

# Attachment Systems for Implant-Supported Overdentures in Edentulous Mandible: A Systematic Review

Acing Habibie Mude\*, Muhammad Ikbal, Irfan Dammar, Vinsensia Launardo, Sutiyo

Department of Prosthodontic, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia.

Corresponding Author: [acinghabibie@unhas.ac.id](mailto:acinghabibie@unhas.ac.id)

## ABSTRACT

The articles were searched from the PubMed database; the electronic databases were conducted using MeSH browser, search terms, and their combinations: "mandibular prosthesis" and "Denture, Overlay" and "dental implants." There are 414 journals explained about this, with only five journals meet the inclusion criteria. In five relevant articles, it showed that there were no significant differences in particular attachment systems in terms of pain or discomfort, appearance, mastication, speech, stability, and oral hygiene aspects. Novaloc, which is one of the new types of attachments, is more resistant to wear than the nylon often used in other systems. There are sufficient results to support the attachment system used with implant-supported overdenture in fully edentulous patients to improve patient satisfaction and prosthetic retention. The attachment system can affect prosthetic maintenance and its complications. Specific attachment recommendations for mandibular patients can be relied upon positively from patients with low treatment costs, proper maintenance, and minimally invasive. However, the most important thing is patient satisfaction may not depend on the attachment system.

**Keywords:** Attachment systems, Dental implant, Implant-supported overdentures, Mandibular prosthesis

## Correspondence:

Acing Habibie Mude

Department of Prosthodontic, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia.

Corresponding Author: [acinghabibie@unhas.ac.id](mailto:acinghabibie@unhas.ac.id)

## INTRODUCTION

The Prosthodontic Glossary describes edentulous as a condition that does not have one or more permanent teeth and it is a condition that often occurs in the age group 65 years and over, which is often attributed to the effects of aging and is an irreversible event.<sup>1</sup> Most of the patients with missing teeth complain of difficulties in functioning, speaking, chewing, and eating, which causes a decrease in their quality of life.<sup>2</sup> Implant-retained overdentures are the best solution yet viable and cost-effective solution to prosthodontic rehabilitation of a toothless mandible.<sup>3</sup>

Overdenture, also known as overlay denture, hybrid prosthesis, telescoping denture or tooth supported a denture, defines as a type of partial or complete denture that can be removed and rests on one or more natural teeth, tooth roots, and/or dental implants.<sup>4</sup> One type of implant-retained overdenture can improve the success of rehabilitative treatment, reduce resorption of residual ridge and increasing better chewing function, as well as nutritional status, speech ability and patient confidence also patient satisfaction.<sup>5</sup> According to the McGill studies, an overdenture with two-implant retained should become the gold standard of the edentulous mandible treatment.<sup>4,5</sup> Implanted overdenture, which has a success rate ranging from 94% to 100%, has also been proven by several studies as the best treatment option to restore a completely edentulous arch.<sup>1</sup> Bar, ball, magnet types, telescopic attachments, Locator attachments, and Novaloc attachment are most common popular attachment.<sup>6,7,8</sup>

This study aims to address treatment outcomes in terms of the type of attachment, prosthetic maintenance, its complications, and patient satisfaction among implant-supported overdenture patient<sup>1,2,3</sup>.

## MATERIAL AND METHOD

The articles were searched from PubMed Database to establish a study protocol. PICO question defined the search strategy, where P = patient with mandibular implant overdentures, I = the bar, ball, Novaloc, or

Locators as attachment systems used, C = the Survival rate of implants, prosthetic maintenance and complications, and also patient's level of satisfaction, O = evaluated. The electronic databases were searched using Medical Subject Headings (MeSH) browser, search terms, and their combinations: "mandibular prosthesis" or "Denture, Overlay" and "dental implants." There are 414 articles explained about this, with only five journals meet the inclusion criteria.

## Study Selection

All titles and abstracts of the selected journals were reviewed for the following inclusion criteria: Criteria Inclusion:

- English language article
- Restricted research on "Humans."
- RCT (Randomized Controlled Trial) and clinical trial
- Follow-up of at least one year

The exclusion criteria were all journal which did not satisfy the requirements mentioned above:

- Such as animal studies,
- The study duration of less than one year
- Treatments with complication are excluded in this study
- Case reports or technical reports
- Incomplete paper without abstract

After reading the full texts of the articles, the data evaluated to the previously defined exclusion criteria and eligibility criteria that were used to identify articles that will be used for this study.

## RESULTS

The database search resulted 414 articles from PubMed. The titles and abstracts were reviewed afterward, and 12 articles were eligible for further analysis. The full texts

been evaluated by the reviewer and yielded five articles that meet the inclusion criteria. The flowchart of article selection (see Figure 1), with a total of 5 selected from an initial yield of 414 studies by an electronic literature search. After 414 titles of full text reviewed, five articles were chosen for this systematic review inclusions. The full texts been evaluated by the reviewer and yielded five articles with the total patient 189, with the most attachment type that commonly used was the ball, bar, novaloc, and locator (88 ball attachments, 23 bar attachments, 13 novaloc attachments, and 69 locator attachments).

Table 1. Showed that there are three RCT and two randomized cross-over clinical trial. Five studies presented data on prosthetic treatments and some complications. The survey of Kleis et al., Jofre et al., Alsabeeha et al., show that the most common occurrence of complications are O-Ring Change, the rubber ring exchange, two matrix replacements two overdenture fractures for ball attachment. Meanwhile, Alsabeeha found that Local type attachments have more difficulties and maintenance than ball attachments. Several articles presented prosthetic support, and complications in mandibular overdentures did not differ significantly according to the attachment system used.

Five articles showed on patient satisfaction, and conclude that there are no significant differences in patient level of satisfaction. Alsabeeha et al. mentioned that patient satisfaction on Ball attachment is better than Locator attachment, while De Souza et al., shows patient satisfaction with Novaloc is better than Locators.

## DISCUSSION

Several studies have shown that implant-supported overdentures resulted in a far better patient level of satisfaction compared to the conventional complete denture. In five articles, it was stated that there were no significant differences in specific attachment system preferences in several factors such as pain or discomfort, esthetic function, mastication function, speech function, stability, and oral hygiene.

The use of O-balls or cylindrical patrices as attachment system, has been used in most single-implant overdenture studies. This system not only tends to increase the performance of mandibular dentures but also requires routine maintenance (eg. changes or matrix activation).<sup>9</sup> In addition, midline implant placement did not appear to increase the incidence of denture fracture when compared with the two-implants overdenture.<sup>8</sup>

According to Pisani et al., when compared to ball attachments, attachment locators have higher retention due to the extended retention area on internal and external surfaces and the durability of its nylon components.<sup>10</sup> In one study, patient satisfaction was higher with bar attachment, and there was no difference in prosthesis retention or implant failure compilation comparing bar and ball attachment as reported by patient.<sup>1</sup> Overdenture fractures, relines, overdenture replacement and incidence of peri-implant mucosal enlargement are four common maintenance required for ball attachment (such matrix replacement).<sup>10</sup>

A new type of attachment, Novaloc, is an alternative that has mechanical retention of the polyetheretherketone (PEEK) matrix in the cylinder patrix, which possibly more tolerate than nylon.<sup>9</sup>

## CONCLUSION

There is not enough evidence to support the attachment system for use with implant-supported overdentures in patients who are genuinely edentulous to increase prosthesis retention and patient satisfaction. The attachment system is one of the keys of prosthetic maintenance and complications. Combining the results from the patient's point of view with lower cost, convenience, patient satisfaction, and minimally invasiveness is the recommended aspect for attachment selection in mandibular edentulous patients.

## ACKNOWLEDGEMENTS

The authors gratefully acknowledge to the staff of Prosthodontic Department Hasanuddin University Dental Hospital.

## REFERENCES

1. Anas El-Wegoud, M., Fayyad, A., Kaddah, A., & Nabhan, A. (2018). Bar versus ball attachments for implant-supported overdentures in complete edentulism: A systematic review. *Clinical Implant Dentistry and Related Research*, 20(2), 243-250. <https://doi.org/10.1111/cid.12551>
2. Ciccù, M., Cervino, G., Bramanti, E., Lauritano, F., Lo Gudice, G., Scappaticci, L., ... & Risitano, G. (2015). FEM analysis of mandibular prosthetic overdenture supported by dental implants: evaluation of different retention methods. *Computational and Mathematical Methods in Medicine*, 2015. <https://doi.org/10.1155/2015/943839>
3. Cepa, S., Koller, B., Spies, B. C., Stampf, S., & Kohal, R. J. (2017). Implant-retained prostheses: ball vs. conus attachments—A randomized controlled clinical trial. *Clinical oral implants research*, 28(2), 177-185. <https://doi.org/10.1111/clr.12779>
4. Cialy, J. S., Thalib, B., Dharmautama, M., Wiro, W., & Ervina, E. (2016). Preventive and conservative prosthodontic treatment using overdenture and Richmond crown. *J Dentomaxillofac Sci*, 1, 193-195. <https://doi.org/10.15562/jdmfs.v1i3.316>
5. Laverty, D. P., Green, D., Marrison, D., Addy, L., & Thomas, M. B. M. (2017). Implant retention systems for implant-retained overdentures. *British Dental Journal*, 222(5), 347-359. <https://doi.org/10.1038/sj.bdj.2017.215>
6. Kim, H. Y., Lee, J. Y., Shin, S. W., & Bryant, S. R. (2012). Attachment systems for mandibular implant overdentures: a systematic review. *The journal of advanced prosthodontics*, 4(4), 197-203. <https://doi.org/10.4047/jap.2012.4.4.197>
7. Kleis, W. K., Kämmerer, P. W., Hartmann, S., Al-Nawas, B., & Wagner, W. (2010). A comparison of three different attachment systems for mandibular two-implant overdentures: one-year report. *Clinical implant dentistry and related research*, 12(3), 209-218. <https://doi.org/10.1111/j.17088208.2009.00154.x>
8. De Souza, R. F., Bedos, C., Esfandiari, S., Makhoul, N. M., Dagdeviren, D., Abi Nader, S., ... & Feine, J. S. (2018). Single-implant overdentures retained by the Novaloc attachment system: study protocol for a mixed-methods randomized cross-over trial. *Trials*, 19(1), 1-11. <https://doi.org/10.1186/s13063-018-2606-7>
9. Pisani, M., Bedos, C., da Silva, C. H. L., Fromentin, O., & de Albuquerque Jr, R. F. (2017). A qualitative study on patients' perceptions of two types of attachments

*Attachment Systems for Implant-Supported Overdentures in Edentulous Mandible: A Systematic Review*

for implant overdentures. *Journal of Oral Implantology*, 43(6), 476-481.  
<https://doi.org/10.1563/aaid-joi-D-17-00166>

10. Jofré, J., Hamada, T., Nishimura, M., & Klattenhoff, C. (2010). The effect of maximum bite force on marginal bone loss of mini implants supporting a mandibular overdenture: a randomized controlled trial. *Clinical oral implants research*, 21(2), 243-249.  
<https://doi.org/10.1111/j.1600-0501.2009.01834.x>

*Attachment Systems for Implant-Supported Overdentures in Edentulous Mandible: A Systematic Review*

**Table 1.** Included papers by inclusion criteria

Authors (Y)	Methods	Participants/ patients	Follow- up time	Implant's type	Attachment' s type	Prosthetic maintenance and its complication	Patient's level of satisfaction
Kleis et al. (2010)	Randomized Controlled Trial	60	12 months	BIOMET3i	Bar, Locator	<ul style="list-style-type: none"> <li>• Bar: Changing O-Ring</li> <li>• Locator: Changing female part</li> </ul>	Not Significant
Jofre et al. (2010)	Randomized Controlled Trial	45	15 months	Sendaxs	Ball, Barr	Ball: rubber ring exchange	Not recorded
Alsabeeha et al. (2011)	Randomized Controlled Trial	34	12 months	Southern and Neoss regular	Ball, Locator attachment	<ul style="list-style-type: none"> <li>• Ball: two matrix replacements two overdenture fractures</li> <li>• Locator attachments: sixteen shows replacement of matrix; two relines of denture; and replacing one overdenture</li> </ul>	Ball is better than Locator attachment
Pisani et al. (2017)	Randomized cross-over clinical trial	22	12 months	Straumann	Ball, Locator	Not recorded	Not recorded
De Souza et al. (2018)	Randomized cross-over clinical trial	26	18 months	Straumann	Novaloc, Locators	Not recorded	Novaloc is better than Locators