1 Versacryl

The flexible acrylic resin (versacryl) has been developed to overcome the disadvantages of heat cure acrylic resin. As the finished thermoplastic acrylic resin often in worm water providing a wide range of consistencies, when it is inserted and adapted to the patients' mouth, it cools to body temperature and takes on the desired rigidity to full fill its new function, the softness of flexible acrylic provides a feeling of comfort to the patient. Versacryl has a compressive or cushioning action. Under functional load, Versacryl absorbs the applied stress and minimizes the distortion of the supporting tissues⁶.

Also, it may reduce the fatigue of the masticatory muscles. This, in turn, may positively affect the health of the supporting tissues and result in a better masticatory muscle activity, thus improving the patient satisfaction and survival rate of the implant.

4.2 Electromyography (EMG)

The superficial masseter and anterior fibers of the temporalis muscle were selected to represent the masticatory muscle activity because they are the largest and strongest masticatory muscles and, thus, have a major role in mandibular movement. They also are accessible during EMG records^Z.

The findings of the selected study indicated that resilient Versacryl overdentures resulted in a significant reduction in the activity of the temporalis and masseter muscles. Chewing using the Versacryl overdenture was faster and required fewer chewing strokes. This may result in improvement of the masticatory function and preservation of the masticatory apparatus⁸.

The mean EMG values of masseter and temporalis muscles in the selected RCT were gradually decreased from the time of implant placement until the end of the follow-up period. This may be attributed to the adaptability of the neuromuscular system to the overdenture treatment throughout the follow-up period. Consequently, the effort needed for mastication decreased with time⁹.

4.3 Implant

Treatment with Implant Supported Overdentures (ISODs) improved the functional state of the masticatory apparatus and aided in establishment of better neuromuscular coordination by improving retention, support, and stability of the prosthesis, and, consequently, less effort had to be exerted by the muscles to control the prosthesis during function^{10.11}.

5. Conclusion

In this systematic review, the use of flexible acrylic resin in the construction of ISODs resulted in improved masticatory muscle activity thus improving the patient satisfaction.

6. Recommendation

- Funding and organizational searching for a large amount of data that should be collected to conduct a systematic review would be of greater help rather than individual data searching and self-funding.
- More clinical trials should be performed that evaluate different parameters of the impact of the flexible acrylic resin on the bone level changes underneath the denture base and around the implant.

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