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RESEARCH ARTICLE

COMPARATIVE EVALUATION OF RETENTION CHARACTERISTICS OF BALL ATTACHMENT AND LOCATOR ATTACHMENT SYSTEMS IN IMPLANT RETAINED OVER DENTURES- A SYSTEMATIC REVIEW

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ABSTRACT

Background: Implant supported over denture is a very common treatment modality in edentulous patients. Especially 2 implant supported mandibular (OD-1) type of prosthesis is very widely used by clinicians. These over dentures can be used with varying attachment systems. This systematic review compares two implant attachment systems i.e. Ball and Locator to know which one provided better retention. **Results:** A total number of 94 articles were identified through the electronic search. Only 3 articles were included on the basis of inclusion and exclusion criteria. All the 3 articles were reviewed by the two authors for their study characteristic. All the articles showed varying results regarding retention characteristics provided by both attachment systems. **Conclusion:** We can conclude that Locator attachment systems are relatively better than ball attachment systems.

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INTRODUCTION

Edentulism is one of the most common finding in the old age. In past recent years, replacement of lost teeth has become a major concern among individuals. Prosthetic rehabilitation of edentulous jaws include compelling treatments both for dentists and patients (Buykerkmen, 2017). Apart from other treatment options for edentulism, implants have become very common. upon the biomechanical combination of support, stability and retention in edentulous patients is the success of denture therapy. Dental implant is becoming a common option for replacement of lost tooth/teeth due to various reasons (Jabbour et al., 2014). For more than 100 years, the only treatment option available for an edentulous patient was a conventional complete denture. But complaints about lack of retention and stability of mandibular dentures, together with decreased chewing efficiency aren't uncommon (Assuncao et al., 2007). Because the floor of the mouth is movable the lower denture shows less retention as it refrains from establishing a good peripheral seal lingually. Denture stability is maximized in presence of ideal ridge height and conformation (Cristache, 2014). The treatment of choice for edentulous elders has been suggested to be mandibular two-implant overdentures (IODs).

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It's proven that they have significantly improved the functional capacity and quality of life of many patients. Varying attachment systems have been designed to secure dental implants to IODs (Jabbour et al., 2014). Ideally, an attachment system must provide an easy installation and removal of the prosthesis. But simultaneously it must also firmly hold the prosthesis in place during function. Attachment systems are manufactured in an extensive array of materials and shapes (de Albuquerque, 2019). Prosthesis can be connected to implants in several ways. Direct attachments or bar and clip system can be incorporated.

Direct attachments comprise of magnets, Locators and studs. These attachment systems may be used on their own, or as secondary retention systems in alongwith a bar (Vasant, 2013). The attachment type has a very important role to play: a tight fitting connection of the denture with dental implant induces stress that is likely to cause failure of the implant. Also, splinting of dental implants by bar-clip construction is time-consuming, costly and complicated (Cristache et al., 2014). This systematic review was conducted to compare between retention characteristics of ball attachment system and locator attachment system to find out which one is better. This will help in treatment planning of attachments for implant supported overdenture.

MATERIALS AND METHODS

ELIGIBILITY CRITERIA

Inclusion criteria:

- All the randomized control trials evaluating retention characteristics of ball attachment systems and locator attachment systems.
- All the clinical studies evaluating retention characteristics of ball attachment systems and locator attachment systems.
- Articles in English language or the ones that can be translated to English.
- All the studies comparing retention characteristics of ball attachment and locator attachment systems.
- All the studies conducted between 2009 to 2019.

Exclusion criteria

- All the studies conducted in vitro.
- All the narrative reviews, case-reports, abstracts, letters to editors, editorials and animal studies.
- All the letter to editor.
- All the articles published in languages other than English which cannot be translated.

PICO

P (population) – Patients with implant-retained overdenture.
I (intervention) – Implant with Ball attachment system.
C (comparison) – Implant with Locator attachment system.
0 (outcome) – Retention characteristics.
0 (outcome) – Retention characteristics.

Information sources: Literature search strategy was developed using keywords related to dental implants, overdenture, implant supported overdenture, attachment system, ball attachment system and locator attachment system. Data was searched from PubMed, Google scholar, Hinari and Cochrane library from January 1st 2009 to October 31st 2019. Cross references were checked from relevant articles. Hand searching was done for the articles when the full text of the articles was not available through electronic databases.

Search: PubMed, Google scholar, Hinari and Cochrane library were the databases used to complete the search for all full text articles available from January 1st 2009 to October 31st 2019. Articles were restricted to English language only. Using the review of literature the keywords to carry out the search were decided. The search strategy used for searching articles in PubMed were Prosthesis Retention AND Denture Precision Attachment, Retention AND "locator attachment" AND "implant retained overdenture" and Retention AND "ball attachment" AND "implant retained over denture".

Search Engines

Pub Med
Google Scholar
Hinari
Cochrane

With the help of an expert a Microsoft excel sheet was prepared for standardized data extraction.

Initial few entries were made in the Excel and it was reviewed by an expert. Any denial amongst the authors was resolved by discussion. Predetermined criterias for extracting the data were as under:-

- The major interest was to obtain the baseline and retentive values for different attachment systems.
- Follow up period from baseline and 1 week post insertion was considered.

RESULTS

STUDY SELECTION

One review author (PT) independently screened the titles and abstracts obtained by search strategy and included them if they met the inclusion criteria. Later full texts of all the included studies were obtained. After obtaining the full texts of the articles they were screened by reading the whole article and then decided if they met the inclusion criteria. Whenever there was uncertainty regarding any study to be eligible for inclusion, the problem was resolved by discussing it with the second author (NA). Finally, the search yielded 3 studies to be included in systematic review. All the excluded studies were recorded with reason for exclusion for each study. None of the authors were blinded to the journal titles, study authors or the institutions where the studies were conducted.

DISCUSSION

Implant supported overdenture is a very common treatment modality in edentulous patients. Especially 2 implant supported mandibular (OD-1) type of prosthesis is very widely used by clinicians. According to the York Consensus 2009, the ideal first treatment option in an edentulous mandible should always be atleast 2 implant supported (OD-1) prosthesis. The overdentures are used with varying attachment systems. The present systematic review was commenced with the aim to find out which implant attachment system amongst Ball and Locator provided better retention. This review consisted of 3 such articles which compare these 2 systems. Cakarer S et al (2011) conducted a study among 36 edentulous patients for the prosthetic restoration of the maxilla or the mandible using 95 implants. Prosthetic complications including, replacements of O-ring attachment and retention clips, fractured overdentures, implant failures, poor oral hygiene maintenance, mucosal enlargements, fractured attachments, loss of retention and dislodgement of attachments were recorded and evaluated. The recall visits were scheduled at 3, 6, 12 months and annually thereafter. The attachment systems incorporated in the study were ball, bar and Locator. Within the limitations of this study, they concluded that all the attachment systems proved to be useful. No significant difference was noticed between the attachment systems related to implant failure, replacement of the attachment and fractured overdentures. They concluded that considering the rate of complications witnessed in clinical practice, Locator attachment proved to be more advantageous compared to ball and bar attachment sytems. Jabbour Z et al (2014) conducted a study in 24 patients and was divided in 2 phases of 12 months each. At phase 1, patients randomly received either two new ball attachments (Retentive Anchor [RA], ref 048.439,Straumann,Burlington,ON,Canada) with gold matrices (Goldmatrix, ref 048.410, Straumann) or two new cylindrical stud Locator attachments (Locator [LA], Zest

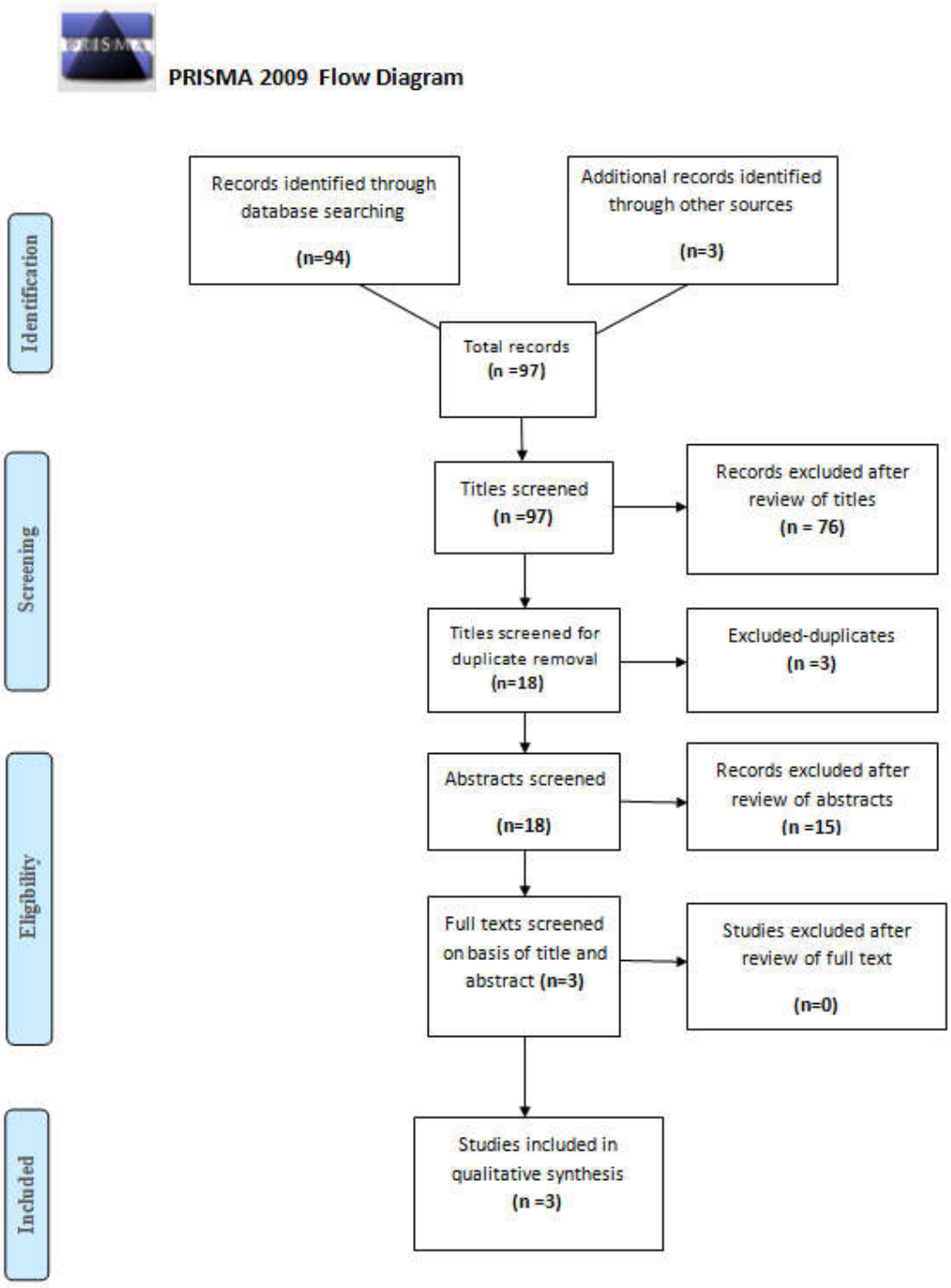

Figure1. Depicts the process of selecting the articles and excluding them at each step. 94 Records were identified through the data search using search strategy in Pub Med. Through Google scholar 3 articles were selected based on titles. Total articles number arrived to be 97. Second step was screening through the titles and after screening 76 articles were excluded because they were not related to the objectives of the systematic review. Some articles mentioned studies done in vitro or on acrylic models whereas, some mentioned materials other than ball and Locator attachments. 21 articles which remained were screened for duplicates manually. Out of 21 articles, three articles were found to be duplicates and hence remaining 18 articles were screened through abstracts as a next step. Finally, 3 articles were screened for full text. At the end 3 studies remained which underwent qualitative synthesis.

Search Strategy	Articles in hits	Selected articles
Prosthesis Retention AND Denture Precision Attachment	14	2
Prosthesis retention AND denture overlay	52	1
Retention AND locator attachment AND implant retained over denture	3	0
clocator attachment OR ball attachment AND implant retained over denture	21	0
Retention AND ball attachment AND implant retained over denture	4	0

S.no/study id	Author	Year	Name of the Journal	Intervention	Comparison	Sample size (I)	Sample size (C)	Method/Testing	Retention characteristics		Retention characteristics LOCATOR				Retention characteristics RETENTIVE ANCHOR				Results	Remarks
									Intervention	Comparison	Mean (I)	SD (I)	Mean (I)	SD (I)	Mean (C)	SD (C)	Mean (C)	SD (C)		
1	Jabbour Z et al	2013	Clinical Implant Dentistry and Related Research	Straumann Ball	Zest Anchor locator	22	22	a digital force measurement gauge	Locator	Retentive Anchor	Left Side		Right Side		Left Side		Right Side		Increase in labial lingual inter implant angulation causes significant loss of retention on Locator attachment against that for the ball attachment system.	
										PHASE 1										
										Baseline	40.9	11	37.4	11.6	33.7	7.6	32.6	5.7		
										Week 1	30.5	5.2	25.5	4.8	30.4	6.9	28.4	4.7		
										Month 3	22.1	6.9	15.9	7.6	32.4	15.1	28.7	5.5		
										Month 6	17.7	6.5	18.5	5.1	22.5	6.1	23.6	5.4		
										Month 12	14.8	4.3	10.7	5.3	21.9	9.8	20	9.3		
										PHASE 2										
										Baseline	38.3	14.1	37.7	5.4	36.4	5.3	32.9	4.6		
										Week 1	25.2	4.9	25.8	7	30.8	5.5	32.4	3.4		
										Month 3	15.6	10.7	18.4	9.4	27.8	8	30.4	5.7		
										Month 6	15	11.1	15.7	8.9	24.6	5.2	28	8.4		
										Month 12	10.9	8	11.6	7.5	19	11.3	20	9		
2	Cristache et al	2014	Clinical Oral Implant Research	Retentive Anchor Ball	Locator	23	23	Six field table analysis, By Payment et al 2001											Both attachment systems can be considered equally good.	
3	Cakarer S et al	2011	Medicina Oral Patologia Oral y Cirugia Bucal	Ball	Locator	19	8												14 complications were encountered in the Ball group and 0 in the Locator group were observed. Hereby proving Locator to be a better attachment system	

Data extraction sheet

Anchors, Escondido,CA,USA) with clear nylon inserts (ref 8524, Zest Anchors). They tested the effect of interimplant angulation on the loss of retention of two attachment systems that have different geometric shapes. Within the limitations of this study, they concluded that increased labial–lingual interimplant angulation seems to cause higher impact on loss of retention of Locator attachments than on ball attachments.

Cristache et al. (2014) conducted a study that was divided in 3 groups with a 5 year follow up. Group B being retentive anchor, group M being magnet attachments and group L being Locator attachments. No statistical difference was observed in the age groups, interimplant distance and height of in the lower canine region. No correlation was noticed between any group and the bone quality, bone amount, sex of the patient or length of the implant. Even in terms of period of edentulism no significant difference was observed between the groups. The number of maintenance recalls were 241 in 5 years, which were distributed as: 195 in Group B (184 in Subgroup B.1 i.e. Gold matrix and 11 in Subgroup B.2 i.e. Titanium matrix), 31 in Group L and 15 in Group M. Each patient in Subgroup B.1 needed activation of matrix at 6 months till a year. Amongst these there were 4 patients that needed matrix replacement (8 prosthetic components for 2 implants). No differences were statistically recorded amongst Subgroup B.2, Group L and Group M.

Three studies have been chosen in this review that comprised of both locator and ball attachment systems except it is still unclear as to which system serves better. One of the articles stated that Locator attachment proved to be a better system than ball attachments. But, one of the studies which is a 5 year follow up showed that initial investment as well as initial retention of both ball and Locator attachment systems were acceptable but in the long run magnets proved to be providing maximum patient satisfaction. While, another study stated that Locator attachment was more advantageous to ball attachment systems as at the end of 12 months there were no complications associated to them. As the number of the studies were low, and out of 15 studies 3 studies presented with retention characteristics, while other studies have incorporated other attachment systems as well as most of them were in—vitro. Few other studies were questionnaire studies that depicted difficulties or change in quality of life of overdenture wearers.

Limitations: Total number of articles screened for full text are limited in number i.e, only 3 articles are screened in this systematic review.

Conclusions: We can conclude that Locator attachment systems are relatively better than ball attachment systems.

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