Sys Rev Pharm 2020;11(9):15-19
A multifaceted review journal in the field of pharmacy

Locator or Ball Attachment Systems for Mandibular Implant Overdentures: A Systematic Review

Muhammad Ikbal, Acing Habibie Mude, Irfan Dammar, Vinsensia Launardo, Ian Afifah Sudarman

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

Corresponding Author*:* ikbal_muhammad@unhas.ac.id

ABSTRACT

The aim of this study is to lecture treatment results award to attachment systems for mandibular implant overdentures in terms of prosthesis retention, marginal bone loss to the implant and patient satisfaction, between locator and ball attachment system. This systematic review was conducted using Wiley and PubMed of match journals regarding inclusion and exclusion criteria. Clinical trial studies on mandibular implant overdentures from January 2009 to November 2019 were chosen 10 articles from 125 articles were lastly included and the data on prosthesis retention, marginal bone loss and patient satisfaction were analyzed similar to attachment systems. From the limited amount of research, the model of attachment did not show a significant difference between marginal bone loss and implant patient satisfaction measure. but, overdentures with locator attachment tend to have a higher retention than the attachments ball. The conclusion is that the locator and the ball attachment system present the same clinical performance on marginal bone loss and patient satisfaction, but the locator attachment has a higher retention than the ball attachment.

Keywords: Attachment systems, Ball attachment, Implant overdentures, Locator attachment

Correspondence:
Muhammad Ikbal
Department of Prosthodontic, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia.
Corresponding Author*:* ikbal_muhammad@unhas.ac.id

INTRODUCTION

Patients with edentulous tooth complaints can have great difficulty using their conventional dentures because of the stability, support, retention bolts, and associated compromise in ability and comfort when chewing.[1] Overdenture use of mandibular implants has been done in many studies and found to be simpler and more economical the cost of a fixed prosthesis implant.[2] Overdenture of two implants in mandibular complete maxillary dentures is the primary choice for management of full edentulous patients.[3]

To increase stability and retention of dentures, an excess attachment system can be used for cases of mandibular implant overdenture.[1] Different attachment systems used to design prosthetic un-splinted of mandibular implant overdentures. in general, gold alloy matrices standard 2.25mm ball attachments are used with documented positive results. Recently, the spread out utilize of the Locator attachment system has become modern.[4]

In 2001, the attachment system Zest Anchors Company® attachment systems empower one of the most famous Locator, with a design optimized for the purpose of reforming storage and stability provided by the ball-type attachment. This system consists of Patrix (for men) and matrix (for women). It is classified as a strong universal hinge device and is designed for a limited distance between the arches, allowing the angle between the implants increased to 40º.[5]

Mostly, the attachment system depends on practitioners' events and preferences. from several studies that have been conducted comparing various attachments in ways that are useful for clinical decision making. and also, research on systematic review articles has shown how long the implant lasts, [6] complications in prosthetic [7] and Overdenture patient satisfaction [8] of the mandible without comparison the attachment system. Therefore, a systematic review of the implant overlay system is needed to focus on the published results.

The aim of this review is the outcome of treatment depends on the attachment system for overdenture of the mandibular implant associated with prosthesis retention, marginal bone loss to the implant and patient satisfaction between the locator and ball attachments.

MATERIAL AND METHOD

This study was written in accordance with PRISMA guidelines (Selected Reporting Items for Systematic Review and Meta-Analysis) to report studies evaluating health care interventions.[9] The PICO format (Population, Intervention, Comparison, Results) is used to show clinical questions with obvious inclusion criteria.[10] Questions characteristics and criteria for inclusion are clinical studies involving full Overdenture edentulous mandibular implant (P) opposing maxillary complete dentures conventional (I). Studies were selected and then divided further by the Overdenture attachment system (especially ball and locator attachment) used (C). 1) attachment retention; 2) bone loss marginal to the implant; and 3) patient satisfaction (O) evaluated.

Search Strategy

This systematic review search uses an implanted overdenture of the MeSH browser " and "Attachment systems" and "overdentures" and "ball attachment" and "locator attachment", and limited by "Human", "English" and the publication dates is 10 years in the database. The electronic search was also conducted using Wiley with the same keywords. Manual search of full text articles and related reviews is done afterwards.

Eligibility Criteria

The inclusion and exclusion criteria in this systematic review were the following:

Inclusion Criteria were randomized clinical trials (RCT) and clinical trial studies on overdenture of mandible and maxillary implants from January 2009-November 2019, the comparative study between attachment in

mandibular implant overdenture with at least 2 pieces and the same number of implants, root form implants endosseous standard, upper complete denture, conventional loading, and article published in English.
Exclusion criteria were case reports or without statistical comparison; period of function less than 6 months; using bar, magnet, and telescopic abutments; combination or cantilevered application of attachments; animal studies; and paper without full text.

Selections of Study
The characteristics of the keywords used by participating authors (IA and MI) sort the article of texts based on the abstract read or the whole text complete. In general, the two authors then chose the manuscript based on the predetermined inclusion criteria. Then, all selected abstracts and full texts are evaluated.

Extraction of Data
The two authors involved (IA and MI) conducted an article evaluation based on inclusion and exclusion criteria. Data extracted are, time of observation, type of implant used, number of implants, results of treatment, type of attachment, and results of statistical analysis comparing factors not obtained: 1) attachment retention; 2) margin margins into the implant; 3) patient satisfaction.

RESULT

Figure 1 the initial search resulted in 125 articles. After screening the title and reviewing the full-text articles, 115 articles were excluded with the following specification: 25 articles were duplicate, 10 articles were literature review or systematic review and meta-analysis, 15 articles were part of the textbook, 60 articles did not compare about locator or ball attachment. After screening, reviewing and selecting those articles, only 10 articles met the inclusion criteria.
Table 1 showed that there were 10 articles in this systematic review is a randomized clinical trial that concerns oral rehabilitation prosthetic with a supported Overdenture implants using the locator system comparisons ball system. The clinical study published between January 2009 to November 2019 and research follows up around 1 to 5 years.
Table 2 showed that there were 10 articles assessing the retention of overdentures with the locator and ball attachments and the results are overdentures with the locator attachment incline to have taller retention than the ball attachment. 5 articles reported locators to have better retention than ball attachment. Three articles reported ball have better retention than locator attachment and 2 reported similar results for both.[11-20]

DISCUSSION

Several clinical studies evaluating the locator system, compared with other attachments and show that the system locator indicates a higher level of maintenance than the ball attachment.[11,13]. Thus, the locator found to be more profitable in a clinical viewpoint.[14]
The locator attachment is designed to make insertion and removal easier, has dual retention, and ability to self-align thus increasing its resiliency and tolerance for implant divergency (up to 40°). Due to these design features, the locator rapidly became one of the most popular stud attachments.[15]
Otherwise, research by Carine reports that there are important differences that are monitored for the quality of abutment retention. Retention for ball support is better at each implant position proportionally to the locator support ($p<0.005$). Also, the concept of optimally balanced occlusion was statistically better for 2IOD balls ($p<0.001$).[20]
In table 3, Loss of bone around the implant support for overdenture mandible assessed in 5 randomized clinical trials. Four of these trials are not watching the difference in bone loss between participants with Overdenture help fixing locator and ball. Only the study by Akca which shows the vertical bone loss greater than the attachment of attachment ball locator.[16]
These results are similar to studies from Carine, who found that implant yield and marginal bone loss were not significantly affected by attachment but there are factors that can cause bone loss around locator attachment. The form of attachment of the cylinder locator is not easy to wash.[12,20] cleaning using a palatal, buccal, mesial and distal toothbrush, including areas close to the gingival margin, should be of concern for the patient to rotate the toothbrush section in such a way. the way around the buffer that the wall is washed. Collecting food on a tracker is often difficult. A ball can be a simple attachment that is washed with horizontal brushing movements that are easy to abutment.[17,18]
In table 4, here are nine RCT evaluating patient satisfaction with overdenture locators and ball attachments included in this systematic review. Some of the general aspects analyzed include aesthetic, phonetic results, retention, mastication, ease of use, and cleanliness. Principal studies indicate no significant differences in patient complaints, overall satisfaction based on VAS and personal patient preferences based on the attachment system used.[20] Four studies suggest that patient satisfaction using locator attachment is better than a ball-type attachment.[13,15,16]
Only one study by Corina et al that stated patient satisfaction using ball attachment was better than locator attachment. Corina reported superior stability in overdentures using ball support after 5 years of use.[17] Furthermore, 4 studies stated satisfaction the same patient between overdenture users with locator and ball attachments.[11,12,18,20]
The successful treatment is mostly caused by the primary stability at placement, the one factor that could influence this stability is occlusal loading through provisional restoration, while the loss of early retention lead to failure or the implant treatment.[21,22]
The simplicity of use and maintenance of ball attachment, its low cost, removal of a superstructure bar, its wide range of movement, and large patient satisfaction are the main advantages of ball attachment. On the other hand, it wears over time, steadily loses retention, and must be changed from time to time and the ball attachments must be parallel to each other. The advantages of the locator attachment are its self-aligning, has double retention, rotational action, built-in guide planes providing precise insertion; it can also be used in nonparallel situations, can be utilized in cases with curtailed inter arch spaces and is obtainable in different retention with different colors values; resilient, durable and retentive. Besides, its repair and replacement are easy and fast.[11,19,20]

CONCLUSION

Both the locator and ball attachment systems show correspondent clinical performance regarding patient

satisfaction and marginal bone loss, the marginal bone loss and implant outcome are not meaningfully affected by the attachment option, but the ball attachment have lower retention than the locator attachment because 5 articles reported locator have better retention.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the Department of Prosthodontic from Hasanuddin University Dental Hospital

REFERENCES

1. 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
2. Carlsson, G. E. (1998). Clinical morbidity and sequelae of treatment with complete dentures. *The Journal of prosthetic dentistry*, *79*(1), 17-23. https://doi.org/10.1016/S0022-3913(98)70188-X
3. British Society for the Study of Prosthetic Dentistry. (2009). The York consensus statement on implant-supported overdentures. *The European journal of prosthodontics and restorative dentistry*, *17*(4), 164. https://doi.org/10.4047/jap.2012.4.4.197. Epub 2012 Nov 29.
4. Alsabeeha, N. H., Payne, A. G., De Silva, R. K., & Thomson, W. M. (2011). Mandibular single-implant overdentures: preliminary results of a randomised-control trial on early loading with different implant diameters and attachment systems. *Clinical oral implants research*, *22*(3), 330-337. https://doi.org/10.1111/j.1600-0501.2010.02004.x
5. Miler, A. M. Q. P., Correia, A. R. M., Rocha, J. M. C., Campos, J. C. R., & da Silva, M. H. G. F. (2017). Locator® attachment system for implant overdentures: a systematic review. *Stomatologija*, *19*(4), 124-9.
6. Ma, S., Tawse-Smith, A., Thomson, W. M., & Payne, A. G. (2010). Marginal bone loss with mandibular two-implant overdentures using different loading protocols and attachment systems: 10-year outcomes. *International Journal of Prosthodontics*, *23*(4).
7. Andreiotelli, M., Att, W., & Strub, J. R. (2010). Prosthodontic complications with implant overdentures: a systematic literature review. *International Journal of Prosthodontics*, *23*(3).
8. Assunção, W. G., Barão, V. A. R., Delben, J. A., Gomes, E. A., & Tabata, L. F. (2010). A comparison of patient satisfaction between treatment with conventional complete dentures and overdentures in the elderly: a literature review. *Gerodontology*, *27*(2), 154-162. https://doi.org/10.1111/j.1741-2358.2009.00299.x
9. Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., ... & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Journal of clinical epidemiology*, *62*(10), e1-e34. https://doi.org/10.1016/j.jclinepi.2009.06.006
10. Wallace, B. C., Kuiper, J., Sharma, A., Zhu, M., & Marshall, I. J. (2016). Extracting PICO sentences from clinical trial reports using supervised distant supervision. *The Journal of Machine Learning Research*, *17*(1), 4572-4596.
11. 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.1708-8208.2009.00154.x
12. 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 for implant overdentures. *Journal of Oral Implantology*, *43*(6), 476-481. https://doi.org/10.1563/aaid-joi-D-17-00166
13. Cakarer, S., Can, T., Yaltirik, M., & Keskin, C. (2011). Complications associated with the ball, bar and Locator attachments for implant-supported overdentures. *Med Oral Patol Oral Cir Bucal*, *16*(7), e953-9. http://dx.doi.org/doi:10.4317/medoral.17312
14. Alqutaibi, A. Y., & Kaddah, A. F. (2016). Attachments used with implant supported overdenture. *International Dental & Medical Journal of Advanced Research*, *2*(1), 1-5. . http://dx.doi.org/10.15713/ins.idmjar.45
15. Krennmair, G., Seemann, R., Fazekas, A., Ewers, R., & Piehslinger, E. (2012). Patient preference and satisfaction with implant-supported mandibular overdentures retained with ball or locator attachments: a crossover clinical trial. *International Journal of Oral & Maxillofacial Implants*, *27*(6).
16. Akça, K., Çavuşoğlu, Y., Sağırkaya, E., & Cehreli, M. C. (2013). Early-loaded one-stage implants retaining mandibular overdentures by two different mechanisms: 5-year results. *International Journal of Oral & Maxillofacial Implants*, *28*(3).
17. Matthys, C., Vervaeke, S., Besseler, J., Doornewaard, R., Dierens, M., & De Bruyn, H. (2019). Five years follow-up of mandibular 2-implant overdentures on locator or ball abutments: Implant results, patient-related outcome, and prosthetic aftercare. *Clinical Implant Dentistry and Related Research*, *21*(5), 835-844. https://doi.org/10.1111/cid.12840
18. Shady, M. M. A., Eltorky, I. R., & Abd Eaal, Z. M. (2016). Comparative study of two types of attachments for mandibular implant-retained single complete overdenture. *Tanta Dental Journal*, *13*(3), 157. https://doi.org/10.4103/1687-8574.191434
19. Abdelfattah, M. Y., & Fahmi, M. K. (2020). Evaluation of two different attachment systems used with mandibular implant-retained overdenture. *Journal of Dental Implants*, *10*(1), 10. https://doi.org/10.4103/jdi.jdi_23_18
20. Cristache, C. M., Muntianu, L. A. S., Burlibasa, M., & Didilescu, A. C. (2014). Five-year clinical trial using three attachment systems for implant overdentures. *Clinical oral implants research*, *25*(2), e171-e178. https://doi.org/10.1111/clr.12086
21. Ikbal, M., Odang, R. W., Indrasari, M., & Dewi, R. S. (2017, August). Influence of immediate loading on provisional restoration in dental implant stability. In *J. Phys. Conf. Ser* (Vol. 884, p. 012037).
22. Sultana, N., Bartlett, D. W., & Suleiman, M. (2017). Retention of implant-supported overdentures at different implant angulations: Comparing Locator and ball attachments. *Clinical Oral Implants Research*, *28*(11), 1406-1410. https://doi.org/10.1111/clr.13

003

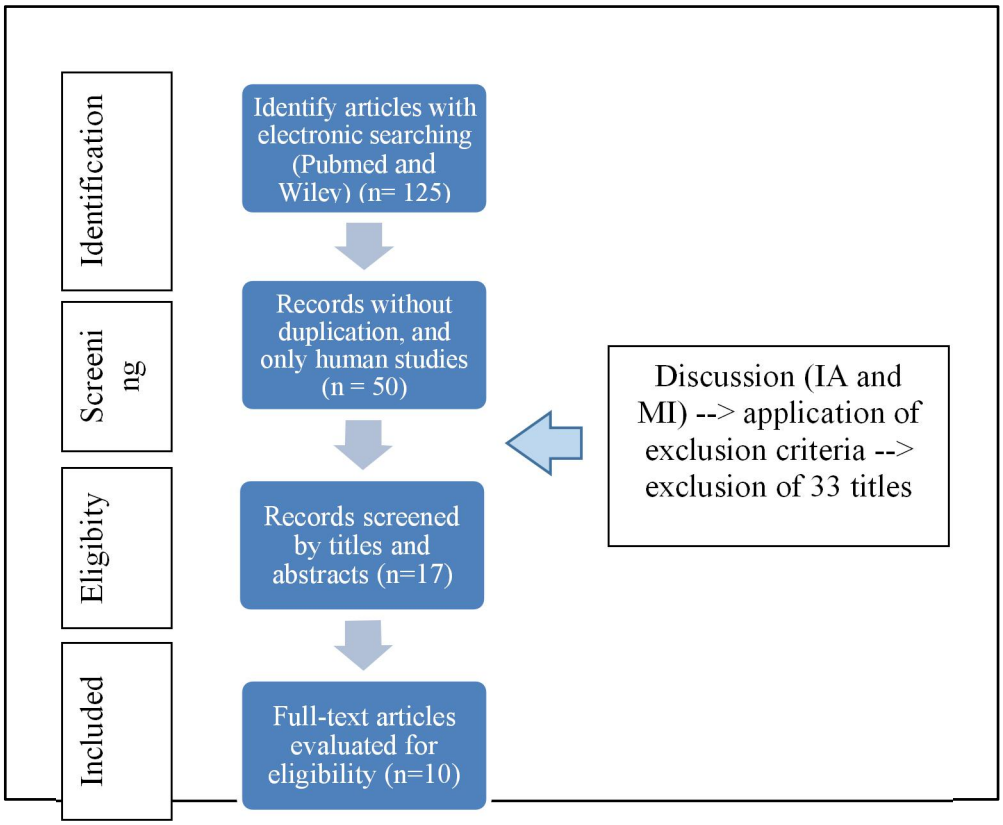

Figure 1. Prisma Flow Chart

Table 1. Included studies by inclusion criteria

No	Author and Year	Study Design	Follow Up	Type of Attachment	Implant Type
1	Kleis et al (2009)	RCT	1 year	Locator, Ball	Dal-Ro BIOMET 3i, TG-O-Ring
2	Rubens et al (2010)	RCT	1 year	Locator, Ball	Straumann AG (Switzerland), Zest Anchors Inc 123 (Escondido CA USA)
3	Cakarer et al (2010)	RCT	2 years	Locator, Ball, Bar	Astra Tech, BioHorizons, Bio Lok, Endopore, Frialit, ITI, Swiss Plus.
4	Ahmad Yaseen et al (2012)	RCT	1 year	Locator, Ball	Superline, dentium implant system (Korea)
5	Krennmair G et al (2012)	RCT	1 year	Locator, Ball	Not mention
6	Akca et al (2013)	RCT	5 years	Locator,Ball	Strauman (Switzerland)
7	Corina et al (2014)	RCT	5 years	Locator, Ball, Magnet	Strauman (Switzerland)
8	Abo Shady et al (2016)	RCT	1 year	Locator, Ball	Not mention
9	Abdelfattah et al (2019)	RCT	1 year	Locator, Ball	Vacum Titanium Plasma Sprayed (VTPS), PIT-ESAY-Implant (Oralsonics Bremen)
10	Carine et al (2019)	RCT	5 years	Locator, Ball	Osseospeed (Dentsplay)

Table 2. The studies in retention analysis of mandibular overdentures with locator or ball attachment

Author	Year	Site, Number of Implant	Better Performance
Kleis et al	2009	Mandible	Ball
Rubens et al	2010	Mandible 2	Similar
Cakarer et al	2010	Mandible, 2,3,4 Implants	Locator
Ahmad Yaseen et al	2012	Mandible 2	Locator
Krennmair G et al	2012	Mandible 2	Locator
Akca et al	2013	Mandible 2	Locator
Corina et al	2014	Mandible 2	Ball
Abo Shady et al	2016	Mandible 2	Similar
Abdelfattah et al	2019	Mandible 2	Locator
Carine et al	2019	Mandible 2	Ball

Table 3. The studies in bone loss analysis of mandibular overdentures with locator or ball attachments

Author	Year	Site, Number of Implant	Better Performance
Kleis et al	2009	Mandible	Similar
Krennmair G et al	2012	Mandible 2	Similar
Akca et al	2013	Mandible 2	Locator
Abo Shady et al	2016	Mandible 2	Similar
Carine et al	2019	Mandible 2	Similar

Table 4. The studies in patient satisfaction analysis of mandibular overdentures with locator or ball attachments

Author	Year	Site, Number of Implant	Better Performance
Kleis et al	2009	Mandible	Similar
Rubens et al	2010	Mandible 2	Similar
Cakarer et al	2010	Mandible, 2,3,4 Implants	Locator
Ahmad Yaseen et al	2012	Mandible 2	Locator
Krennmair G et al	2012	Mandible 2	Locator
Akca et al	2013	Mandible 2	Locator
Corina et al	2014	Mandible 2	Ball
Abo Shady et al	2016	Mandible 2	Similar
Carine et al	2019	Mandible 2	Similar.