

Original Research

Assessment of retentive capacity of attachment systems in implant retained overdentures

Sidhant Sudan¹, Praveen Verma², Pramod Bhagat³, Vinod Patel⁴, Uttam Parmar⁵, Anshul Sahu⁶

¹Registrar, Department of Prosthodontics, Indira Gandhi Government Dental College, Jammu;

²Senior Lecturer, Department of Prosthodontics, Triveni institute of Dental Sciences Hospital and Research Center, Bilaspur, Chhattisgarh;

³MDS Prosthodontics, Private Practitioner, Motihari, Bihar;

⁴Senior Lecturer, Department of Pediatric and Preventive Dentistry, New Horizon Dental College and Research Institute, Bilaspur, Chhattisgarh;

⁵Senior Lecturer, Department of Prosthodontics, College of Dental Sciences and Hospital, Bhavnagar, Gujarat;

⁶Senior Lecturer, Department of Prosthodontics, Triveni Institute of Dental Sciences Hospital and Research Center, Bilaspur, Chhattisgarh

ABSTRACT:

Background: The stabilization of the lower denture with two interforaminal implants has provided reliable and predictable treatment outcomes. The present study assessed the retentive capacity of attachment systems in implant-retained overdentures.

Materials & Methods: Edentulous mandibular models were made with heat-cured polymethyl methacrylate resin. Acrylic resin mandibular overdentures were fabricated and provision was made to receive three different overdenture attachment systems, prefabricated ball/o-ring attachment, Hader bar and clip attachment and Locator® implant overdenture attachment stud type. Using a universal testing machine, each of the models were subjected to 100 pulls. **Results:** Group I had Ball/o-ring attachment, group II had Bar and clip attachment and group III had Locator attachment. There was significant difference in retentive forces before and after thermocycling in all groups. Inter group comparison also revealed significant difference ($P < 0.05$). **Conclusion:** Authors found that the bar and clip attachment exhibited the highest peak as well as the highest mean retention force.

Key words: Thermocycling, Retentive, implant-retained overdentures

Received: 22 February, 2020

Accepted: 13 March, 2020

Corresponding author: Dr. Sidhant Sudan, Registrar, Department of Prosthodontics, Indira Gandhi Government Dental College, Jammu, India

This article may be cited as: Sudan S, Verma P, Bhagat P, Patel V, Parmar U, Sahu A. Assessment of retentive capacity of attachment systems in implant retained overdentures. *J Adv Med Dent Scie Res* 2020;8(4):111-113.

INTRODUCTION:

The stabilization of the lower denture with two interforaminal implants has provided reliable and predictable treatment outcomes. It is regarded as the minimum standard of care for edentulous patients.¹ The prognosis of the prosthesis depends on two important factors: (1) Retention and (2) stress distribution. Retention is the function of and is directly related to the attachment system employed. The success of implant-retained overdentures primarily depends on the

retentive capacity of its attachment element to sustain its long-term functionality. The choice of the attachment is dependent upon the retention required, jaw morphology, anatomy, mucosal ridge, oral function, and patient compliance for recall.²

Retention is the quality inherent in the dental prosthesis acting to resist the forces of dislodgment along the path of placement. A poor lower alveolar ridge can result in problems such as a lack of stability and lack of support. Some patients are able to develop a high degree of

neuromuscular control of the tongue, to stabilize the lower denture effectively.³ However, some never develop the required degree of control. It is these patients who may require additional help to achieve a satisfactory level of oral function. In many cases, dental implants can provide this help. This can be achieved with a variety of retention systems. Stability, retention and support can be dramatically improved, with commensurate improvements in chewing ability, speech and social confidence.⁴ The present study assessed the retentive capacity of attachment systems in implant-retained overdentures.

MATERIALS & METHODS

The present study was conducted in the department of Prosthodontics. It comprised of 130 patients of both genders. The study was approved from institutional ethical committee. All patients were informed regarding the study and written consent was obtained.

General data such as name, age, gender etc. was recorded. Edentulous mandibular acrylic resin models made with heat polymerized polymethyl methacrylate

resin. Acrylic resin mandibular overdentures fabricated with heat polymerized polymethyl methacrylate resin. Three overdenture models were prepared and five denture samples were prepared for each group. Group I- Ball/o-ring attachment, group II - Bar and clip attachment and group III - Locator® attachment. The implant analogs were placed in the acrylic models using physiodispenser, simulating the conventional placement of implant in osteotomy site in the mandible and subsequently secured with resin cement. Each attachment system was secured into the implant replicas on the acrylic resin model and the overdentures with the corresponding housing were subsequently placed on it and tightened to 35 Ncm. Using a universal testing machine, each of the models were subjected to 100 pulls each to dislodge the overdenture from the acrylic model, and the force values as indicated on the digital indicator were tabulated both before and after thermocycling (AT). Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of systems

Group I	Group II	Group III
Ball/O ring attachment	Bar and clip attachment	Locator attachment

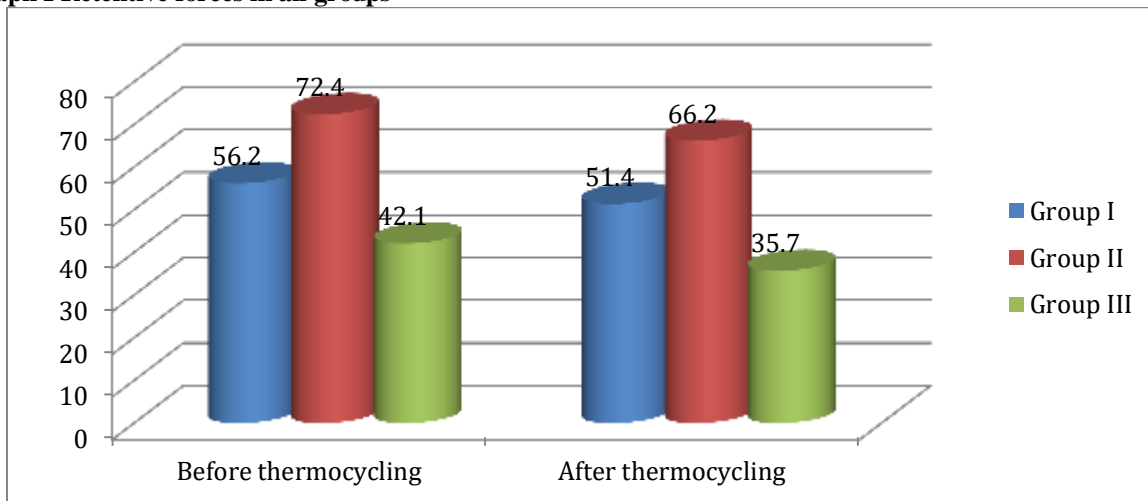
Table I shows that group I had Ball/o-ring attachment, group II had Bar and clip attachment and group III had Locator attachment.

Table II Retentive forces in all groups

Groups	Group I	Group II	Group III	P value
Before thermocycling	56.2	72.4	42.1	0.01
After thermocycling	51.4	66.2	35.7	0.01
P value	0.05	0.02	0.02	

Table II shows that there was significant difference in retentive forces before and after thermocycling in all groups. Inter group comparison also revealed significant difference (P< 0.05).

Graph I Retentive forces in all groups



DISCUSSION

There are several ways to connect the prosthesis to implants. This can be done either directly on to the bar, as in a bar and clip system, or by using direct attachments. The latter include studs, Locators[®], and magnets.⁵ These attachment systems may be used on their own, or as secondary retention systems in combination with a bar. Studies have shown superior patient-based outcomes using two implant mandibular overdentures compared to conventional lower dentures. These led to the publication of the McGill Consensus in 2002, which stated that the treatment of choice for an edentulous mandible should be a two-implant retained overdenture.⁶ In ball and clip attachment, the major bar types come with matching clips. These are incorporated into the prosthesis, either at the time of processing, or afterwards, as a pick-up procedure.⁷ Some systems include a spacer that can be incorporated at the time of processing. Use of the spacer means that there will be a space between the clip and the bar when the prosthesis is at rest in the patient's mouth. When the patient bites, the denture is then capable of some vertical movement. This means that there can be some mucosal support for occlusal loads, rather than only implant support.⁸ The present study assessed the retentive capacity of attachment systems in implant-retained overdentures. In present study, group I had Ball/o ring attachment, group II had Bar and clip attachment and group III had Locator attachment. There was significant difference in retentive forces before and after thermocycling in all groups. Inter group comparison also revealed significant difference ($P < 0.05$).

Locators are newer type of connector which have a low profile compared to other common types of attachment. They therefore require less prosthetic space to use. Nylon males within the denture attach to the Locator[®] abutments. Elsyad et al⁹ in their study locators were divided into three subgroups according to the degree of retention of the male nylon insert: Locator extra-light retention (blue insert), Locator light retention (pink insert), and Locator medium retention (transparent insert). Vertical and oblique (anterior, posterior, and lateral) dislodging forces were measured at the beginning of the study (initial retention) and after 540 cycles of denture insertion and removal (final retention). For all dislodging forces, Locator medium recorded the highest initial and final retention. Telescopic attachments recorded the lowest retention during vertical and anterior dislodging, and Locator extra-light recorded the lowest retention during lateral and posterior dislodging. For all types of Locator attachments, anterior dislodging recorded the highest initial and final retention, and lateral dislodging recorded the lowest retention. For the telescopic attachment, posterior dislodgment recorded the highest

initial and final retention, and anterior dislodging recorded the lowest retention.

Shastri et al¹⁰ compared the change in the retentive force and removal torque of three attachment systems during simulation of insertion-removal cycles. The statistical model revealed a significantly different behavior of the attachment systems both before and AT. The ball/o-ring and bar attachments developed higher retentive force as compared to the locator attachment. The bar and clip attachment exhibited the highest peak as well as the highest mean retention force at the end of the study. The Locator[®] attachment showed a decrease in retentive potential after an early peak.

CONCLUSION

Authors found that the bar and clip attachment exhibited the highest peak as well as the highest mean retention force.

REFERENCES

1. Müller F, Naharro M, Carlsson GE. What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? *Clin Oral Implants Res* 2007;18 Suppl 3:2-14.
2. Carlsson GE, Omar R. The future of complete dentures in oral rehabilitation. A critical review. *J Oral Rehabil* 2010;37:143-56.
3. Polzer I, Schimmel M, Müller F, Biffar R. Edentulism as part of the general health problems of elderly adults. *Int Dent J* 2010;60:143-55.
4. Allen PF, McMillan AS, Walshaw D. A patient-based assessment of implant-stabilized and conventional complete dentures. *J Prosthet Dent* 2001;85:141-7.
5. Awad MA, Lund JP, Shapiro SH, Locker D, Klemetti E, Chehade A, et al. Oral health status and treatment satisfaction with mandibular implant overdentures and conventional dentures: A randomized clinical trial in a senior population. *Int J Prosthodont* 2003;16:390-6.
6. Heckmann SM, Heussinger S, Linke JJ, Graef F, Pröschel P. Improvement and long-term stability of neuromuscular adaptation in implant-supported overdentures. *Clin Oral Implants Res* 2009;20:1200-5.
7. Bayer S, Keilig L, Kraus D, Grüner M, Stark H, Mues S, et al. Influence of the lubricant and the alloy on the wear behaviour of attachments. *Gerodontology* 2011;28:221-6.
8. Rutkunas V, Mizutani H, Takahashi H. Evaluation of stable retentive properties of overdenture attachments. *Stomatologija* 2005;7:115-20.
9. Elsyad MA, Agha NN, Habib AA. Retention and Stability of Implant-Retained Mandibular Overdentures Using Different Types of Resilient Attachments: An In Vitro Study. *Int J Oral Maxillofac Implants*. 2016 Sep-Oct;31(5):1040-8.
10. Shastri T, Anupama NM, Shetty S, Nalinakshamma M. An in vitro comparative study to evaluate the retention of different attachment systems used in implant-retained overdentures. *J Indian Prosthodont Soc* 2016;16:159-66.