An Evaluation of Attachments: Implant-supported Overdentures

Divya UK Jha, Mukesh K Singhal, Chandana Nair, Gopi N Dubey, Anshika Agarwal, Sankey K Badiya, Rumneet Kaur Billing

ABSTRACT

The implant-supported overdenture attachments are used commonly, i.e., clips/bar, ball, magnets, locator, and telescopic crown attachments. This review article presents basic information between the different attachment systems used to retain and support the maxillary and mandibular implant overdentures in completely edentulous patients. It is based on a dental journal search limited to English-language articles published from 1990 to date. The article discloses the introductory information and advantages of aforesaid attachment systems. It also discusses the comparisons among the implant survival rate, marginal bone loss, soft tissue complications, retention, stress distribution, space requirements, maintenance complications, and patient satisfaction against the mentioned attachment systems. This is concluded from the presentation, and it completely highlights that the use of ball and locator system has overall advantage over the other systems.

Keywords: Attachment systems, Denture Precision attachments, Implant-supported overdentures, Removable overdentures.


Source of support: Nil
Conflict of interest: None

INTRODUCTION

The necessity of suffering from uncomfortable dentures was eliminated by the introduction of dental implants in the early 1980s. The problem of lack of stability and retention, especially in the mandibular denture, has been solved by the fabrication of overdenture prosthesis. Implant-supported overdentures (IODs) are considered one of the best options for this. The attachment systems are considered the pillars of overdenture treatment. An overdenture attachment permits movement during function and removal from the mouth. Ideally, the attachment should offer the possibility of controlling the degree of retention provided. It is very important for the clinician to have a good knowledge of the various attachment systems, their advantages and disadvantages, and indications and contraindications for achieving long-lasting stable results. The present review article discusses the bar/clip (Fig. 1), ball (Fig. 2), magnet, locator (Fig. 3), and telescopic crown (Figs 4A and B) attachments.

MATERIALS AND METHODS

The data presented in this review article has been collected from various previously published articles and case reports comparing the different attachment systems and periodically checking the longevity and patient satisfaction for each attachment system on the basis of implant survival rate, marginal bone loss, soft tissue complications, retention, stress distribution, space requirements, maintenance and complications, and patient satisfaction. These publications were accessed by a thorough search of the dental journals available for IODs, attachment systems, and removable overdentures.

The data collected from various journals have been tabulated as Table 1—bar/clip; Table 2—ball; Table 3—magnet; Table 4—locator; and Table 5—telescopic crown.

From the above tabulated data, we can see the superiority of locator attachment over the other types of attachment systems. This difference between the in vitro studies and clinical trials leads us to the conclusion that the ball attachment still stays the most economical and well-suited attachment system for all.
DISCUSSION

Conventional dentures rely upon the residual alveolar ridge and mucosa for support and retention. Many patients have problems adapting to their complete dentures, especially to the mandibular prosthesis. Attachment stabilizes the prosthesis and the patient is able to consistently reproduce a determined-centric occlusion. The review of trends in IOD research examined the performance of attachment systems, comparisons, and outcomes in both clinical and in vitro settings. The in vitro studies generally utilized multiple attachment systems that showed significant differences among them while the clinical studies generally evaluated only one attachment system with no significant findings. This analysis of the literature showed that there is a large discrepancy between the study designs and the outcomes between the clinical and in vitro studies for IOD. Most of the common findings seen in the IOD research are as follows.

The observation period for clinical studies ranged from 0.5 to 20 years with a mean of 3.6 years. Articles involving two mandibular implants were the most common. Ball attachment was the most common attachment compared, followed by bar and magnet. The locator attachment system is the latest attachment system; therefore, it has been a gradual increase in the clinical and in vivo studies regarding this attachment system. Mahajan et al. describes the various advantages of locator attachment system in a severely atrophied mandibular arch due to locator’s low-profile in vivo study.

Turk et al. performed an in vivo study comparing retention of ball and locator attachment, using four dental implants and two polyethylene blocks. Ball attachments showed significant retention loss after 100, 200, 400, 500, 1500, and 4000 cycles, and the locator attachments showed significant retention loss after 100, 200, 300, 500, and 3000 cycles. Attachment retention forces from 5 to 7 Ncm are sufficient to stabilize over dentures (OVDs) during function. Based on this information, the retention forces of both attachment systems tested in the study would be acceptable after 4.5 years (mean of 9.7 Ncm for ball attachments and 21.7 Ncm for locator attachments after 5000 insertion–separation cycles). Classified as attachment with resilient patrix, the locator attachment system has showed increased retention, lesser space requirement, and better ease of insertion due to its self-aligning fit. But there is lack of significant superiority to the ball attachment in the clinical studies.
Table 1: Bar/clip attachment

<table>
<thead>
<tr>
<th>Attachment system</th>
<th>Implant survival rate</th>
<th>Marginal bone loss</th>
<th>Soft tissue complications</th>
<th>Retention</th>
<th>Stress distribution</th>
<th>Space requirements</th>
<th>Maintenance and complications</th>
<th>Patient satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar/clip</td>
<td>No correlation found</td>
<td>Mean marginal bone loss of 0.3 mm in first year has been noted</td>
<td>Hyperplasia of the mucosa covering the residual ridge</td>
<td>More retentive when subjected to vertical and oblique forces</td>
<td>Higher stress distribution than ball attachment but decreased in comparison to telescopic attachment</td>
<td>A distance of 10–12 mm from the crest of the ridge to incisal edge</td>
<td>Most frequent repair involves retentive clips (25%)</td>
<td>Good</td>
</tr>
</tbody>
</table>

Table 2: Ball attachment

<table>
<thead>
<tr>
<th>Attachment system</th>
<th>Implant survival rate</th>
<th>Marginal bone loss</th>
<th>Soft tissue complications</th>
<th>Retention</th>
<th>Stress distribution</th>
<th>Space requirements</th>
<th>Maintenance and complications</th>
<th>Patient satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball</td>
<td>No correlation found</td>
<td>No significant loss seen</td>
<td>Does not affect the peri-implant condition</td>
<td>Satisfactory</td>
<td>Under vertical forces, minimum stress transferred to implant</td>
<td>A distance of 10–12 mm from the crest of the ridge to incisal edge</td>
<td>More appointments after insertion required for flange adjustment</td>
<td>Good</td>
</tr>
</tbody>
</table>

Table 3: Magnet attachment

<table>
<thead>
<tr>
<th>Attachment system</th>
<th>Implant survival rate</th>
<th>Marginal bone loss</th>
<th>Soft tissue complications</th>
<th>Retention</th>
<th>Stress distribution</th>
<th>Space requirements</th>
<th>Maintenance and complications</th>
<th>Patient satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet</td>
<td>No correlation found</td>
<td>No significant loss seen</td>
<td>Plaque accumulation is highest</td>
<td>Least retentive attachments Unreliable and weak retention</td>
<td>Less excessive forces are transmitted to the implant</td>
<td>Has low profile</td>
<td>More appointments after insertion required for flange adjustment</td>
<td>Less satisfaction due to frequent complications</td>
</tr>
</tbody>
</table>

Table 4: Locator attachment

<table>
<thead>
<tr>
<th>Attachment system</th>
<th>Implant survival rate</th>
<th>Marginal bone loss</th>
<th>Soft tissue complications</th>
<th>Retention</th>
<th>Stress distribution</th>
<th>Space requirements</th>
<th>Maintenance and complications</th>
<th>Patient satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locator</td>
<td>No correlation found</td>
<td>No significant loss seen</td>
<td>Does not affect the peri-implant condition</td>
<td>Dual retention (mechanical plus frictional) After 5000 insertion–separation cycle shows better retention than ball attachments</td>
<td>Satisfactory</td>
<td>A minimum space of 8.5 mm require Available in multiple vertical height options starting as low as 2.0 mm Excellent for cases with angulations problem and low occlusal space</td>
<td>Higher percentage of retention loss due to wear</td>
<td>Good</td>
</tr>
</tbody>
</table>
An Evaluation of Attachments: Implant-supported Overdentures

Table 5: Telescopic crown attachment

<table>
<thead>
<tr>
<th>Attachment system</th>
<th>Implant survival rate</th>
<th>Marginal bone loss</th>
<th>Soft tissue complications</th>
<th>Retention</th>
<th>Stress distribution</th>
<th>Space requirements</th>
<th>Maintenance and complications</th>
<th>Patient satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telescopic crown</td>
<td>No correlation found</td>
<td>No significant loss seen</td>
<td>Does not affect the peri-implant condition</td>
<td>Frictional retention shows an increase in retention with use</td>
<td>Significant amounts of masticatory forces are transferred to the supporting implant, while a minimum masticatory loading is transferred to the residual alveolar ridge</td>
<td>Cannot be used in cases where there is decrease interarch space</td>
<td>–</td>
<td>Good</td>
</tr>
</tbody>
</table>

CONCLUSION
Clinicians tend to use attachment system based on reference, rather than scientific evidence, due to high rate of success of dental implants regardless of attachment system. However, such decisions should be based on a hierarchy of scientific evidence where different study designs provide results of varying “strength.”

The various in vitro studies have shown a significant positive response to the locator attachment system. Hence, it can be concluded that ball attachment system still has higher clinical superiority due to the fact that it is more economical, is easily available for overdenture, there is comparative ease in fabrication of denture with it, and laboratory procedure for attaching ball attachments provides more durable and long-lasting prosthesis compared to chairside procedure. These attachments are more reliable and acceptable by the patient.

Further clinical studies that can validate in vitro research should be encouraged to address this discrepancy between the two areas.

ACKNOWLEDGMENTS
I, Divya UK Jha, would like to acknowledge my husband Dr Gopi Nath Dubey and our parents for their kind support. I am also thankful to Dr MK Singhal, Head of the Department, Institute of Dental Sciences, Bareilly, for his constant guidance and support. I am also grateful to Dr Chandana Nair and Dr Anshika Agrawal for their help in writing this article.

REFERENCES