The Effect of Implant Number, Distribution with Different Attachments on the Retention and Stability of Implant Supported Overdenture

Areej Mufeed Abdulamajeed, Radhwan H. Hasan

Dept. of prosthetic, College of Dentistry/ Mosul University, Iraq

Abstract

Background

It was stated that the “PREVENTION IS BETTER THAN CURE” Today, with the more attention on preventive measures in prosthodontics, the use of implant supported overdenture has increased to the point where it is now a feasible alternative to most treatment plan outlines in the construction of prosthesis for patients (Sheldon Winkler, 2009).

Objective

Evaluate the effect of number and distribution of an implant upon in vitro retention and stability of a simulated implant-supported overdenture.

Methods

In this in-vitro experimental study a model simulating a mandibular edentulous ridge with 7 dental implants analogs inserted in the model approximating the tooth position in the natural dentition was constructed. A two overdenture housing for each type of attachment made of acrylic resin with three hooks attach to occlusal surface of it which connected to three chains attached to a force gauge testing machine was used to measure peak load (N) required to disconnect (dislodge) an attachment in three directions vertical, rotational and oblique. Two different type of attachments have been studied (Ball, Locator). This study was aimed to evaluate retention and stability of implant-retained overdentures based upon implant number and distribution.

Result

One way ANOVA analysis of variance test indicated that there were significant differences at P<0.05, using Duncan’s Multiple Range Test for comparison among the groups of Ball and Locator attachment indicated that groups of multi implants recorded the significantly higher measured peak load (N) in the three directions of dislodgement

Conclusion

variation in implant’s number and distribution affect the retention and stability of implant supported overdenture according to type of attachment utilized.

Key Words

Overedentur retention, Ball attachment, Implant number
**Introduction**

Teeth may be lost because of trauma, caries, periodontal disease, congenital defects, and iatrogenic treatment. Tooth loss has a negative impact on masticatory function, aesthetics, and self-image. Fixed partial dentures, removable partial dentures, complete dentures, and implant-supported dentures can replace missing teeth comfortably and aesthetically [1].

Loss of natural teeth and subsequent alveolar resorption has a significant impact on appearance [2]. Bone resorption in the maxilla occurs mostly on the buccal aspect and this leads to a decrease in lip support. [3] Anterior tooth position influences retention and stability of the denture with speech pattern [2,4].

Overdentures help to partly overcome several problems posed by conventional complete dentures like progressive bone loss, poor stability and retention, loss of periodontal proprioception, low masticatory efficiency [5]. With implant supported Overdentures problems related to retention and stability were solved, patients feel more secure, their chewing ability improves and thus their nutrition [6].

Various numbers of implants (typically one, two, or four) have been recommended for mandibular implant overdentures. Four implants have been suggested as one of the treatment options for edentulous patients seeking mandibular implant overdentures. However, in terms of prosthetic maintenance and complications, and patient satisfaction, two and four implant groups do not appear to be significantly different [7].

The prosthetic and attachment system factors involved with treatment planning successful mandibular implant overdentures have been the subject of extensive investigations. [8].

This study evaluated the effect of implant positions and number with two type of attachments on retention and stability of overdenture through determine whether there were any differences in the peak load measurement, a measure of retention and stability (maximum forces developed before complete separation of attachment components) for vertically, obliquely, and anterior-posteriorly directed dislodging forces and took a step towards selecting the locations of implants for overdenture according to evidence-based dentistry (EBD) guidelines.

**Materials and Methods**

Seven implant analogs made of titanium cylindrical with diameter (3.75 mm) and length (13 mm); (internal hex) used in this study. Two types of attachments were used, Ball Attachment: consisted of a titanium ball abutment, screwed into the test model implant analog uses with a teflon cap embedded in the fitting surface of the overdenture. Locator Attachment: consisted of a titanium abutment TIN coated, screwed into the test model implant analogues with a resin replaceable pink retainers were incorporated into the overdenture. An edentulous mandibular test model made of acrylic resin (Figure 1) was
constructed which had no undercut on it all the test were performed.

**Figure 1**: Acrylic resin mandibular test model

To determine the locations of points F1, A, B, C, D, E and F2 have been identified to simulate natural tooth positions, first a denture base was fabricated on the mandibular model cast using light cure acrylic resin. Then, normal size artificial teeth were arranged on the acrylic base. The locations of points F1, A, B, C, D, E and F2 were determined. Point C, was the location of midline (symphysis) the contact between the central incisors, point B was the location of mandibular canine tooth at right quadrant, point D was the location of mandibular canine tooth at the left quadrant, point A was the contact point of mandibular premolar teeth of the right quadrant, point E was the contact point of premolar teeth of the left quadrant, the point F1 was the location of the mandibular first molar in the right quadrant and point F2 was the location of mandibular first molar in the left quadrant. Implant holes were drilled using ITI drill series and milling machine in order to achieve parallel holes. After making sure of the correct distance and direction of the holes, drilling was performed. Analogs of implant were eventually inserted in their respective locations and secured by using cold cure acrylic resin (Figure 2).

**Figure 2**: the implant analogs were inserted

Two experimental overdenture housing were fabricated for each type of attachment systems 3 hooks were fixed in the positions corresponding to the midline, left and right molars. (Figure 3).

**Figure 3**: 3 hooks was fixed in the positions corresponding to the midline, left and right molars

The two attachment systems (Ball, Locator) were activated by screwing the key component of the abutments (depending on which system was used) into the implant analogs (Figure 4) and by positioning its counterpart attachment on fitting surface of the overdenture (Figure 5).
Each sample overdenture attachment system had one part (matrix) contained with overdenture housing and primary

**Figure 4:** the key component of the abutments (A: Ball abutments, B: Locator abutments) screwed into the implant analogs

**Figure 5:** counterpart of attachment (A: Ball, B: Locator) on fitting surface of the overdenture

copying (patrist) attach to test model implants. [9]

Overdenture dislodgement were performed using the device or machine in the (Figure 6). The device had two components:
A: Force Gauge (FG-5100): consisting of the load cell and a force sensor which read the value of the dislodging or tensile forces in newton unit (N) and a hardware component in which the model is placed and tensile forces are applied to the model. B: Test Stand for Force Gauge

Three directions of dislodgement were performed: A 3-point vertical pull was used to determine retention against a strictly vertically directed dislodging force parallel to the path of insertion and withdrawal (Figure 7) with three chains attached to the hooks in the mid-anterior and bilateral molar regions; Following this, the chain located in the right molar area was disconnected, and the 2 legs of the chain were attached to the 2 hooks corresponding to the left molar and central incisors areas. This resulted was an oblique lifting force simulating function (Figure 8); Following that, the chains in the left and right molar region remained, while the chain in the anterior region was removed. This resulted in a rotational pull, an anterior-posterior lifting force (lifting forces applied to the distal extension bases) simulating function (Figure 9), this type of pull was a measure of denture stability.
The implant's abutments of the Ball and Locator attachment systems were distributed to the areas that divided or designed as groups number which represent natural tooth positions (Table 1). (Figure 10, 11) represent the groups of different number and distribution of Ball, Locator attachment system respectively.
Results

1-Mean retentive force measured in newton’s unit (N) and standard deviation standard error for the six groups of both attachment systems (Ball, Locator) were calculated by SPSS statistical program (version 19) and listed at (Table 2,3). Then groups have been analyzed using one-way ANOVA there were significant differences among different groups at (p ≤ 0.05) as shown in (Table 4,5) followed by Duncan multiple range test to compare means among groups of Ball and Locator attachment respectively, indicated that In vertical, rotational and oblique dislodging test. Group F (seven implants at molars, premolars, canines and mid symphyseal regions F1, A, B, C, D, E, F2 positions) had a significantly higher measured peak load (N) than all other groups when compared with all other sets. Group E (single implant model at mid symphyseal region C position) had the lowest measured peak load (N) when compared with all other sets groups (Figures 12, 13).

Figure 12: Duncan’s multiple range test of the six implant groups (Ball attachment) for the vertically directed dislodging forces.

<table>
<thead>
<tr>
<th>groups</th>
<th>Number of Implants</th>
<th>Distribution of implants</th>
<th>Type of attachments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>four implants</td>
<td>F1, A, E, F2</td>
<td>Ball, Locator</td>
</tr>
<tr>
<td>Group B</td>
<td>four implants</td>
<td>F1, B, D, F2</td>
<td>Ball, Locator</td>
</tr>
<tr>
<td>Group C</td>
<td>three implants</td>
<td>C, F1, F2</td>
<td>Ball, Locator</td>
</tr>
<tr>
<td>Group D</td>
<td>three implants</td>
<td>C, B, D</td>
<td>Ball, Locator</td>
</tr>
<tr>
<td>Group E</td>
<td>one implant</td>
<td>C</td>
<td>Ball, Locator</td>
</tr>
<tr>
<td>Group F</td>
<td>seven implants</td>
<td>F1, A, B, C, D, E, F2</td>
<td>Ball, Locator</td>
</tr>
</tbody>
</table>

Table 1: classification of groups

Figure 13: Duncan’s multiple range test of the six implant groups (Locator attachment) for the vertically directed dislodging forces.

2-for comparison between two attachments the statistical analysis of Independent t-test were significant at the (P<0.05) level indicating that statistically significant differences existed between the Ball and Locator The mean retentive force measured in newton’s unit (N), standard deviation indicated that the Ball attachment system had the significant higher mean retentive value than Locator attachment system. With each of the performance measurements (peak load with vertically directed dislodging forces, peak load with anterior-posteriorly directed dislodging forces, peak load with obliquely directed dislodging forces) as shown in (Tables 6, 7, 8)
### Table 2: mean, standard deviation and standard error of vertical dislodgement test of Ball attachment (six implant groups)

<table>
<thead>
<tr>
<th>groups</th>
<th>N</th>
<th>Mean (N)</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>46.8500</td>
<td>.73872</td>
<td>.26118</td>
<td>46.2324</td>
<td>47.4676</td>
<td>45.80</td>
<td>47.80</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>40.3500</td>
<td>.88641</td>
<td>.31339</td>
<td>39.6089</td>
<td>41.0911</td>
<td>39.40</td>
<td>41.60</td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>31.9750</td>
<td>1.61842</td>
<td>.57220</td>
<td>30.6220</td>
<td>33.3280</td>
<td>29.20</td>
<td>35.00</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>28.6500</td>
<td>.77644</td>
<td>.27451</td>
<td>28.0009</td>
<td>29.2991</td>
<td>27.60</td>
<td>29.80</td>
</tr>
<tr>
<td>E</td>
<td>8</td>
<td>8.9000</td>
<td>.56569</td>
<td>.20000</td>
<td>8.4271</td>
<td>9.3729</td>
<td>8.00</td>
<td>9.60</td>
</tr>
<tr>
<td>F</td>
<td>8</td>
<td>51.6250</td>
<td>1.86222</td>
<td>.65839</td>
<td>50.0681</td>
<td>53.1819</td>
<td>48.60</td>
<td>53.80</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>34.7250</td>
<td>14.18998</td>
<td>2.04815</td>
<td>30.6047</td>
<td>38.8453</td>
<td>8.00</td>
<td>53.80</td>
</tr>
</tbody>
</table>

### Table 3: mean, standard deviation and standard error of vertical dislodgement test of Locator attachment (six implant groups)

<table>
<thead>
<tr>
<th>groups</th>
<th>N</th>
<th>Mean (N)</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>34.1250</td>
<td>.68400</td>
<td>.24183</td>
<td>33.5532</td>
<td>34.6968</td>
<td>33.20</td>
<td>35.00</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>30.9250</td>
<td>.80490</td>
<td>.28457</td>
<td>30.2521</td>
<td>31.5979</td>
<td>29.60</td>
<td>32.00</td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>29.4250</td>
<td>.78767</td>
<td>.27887</td>
<td>28.7656</td>
<td>30.0844</td>
<td>28.60</td>
<td>30.40</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>12.1750</td>
<td>.73630</td>
<td>.26032</td>
<td>11.5594</td>
<td>12.7906</td>
<td>11.20</td>
<td>13.40</td>
</tr>
<tr>
<td>E</td>
<td>8</td>
<td>3.2250</td>
<td>.42003</td>
<td>.14850</td>
<td>2.8738</td>
<td>3.5762</td>
<td>2.40</td>
<td>3.60</td>
</tr>
<tr>
<td>F</td>
<td>8</td>
<td>44.1250</td>
<td>.42678</td>
<td>.15089</td>
<td>43.7682</td>
<td>44.4818</td>
<td>43.60</td>
<td>44.60</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>25.6667</td>
<td>13.94207</td>
<td>2.01236</td>
<td>21.6183</td>
<td>29.7150</td>
<td>2.40</td>
<td>44.60</td>
</tr>
</tbody>
</table>

### Table 4: One way ANOVA of vertical directed dislodging test of Ball attachment groups

<table>
<thead>
<tr>
<th>SOV</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>9405.320</td>
<td>5</td>
<td>1881.064</td>
<td>1353.052</td>
<td>*.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>58.390</td>
<td>42</td>
<td>1.390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9463.710</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant difference at p≤ 0.05. df: Degree of freedom. SOV: Source of Variance.

### Table 5: One way ANOVA of vertical directed dislodging test of Locator attachment groups

<table>
<thead>
<tr>
<th>SOV</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>9117.457</td>
<td>5</td>
<td>1823.491</td>
<td>4146.542</td>
<td>*.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>18.470</td>
<td>42</td>
<td>.440</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9135.927</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant difference at p≤ 0.05. df: Degree of freedom. SOV: Source of Variance.
Discussion

An overdenture, once placed in the mouth, is subjected to a variety of forces applied in different directions, there are two aspects of retention: (1) the perspective of the patient, the feeling of how secure the prosthesis is in place as the overdenture is removed and separated from the implant abutments (break load or breakaway force); and (2) the perspective of the clinician, the measurement of the peak load (maximum dislodging force) as the overdenture is resisting removal from the patient’s abutments [9].

The design of removable overdenture for good retention & stability is difficult. It is seen that many treatment concepts involving mandibular overdenture design are based on empirical experiences of individual. Clinicians often base their selection of implant location and attachment systems empirically on expected retentive quality [10].

Various approaches have been used for the retention and stability of implant-supported overdentures. This study examined the effect of different implant’s number, distribution with two attachment systems (Ball, Locator) on retention and stability of implant-supported overdenture. Retention can be considered as the force that resists withdrawal along the path of insertion, while the resistance

Table 6: Descriptive statistics of vertically directed dislodging test in relation to implant’s number and distribution

<table>
<thead>
<tr>
<th>attachment</th>
<th>N</th>
<th>Mean (N)</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical dislodgement</td>
<td>Ball</td>
<td>48</td>
<td>34.7250</td>
<td>14.18998</td>
</tr>
<tr>
<td></td>
<td>Locator</td>
<td>48</td>
<td>25.6667</td>
<td>13.94207</td>
</tr>
</tbody>
</table>

Table 7: Descriptive statistics of rotational directed dislodging test in relation to implant’s number and distribution

<table>
<thead>
<tr>
<th>attachment</th>
<th>N</th>
<th>Mean (N)</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotational dislodgement</td>
<td>Ball</td>
<td>48</td>
<td>28.7854</td>
<td>11.82493</td>
</tr>
<tr>
<td></td>
<td>Locator</td>
<td>48</td>
<td>23.1667</td>
<td>12.57314</td>
</tr>
</tbody>
</table>

Table 8: Descriptive statistics of oblique directed dislodging test in relation to implant’s number and distribution

<table>
<thead>
<tr>
<th>attachment</th>
<th>N</th>
<th>Mean (N)</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oblique dislodgement</td>
<td>Ball</td>
<td>48</td>
<td>32.0875</td>
<td>14.14388</td>
</tr>
<tr>
<td></td>
<td>Locator</td>
<td>48</td>
<td>15.1896</td>
<td>8.38388</td>
</tr>
</tbody>
</table>
to dislodgment of the overdenture base to anterior-posterior forces was refer to as the stability [11]

This in vitro study revealed that as the number of implant increase retention and stability of implant supported overdenture have increased in turn the effort required to exact a dislodging force would be higher. (Figure 14) demonstrate the real dimensions among implants.

![Figure 14: actual dimensions among implants](image)

Statistical analysis showed the highest significant retention values (N) in the vertical dislodgement test (A 3-point vertical pull) was for group F (seven implants at molars, premolars, canines and mid symphyseal regions F1, A, B, C, D, E, F2) positions with both attachment systems, according to Duncan’s Multiple Range Test this means as the number of implant increase the resistance to dislodgement would increase in turn the effort required to exact a dislodging force would be higher as it obvious in the equilibrium equation and free body diagram (Figure 15).

![Figure 15: free body diagram](image)

Group F (seven implants)

\[ \sum F = 0 \]

\[ 3E = 7R \quad \Rightarrow \quad E = 7/3 \, R \]

\[ E = 2.33 \, R \]

The next highest mean retentive value (N) was recorded for group A (four implants model at molars F1, F2 and premolars A, E position) then followed by group B (four implant model at molars F1, F2 and canines B, D positions) in which the equation would be as

\[ 3E = 4R \quad \Rightarrow \quad E = 4/3 \, R \]

\[ E = 1.33 \, R \]

Then group C (three implants model at mid symphyseal C and molars F1, F2 positions), group D (three implants model at mid symphyseal C and canines B, D)

\[ 3E = 3R \quad \Rightarrow \quad E = 3/3 \, R \]

\[ E = R \]

While group E (single implant model at mid symphyseal C region) recorded the lowest mean retentive value (N).

\[ 3E = R \quad \Rightarrow \quad E = 1/3 \, R \]

\[ E = 0.33 \, R \]

The results of anterior-posterior dislodgement (rotational dislodgement) can be explain by principles of the mechanics of leverage, [12] The implant overdenture in rotational dislodgement would function as a class II lever. Assuming
the example of an implant-retained overdenture prosthesis that is intimately fitting the soft tissue support, the fulcrum is the anterior alveolar ridge (mid symphyseal region), the resistance is the attachment system, and the effort (E) is the posterior dislodging force lifting the denture base away from the ridge [13]

• In group F (seven implants group at molars, premolars, canines and mid symphyseal regions F1, A, B, C, D, E, F2 ) where the fulcrum axis was at the labial flange border seal in the mid symphyseal region as in the (Figure 16), the resistance (R) was between the fulcrum and the effort (E) {dislodging force (N)} so the overdenture function as class II lever. To achieve the equilibrium.

\[ \sum M_0 = 0 \]
\[ 2E*29.45 - 2R*29.45 - 2R*19.65 - 2R*13.34 - R*9.7 = 0 \]
\[ 58.9E = 58.9R + 39.3R + 26.68R + 9.7R \]
\[ 58.9E = 134.58R \]
\[ E = 2.28R \]

• In group A (four implants model at molars F1, F2 and premolars A, E position) here the position of fulcrum axis was similar to group F as in the (Figure 17)
\[ E = 1.66R \]

• In group B (four implant model at molars F1, F2 and canines B, D positions) as in (Figure 18) Although in group B we had the same number of implants as in group A but they vary in distribution, in group A implants were narrowly spaced and behave as single unit giving significantly higher dislodging force value so effort (E) {dislodging force (N)} value was less than group A, due to the resistance arm was longer in group A. Higher forces were required to dislodge the prosthesis when implants were positioned in molar and premolar region on the test model.
\[ E = 1.45 R \]

• in group C (three implants model at mid symphyseal C and molars F1, F2 positions) as in (Figure 19) As the number of implants decrease the effort (E) {dislodging force (N)} required to exact a similar dislodging force would be lesser, in comparison to group D higher forces were required to dislodge the prosthesis when implants were widely distributed on the test model By lengthening the resistance arm in this group
\[ E = 1.16 R \]

• in group D (three implants model at mid symphyseal C and canines B, D) as in (Figure 20) Less effort (E) {dislodging force (N)} due to less resistance, the same aforementioned explanation
\[ E = 0.61 R \]

• in group E (single implant model at mid symphyseal C position) as in (Figure 21) We have noticed that effort (E) {dislodging force (N)} value was the lesser among all because one implant was used in the mid symphyseal region which is closest to the fulcrum axis so resistance arm was the shortest in this group.
Figure 16: number and distribution of implants in group F

Figure 17: number and distribution of implants in group A

Figure 18: number and distribution of implants in group B

Figure 19: number and distribution of implants in group C
Also during the oblique dislodgement the results have been identified that as the number of implants increase the dislodgement force (N) would be higher. However, inconsistent results have been obtained among groups according to type of attachment used.

Results of this study in regards to implant distribution and number are in agreement with previous studies, Fatalla AA et al., (2012) they said that the four overdenture support designs with flexible acrylic attachments improved the retention force and reduced the fatigue retention than the three overdenture support designs. [14]

A study by (Scherer M.D et al., 2013) revealed that retention increases with increasing implant number and distribution. The vertical dislodging tests performed in this study simulate retentive force of a mandibular overdenture analog when pulling on three chains simultaneously. The greatest increase occurred when comparing single implants versus two; retention doubled for most systems. This increase in retention was statistically significant and could potentially be clinically significant as well. The lowest mean values were reported in the single implant groups and increased at the two- and three-implant groups this is On Consensus with the result of this study. [13]

In the three-implant-supported overdenture, the most anteriorly positioned implant may provide indirect retention for the denture by preventing the intrusion of the anterior portion of the denture towards the tissues. (Ben-Ur Z et al., 1996) so this

Figure 20: number and distribution of implants in group D

Figure 21: number and distribution of implants in group E
study supports the fact that increasing the number of implants is useful in clinical practice. [15]

In 2002, the McGill Consensus Statement on Overdentures asserted that mandibular two implant overdentures have been shown not only to be superior to conventional complete dentures, but also to improve the quality of life for these patients regardless of the attachment system used (bar, ball, magnet). [16]. However, in general, the use of mandibular overdentures supported by more than two implants does not lead to greater patient satisfaction in terms of denture and social function. Meijer et al. found no clear difference in either clinical or radiographic outcomes between two-implant-retained and four-implant-supported mandibular overdentures over a 10-year evaluation period. [17].

The use of more than 2 implants has been recommended to support a mandibular overdenture in clinical scenarios that will require increased retention such as high muscle attachments, prominent mylohyoid ridges, or extreme gaggers. [18]

Statistical results by Independent t-test indicated that the degree of retention and stability of implant supported overdenture was directly linked to the type of attachment system used and their number and distribution. Whereas the results were statistically higher with Ball attachment than the Locator attachment with the three directions of dislodgement test (vertical, rotational, oblique).

According to study of Meghea D.M et al., (2014) said that type of attachments affect the results whereas vertically applied force was higher with Ball attachment than the Locator attachment [19]. Alsabehaa et al. compared retention forces of six different attachments (four types of Ball attachment and two types of Locator attachment) in the lower arch. They indicated that Ball had more retention force and Locator attachments demonstrated less retention. These are in agreement with the results of this study. [20,21]. However, Krennmair G, et al., (2012) show that there were no differences between Ball or Locator attachment for any items of satisfaction evaluated and neither attachment had a significant patient preference. No differences for peri-implant parameters or for patient satisfaction were noted between the definitive attachments (Ball; Locator) after one year. Although the overall incidence rate of prosthodontic maintenance did not significantly differ between both retention modalities, the Locator attachment required more post insertion aftercare (activation of retention) than the Ball anchors [22].

But at the same time there were researchs found adverse results as Sadig W. A. (2009) evaluated the effect of connector type and implant number and location on the retention and stability of implant-supported overdentures by measuring retentive forces during vertical and 2 types of rotational dislodgment. He found that Locator connectors provide significantly higher retention and stability of implant-supported overdentures, followed by Ball
connectors and then magnets. The 2-implant design offers less retention and stability than the 4-implant model. [23]

The obvious limitation in this study is that the retentive force was evaluated only during simulated overdenture removal. Movement of overdentures in oral environment typically occurs in six directions: occlusal, gingival, mesial, distal, facial, and lingual. While true unidirectional dislodging forces rarely occur in clinical scenarios. These multidirectional movements are difficult to simulate in vitro.

Conclusion

1. Retention and stability of implant supported overdenture is significantly affected by implant number and distribution as the number of implant increase retention and stability of implant supported overdenture have increased.
2. Attachment type affects retention and stability differently by number and location. Ball attachments reported the highest levels of retention and stability with three directions of dislodging tests.

Reference


