How to Cite:
Madhav, M., Sahoo, S., Gupta, A. D., Sharma, Y., Sharma, A., & Arafath, S. (2022). To evaluate the crestal bone loss in mandibular implant overdenture via locator and ball socket attachments: An in - vivo study. *International Journal of Health Sciences*, *6*(S2), 10084–10096. https://doi.org/10.53730/ijhs.v6nS2.7633

To evaluate the crestal bone loss in mandibular implant overdenture via locator and ball socket attachments: An in - vivo study

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***Abstract*---**Edentulism is a debilitating and irreversible condition and is described as final marker of disease burden for oral health. Rehabilitating edentulous patients with residual ridge resorption has improved tremendously because of Implant dentistry . Aims and Objectives: To evaluate the crestal bone loss in mandibular implant over denture via locator and ballsocket attachments: An In - Vivo study. Material and method: This study was undertaken in the Department of Prosthodontics and Crown &Bridge Methodology • According to the inclusion and exclusion criteria, twenty subjects were selected for this study. OPG radiographs were recorded for each subject. They were divided into two groups: Group A and Group B. • Group A subjects (10) received ball and socket retained mandibular implant overdenture against a maxillary complete denture with ball diameter of 2.25mm and gingival height of 3mm while Group B subjects (10) received locator retained mandibular implant overdenture. Results The result obtained was subject to comparison

by ANOVA statistical analysis. It was found that for ball and socket attachment, highest crestal bone was observed on the mesial aspect of the right implant followed by the distal aspect of the same implant. Conclusion Its can be concluded that implant retained mandibular overdentures with locator attachments achieve a successful clinical outcome regarding preservation of crestal bone height and overall maintenance.

***Keywords*---**implants, edentulism, crestal bone loss, ball socket attachment, locator attachment, overdenture.

Introduction

An adequate dentition is of importance for wellbeing and life quality. Despite advances in preventive dentistry, edentulism is still a major public health problem worldwide. Tooth loss doesn't have to occur as we age. The most common oral health conditions that lead to edentulism are dental caries, trauma & periodontal diseases, which can be an incredibly stressful experience for any adult.1 Edentulism is a debilitating and irreversible condition and is described as the final marker of disease burden for oral health. There are many studies about the perception of tooth loss and feelings involving prosthetic rehabilitation. However, qualitative studies that investigated the feelings of edentulous individuals throughout the course from tooth loss to successful prosthetic rehabilitation with complete dentures were not identified. The recognition of subjectivity is vital for the care plan of individuals and can guide the choice of approach that provides improved well-being and contributes to more qualified and quantified humanized care.2

Rehabilitating edentulous patients with residual ridge resorption has improved tremendously because of implant dentistry. Implant supported overdentures have expanded rapidly as a successful treatment modality to rehabilitate completely edentulous patients. It improves retention, stability, function and esthetics as well as preserves the residual bone, especially in the mandible. Many complaints associated with conventional dentures can be addressed when dental implants are used to retain conventional dentures. Overdentures are simply conventional dentures attached to the remaining teeth or dental implants. Several studies have indicated that the use of implant supported overdentures in the mandible is an effective treatment modality, especially in patients with excessive loss of residual bone. The survival rate of implants in the front region of the mandible is excellent, and the rate of surgical complications is very low. As implant overdentures are widely used clinically and understanding about implant overdentures has become higher, the types of implant attachment systems and their application methods have been diversely developed. Although speculative, the faster the attachment releases from the abutment, the greater the stress shielding function. The retentive forces of most attachment systems are in the range of about 20 N. It is also assumed that forces of around 20 N are probably sufficient for overdentures in the edentulous mandibles.3

One therapeutic approach to improve oral function in elderly edentulous patients is the use of overdentures While Conventional denture instability leads to insecurities, inefficient mastication and overall dissatisfaction. With the advent of attachment systems, the success rate of dentures has improved to a great extent. Although it is possible to have various treatment options for edentulous group of patients which includes the use of conventional complete denture and surgical options like two axial implants with locator, ball-socket or bar-clip attachment followed by removable prosthesis or axially placed or tilted implants to support fixed implant bridges or hybrid dentures. Out of the above mentioned treatment choices, implant supported overdentures have proven to be of wide acceptance amongst such patients due to their low treatment cost and high functional outcome.4 The implant & prosthesis success rate in implant overdentures is determined by evaluating the marginal bone levels over a period of time. Literature suggests that loading protocols are a key in determining the outcome of the implant treatment .

Dental specialists today are facing a major influx of completely edentulous patients and patients with generalized compromised teeth who ask for cost-effective full mouth rehabilitation. The choice of overdenture as a treatment modality is significantly less expensive and is within the reach of many patients who are on a limited financial support. The ball-socket attachment consists of a metal ball patrix (male) which is screwed into the fifixture, where the matrix (female) is incorporated in the intaglio surface of the denture. Ball-socket attachments are amongst the simplest of all stud attachments, and are widely used because of their low-cost, ease of handling, minimal chair side time requirements and their possible applications with both root and implant supported prostheses.5 Many authors agree that for un-splinted implants, the most common attachment used is the ball-socket attachment.

Aims and Objectives

- To evaluate the crestal bone loss in mandibular implant over denture via locator and ballsocket attachments: An In - Vivo study.
- To evaluate the crestal bone loss using panoramic radiograph in implant overdenture using the ball-socket attachment.
- To evaluate the crestal bone loss using panoramic radiograph in implant overdenture using the locator attachment.
- To compare the crestal bone lose between locator and ball-socket attachment in the mandibular implant supported overdenture

Material and Method

This study was undertaken in the Department of Prosthodontics and Crown & Bridge, Shree Bankey Bihari Dental College and Research Centre, Masuri, Ghaziabad, Uttarpradesh.

The materials and equipments used for this study

Material/Equipment Manufacturer

Alginate impression material Zelgan Used for making a diagnostic impression
Impression compound Trulon Jyna industries Used for primary impression
Type 2 gypsum product Dental plaster Kalabhai Karson Pvt. Ltd. Used for primary & diagnostic cast
Green stick impression compound DPI- the bombay burmah trading corporation ltd. Used for making final impression
Medium bodied A-silicon Impression material Densply Used for making final impression
Type 3 gypsum product Dental stone Kalabhai Karson Pvt. Ltd. Used for pouring Master Cast Modelling wax Pyrax polymars Used for Jaw Relation
Sperating media DPI- cold moul seal Used as a separating medium for gypsum Auto polymering acrylic resin (polymer & monomer)
DPI- the bombay burmah trading corporation ltd. Used for fabrication of temporary denture bases Ball & socket attachment
Adin Used for overdenture attachment in Group A Locator attachment
Adin Used as overdenture attachment in Group B

Methodology

According to the inclusion and exclusion criteria, twenty subjects were selected for this study. OPG radiographs were recorded for each subject. They were divided into two groups: Group A and Group B. • Group A subjects (10) received ball and socket retained mandibular implant overdenture against a maxillary complete denture with ball diameter of 2.25mm and gingival height of 3mm while Group B subjects (10) received locator retained mandibular implant overdenture against a maxillary complete denture with gingival height of locator being 3mm. • For each subject conventional maxillary and mandibular complete dentures were fabricated prior to implant placement in the edentulous mandibular arch. • Standardized clinical & laboratory steps were followed for the fabrication of conventional complete maxillary and mandibular dentures. • Steps followed were: o Diagnostic impression using alginate impression material.

Materials and Methodology

Primary impression using impression compound impression material. Border moulding using green stick impression compound and final impression using medium bodied Addition silicon impression material. Jaw relation and facebow transfer. Teeth selection and teeth arrangement. Try-in procedure. Acrylization of the trial denture. Finishing and polishing of the denture. Insertion of the conventional complete maxillary and mandibular denture. • According to Misch classification for mandibular treatment options implant placement was planned in B and D positions (OD-1). According to this OD-1 implants in B and D positions are independent of each other. FIGURE -1 Over Denture -1Showing B and D Implant Denture • The planned positions were located on the fabricated mandibular denture and the denture was duplicated using clear acrylic resin. • OPG for each subject was obtained with maxillary conventional & mandibular

clear denture in situ so that magnification errors in the OPG could be eliminated using pre-recorded values of interarch separation by the following formula R=experimental/reference area • After elimination of magnification of error, holes were drilled in the planned position for implant placement in the duplicated mandibular clear denture, using these the planned implant positions were transferred onto the soft tissue with an indelible pencil. • 3.5mm x 11.5mm implants using the standard implant placement procedure were placed on the planned positions in the edentulous mandibular arch of each subject.

- The conventional mandibular denture was temporarily soft lined using viscogel (Densply).
- After 24 hours follow up and evaluation of the surgical site, the subjects were recalled after 3 months for placement of planned overdenture attachments.
- At 3 months recall, the implant sites were exposed, implant cover screws were removed and overdenture attachments were placed accordingly.

Group A subjects received ball & socket attachments.
Group B subjects received locator attachments. • Both attachments were torqued at 25 Ncm. • According to the implant position holes were drilled in the conventional mandibular complete denture. • Metal housings were placed over the implant attachments. • A pickup of the metal housing was done using auto polymerizing acrylic resin (DPI). • Finishing and polishing was done, the mandibular overdenture & maxillary conventional denture was inserted and occlusal corrections were done. • The subjects were recalled at every three months interval for three times for the evaluation and recording the OPG radiographs. • Bone loss was measured in mesial and distal aspect of every implant. • These values were subjected to ANOVA statistical analysis.

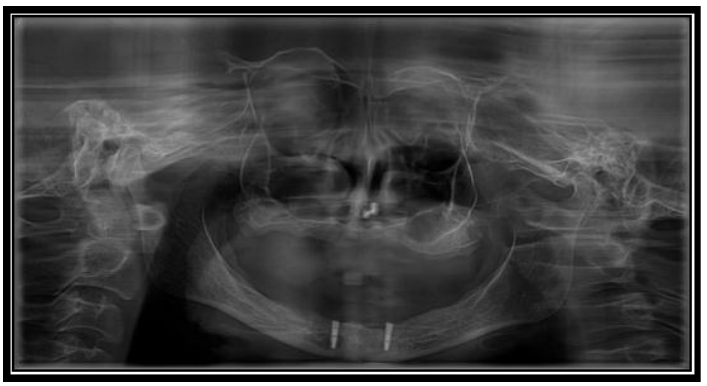


Figure 1 - Post-Operative OPG

Figure 2 – Ball Socket Attachment Placed

Figure 3 - Denture With Ball Attachment Housing

Figure 4 - Implant Supported Overdenture With Ball And Socket Attachment

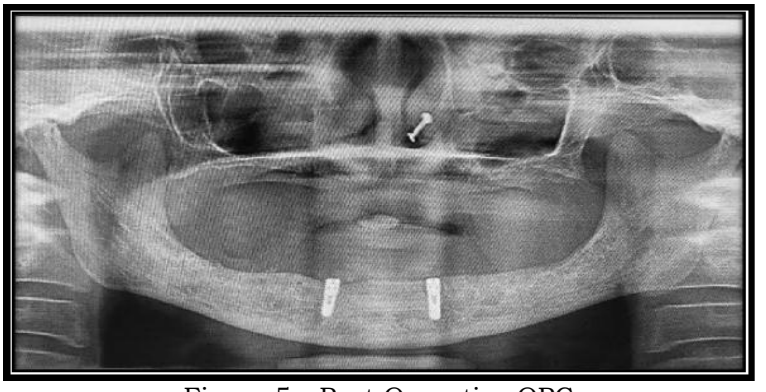


Figure 5 - Post Operative OPG

Figure 6 – Locator Attachmnent Placed

Figure 7 – Denture With Locator Attachment Housing

Figure 8- Implant Supported Overdenture With Locator Attachment

Results

The result obtained was subject to comparison by ANOVA statistical analysis. It was found that for ball and socket attachment, highest crestal bone was observed on the mesial aspect of the right implant followed by the distal aspect of the same implant. Whereas is the left implant showed more crestal bone loss on the distal aspect, least 109 amount of bone loss was observed in the mesial aspect of left implant these readings were found to be consistent throughout the Group A subjects that received ball and socket attachment. Group B subjects that received locator attachments presented with bone loss in the mesial aspect of the right implant followed by distal aspect of the same implant but the values had a marginal difference, whereas for the left implant, distal aspect presented with greater bone loss then the mesial aspect here also the values had a of marginal difference only. When a comparison was made between bone loss occurring between the Group A and Group B subjects, it was found that ball and socket group (Group A) presented with greater crestal bone loss that the locator group (Group B).

S. NO.	Follow up duration	Comparison of Average CBL Values for Group A of both Right and Left Implants			
		Right side		Left side	
		Mesial	Distal	Mesial	Distal
1	3 months	1.98	1.88	1.30	1.49
2	6 months	2.07	2	1.38	1.65
3	9 months	2.11	2.03	1.42	1.70
4	12 months	2.15	2.07	2.87	2.97

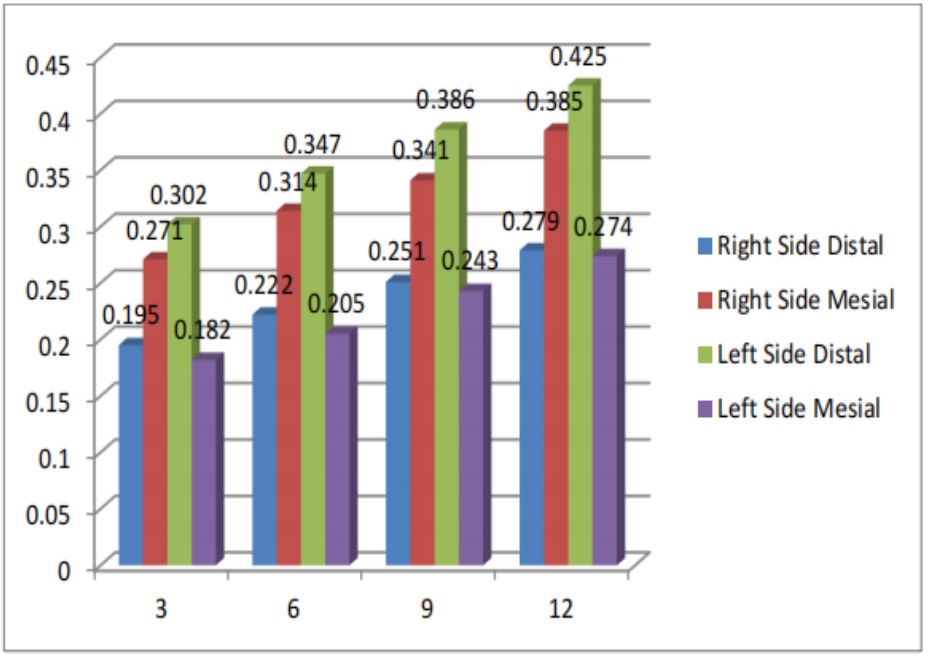
Table 1 Comparison of Average CBL values for Group A of both Right and Left Implants

S. NO.	Follow up duration	Comparison of Average CBL Values for Group B of both Right and Left Implants			
		Right side		Left side	
		Mesial	Distal	Mesial	Distal
1	3 months	0.27	0.19	0.18	0.27
2	6 months	0.31	0.22	0.20	0.34
3	9 months	0.34	0.25	0.24	0.38
4	12 months	0.38	0.27	0.27	0.42

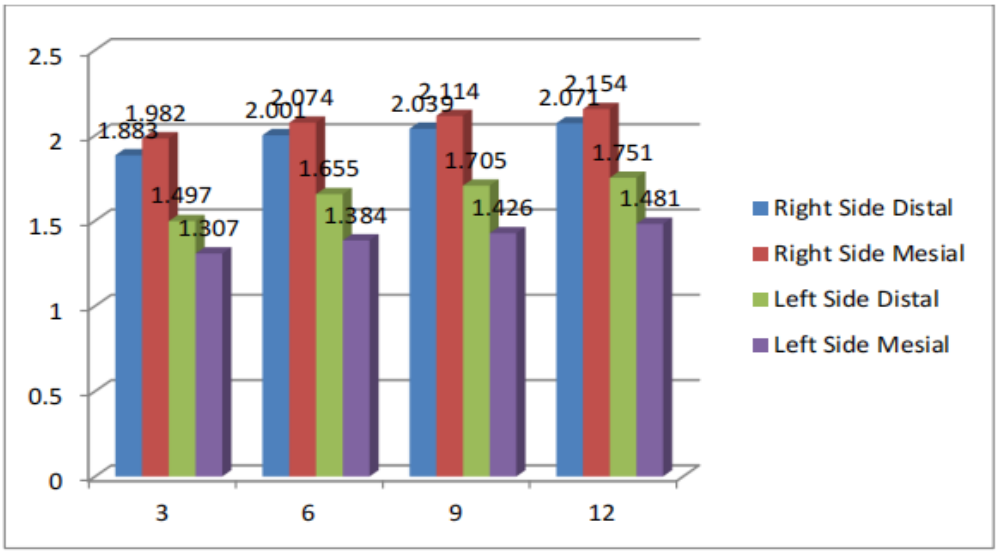
Table 2 Comparison of Average CBL values for Group B of both Right and Left Implants

ANNOVA SUMMARY								
Duration of Follow-Up	P VALUES				F RATIOS			
	3 Months	6 Months	9 Months	12 Months	3 Months	6 Months	9 Months	12 Months
Right Distal Group A & Group B	< 0.00001	< 0.00001	< 0.00001	< 0.00001	162.919	475.479	483.588	504.757
Right Mesial Group A & Group B	< 0.00001	< 0.00001	< 0.00001	< 0.00001	159.403	100.867	105.727	99.3136
Left Distal Group A & Group B	< 0.00001	< 0.00001	< 0.00001	< 0.00001	61.0392	56.4753	56.4554	56.887
Right Mesial Group A & Group B	< 0.00001	< 0.00001	< 0.00001	< 0.00001	64.6912	60.3745	54.991	54.9172

Table 3 P values and F ratios of Group A and B



Graph 1 Comparison of Average CBL values for Group A of both Right and Left Implants



Graph 2 Comparison of Average CBL values for Group B of both Right and Left Implants

Discussion

Complete edentulism has a very detrimental effect on the overall lifestyle nutritional status and psychology of the patient. The most economical treatment choice for such patient is fabrication of a conventional complete maxillary and

mandibular denture. This treatment choice has multiple drawbacks that effect the overall treatment plan. The challenge faced by such patient involves loosening or destabilization of the conventional complete denture prothesis which happens majorly because of gradual resorption of residual alveolar ridge or inability of the operator to make adequate impressions, which leads to great difficulty in use of the prosthesis because of comprised stability, support, retention which in turn compromises the ability and comfort of mastication. In a study conducted by Gunnar E Carlssson, it was concluded that wearing complete dentures may have adverse effects on the health of both oral and the denture supporting tissues. It was also concluded that residual ridge resorption is an inevitable consequence of tooth loss and denture wearing with no causative dominating factor.

More recently the problem of ill-fitting dentures has been tackled with the introduction of implant supported overdentures. Implant supported over dentures involve placement of two or more implants which utilize certain special precision attachments that helps in stabilizing the existing ill-fitting conventional complete denture. In a previous study, it was concluded that complete denture has always been a poor substitute for natural tooth. Mandibular complete dentures, frequently cause pain and discomfort, accelerated residual bone resorption, while failing to restore effective chewing. The provision of two implants to support and stabilize mandibular complete denture. Can result in significant improvements. [6]Another study concluded that for patients with severely resorbed mandible, mandibular over denture retained by dental implants appear to provide a more satisfactory solution to denture related problems.[7] One study which compared the social and sexual activity in edentulous patients treated with conventional compete denture prothesis and implant supported over denture prothesis stated that within two months after insertion of prothesis there was significant improvement in the implant overdenture group in both social activities when compare to conventional complete denture group. It was concluded that edentulism has a negative impact on social life. Mandibular over dentures provides greater improvement in general and intimate activities than conventional mandibular dentures.[8]Another study that evaluated the retention characteristics of various attachment systems for implant over dentures revealed that the attachment systems may be grouped into High Retentive (ERA attachment), Medium Retentive (locator, ball, bar), Low Retentive (locator pink attachment) and Very Low Retentive (magnetic attachment). This classification helps the general practitioner to identify the type of implant over denture attachment to be used for specific needs.[9] In a systemic review the authors concluded that the prosthetic maintenance and complications may be influenced by attachment systems however, patient satisfaction may be independent of the attachment system,[10] used although, one important factor that seems to be lacking in majority of the studies, is the amount of movement that occurs in an attachment retained over denture prothesis, these movements play a very crucial role in overall performance of the prosthesis and longevity of the attachment and implant complex.

In a study that measured marginal bone loss in two implant overdenture using different loading protocols and attachment system over a period of 10 years it was concluded that irrespective of the loading protocol and attachment system used the minimal marginal bone loss may be attributed to mandibular basal bone

remaining from long standing edentulism and on the movements that occur between attachments and prosthesis complex.[11] A study that analyzed the photo elastic stress of various retention mechanism on three implants retained mandibular over denture related that for vertical design, lowest stress was transferred to implant with the bar-ball attachment, while moderate stress was observed in implants on the loaded side with unsplinted attachment system. For the vertical implant design, the observed stresses were distributed to all implants except with ball attachment system, which demonstrated little discernible stresses on the non-loaded side implant.[12]

In the present study, the nature of occurrence of crestal bone loss in both the attachments cannot be only attributed to maintenance of oral hygiene, but majority it can be attributed to the occurrence of movements and the nature and magnitude of forces acting upon the implant supported mandibular over denture. These readings were found to be consistent with other studies where it was found that greater vertical bone loss occurred in ball and socket attachment retained over denture.

Conclusion

Within the limitations of this study, it was concluded that there was a significant difference in the crestal bone loss in mandibular implant overdenture with locator and ball & socket attachments. So it can be concluded that implant retained mandibular overdentures with locator attachments achieve a successful clinical outcome regarding preservation of crestal bone height and overall maintenance.

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