Short Communication

The Effect of Location and Number of Endosseous Implants on Retention and Stability of Magnetically Retained Mandibular Overdentures: An In Vitro Study

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The aim of this study was to compare the effect of location and number of implants on the retention and stability of magnetically retained mandibular overdentures. Four groups of such prostheses were classified according to number and position of the implants in the canine, premolar, or molar regions. Significant differences in retention were observed when 6 magnets were used (4.66 ± 0.45 N), whereas the lowest retention was obtained with 2 magnets (2.1 ± 0.43 N). Only oblique stability was improved significantly when the number of implants was increased. *Int J Prosthodont 2008;21:511–513.*

An overview of reported clinical trials suggests superior functional performance and patient satisfaction with implant-retained mandibular complete overdentures when compared to conventional ones.[1] The use of a wide variety of attachment mechanisms, including bars, studs, and magnets, has proven to be clinically predictable and effective, but most studies have compared the use of 2 magnets with other retention systems.[2] The advantages of magnetic attachment include ease of use, especially where space is limited, as well as a self-seating property. The number of implants required to provide an adequate mandibular implant overdenture treatment outcome remains an area worthy of further investigation.[3]

The aim of this study was to evaluate and compare the effect of location and number of endosseous implants on the retention and stability of magnetically retained mandibular implant overdentures.

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Materials and Methods

Sixteen implants (ITI, Straumann) were placed in 4 acrylic resin simulation models to obtain 4 groups (Fig 1). Ten acrylic resin denture bases were fabricated on a duplicated die stone model using light-curing material (Individo Light Box, Voco). Vents were made in the denture base on top of the implant locations to house the magnetic attachments. Three screw-eye metal hooks were fixed to the acrylic base in a tripodal arrangement to facilitate engaging the specimen with chains during testing. A rigid, flat magnetic keeper unit was secured to the implants (Magfit IP IFN 14, Aichi Steel Co), whereas the magnetic disk (Magfit DX 800, Aichi Steel Co), with 4.90 N retentive force, 1.3 mm height and 4.0 mm diameter, was incorporated into the base of the overdenture according to the manufacturer's instructions using self-curing acrylic resin (Unifast Trad, GC Corp).

Retention of the dentures was assessed by pulling 3 anchored chains attached to a universal testing machine (Fig 2). Stability was measured by the required force necessary to laterally dislodge the dentures using 2 laterally attached chains (Fig 3). Additionally, the posterior stability of the dentures was assessed using posteriorly attached chains (Fig 4) for testing posterior (paraxial) rotational dislodging forces. The specimens were placed in tensile loading at a crosshead speed of 50 mm/min using a universal testing machine (Instron 8500, Instron Corp).

Data were analyzed using 1-way analysis of variance and Scheffe tests ($\alpha = .05$).

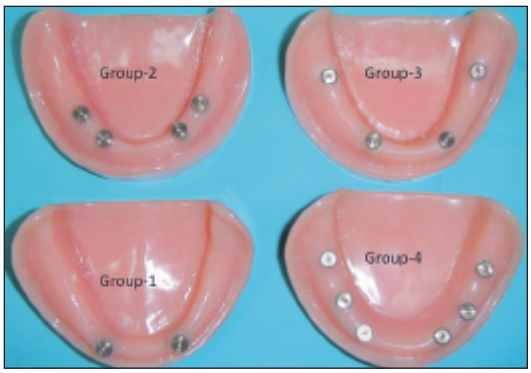

Fig 1 All 4 groups received 2 canine implants 22 mm apart (group 1); group 2 received an additional 2 implants placed in the premolar region (interimplant distance 12 mm); group 3 received 2 additional molar implants (interimplant distance 15 mm), and group 4 received 2 premolar and 2 molar implants.

Fig 2 Retention test: position of the chains for 3-point vertical pullout.

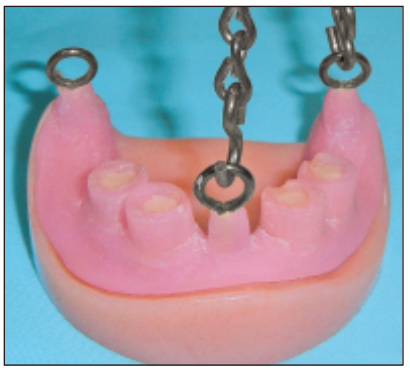

Fig 3 Two chains attached diagonally for testing oblique dislodging forces.

Fig 4 Two chains attached distal to the molar region for testing posterior rotational dislodging forces.

Table 1 Mean (SDs) Vertical and Rotational Dislodging Forces Seen in the Test Groups

Group	Vertical dislodging force (N)	Oblique rotational dislodging force (N)	Posterior rotational dislodging force (N)
Group 1	2.10 ± 0.43	1.93 ± 0.25	2.76 ± 2.08
Group 2	2.38 ± 0.35	3.07 ± 1.02	2.61 ± 1.15
Group 3	2.57 ± 0.39	2.85 ± 0.52	2.60 ± 0.32
Group 4	4.66 ± 0.45	4.76 ± 0.53	4.24 ± 0.67

Results

Significant differences were observed with vertical dislodging forces in the retention test and with posterior rotational dislodging forces in the stability test between group 4, which showed the highest values (4.66 N and 4.24 N, respectively) and groups 1, 2, and 3 (2.10 N, 2.38 N, and 2.57 N, respectively, for retention and 2.76 N, 2.61 N, and 2.60 N, respectively, for posterior stability). Oblique rotational dislodging forces were significantly different between group 1 (1.93 N) and groups 2 and 3 (3.07 N and 2.85 N, respectively) and group 4, which showed the highest value (4.76 N). These data are summarized in Table 1.

Discussion

This in vitro study was performed in an isolated, dry environment, which permitted the evaluation of the magnetic attachment's efficacy, irrespective of other retentive determinants. The recorded observations cannot be automatically extrapolated to the clinical situation; however, it can be deduced that the number and location of implants have an effect on the stability and retention of magnetically retained overdentures. The lowest resistance to oblique dislodging forces and the lowest retentive force were recorded in samples retained with 2 magnets in the region of the canines; this will affect patient satisfaction, as reported in a previous study.[2] The results suggest that there was no significant difference in retention and posterior stability between 2 and 4 magnets, which is in agreement with the findings of Visser et al.[4] The latter concluded that no differences were observed in clinical, radiographic, and patient satisfaction in subjects treated with an overdenture supported by 2 or 4 implants during a 5-year evaluation period. Only oblique rotational forces in stability testing showed a significant difference between 2 and 4 magnets, with the highest value obtained with implants placed in the canine and second premolar regions. This is probably a result of the distribution of magnets over a wide, square area involving more planes that will resist oblique dislodgement. The use of 6 magnets (group 4) significantly increased retention and stability versus the other groups, which is in accordance with the results obtained by Sogo et al.[5]

It must be emphasized that the debate on the merits of using magnets in the head and neck region continues. Long-term clinical studies to assess the performance of these magnets and their vulnerability to corrosion are lacking, a fact that emphasizes even further the obvious restrictions of in vitro studies.

Conclusions

Within the limitations of the present study, the retention and stability of complete overdentures could be improved by paying attention to the location and distribution of the inserted implants.

References

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Literature Abstract

Three-Year clinical performance of cast gold vs ceramic partial crowns

The purpose of this prospective study was to evaluate the clinical performance and longevity of cast gold (CGPC) and ceramic (PCC) partial crowns using a split mouth design. A pool of 29 patients were enrolled and selected based ongood oral hygiene. Teeth were selected for placement of the restorations based upon the need for cuspal coverage, minimal mobility, and the ability to place a rubber dam. Preparations were done by final-year clinical students under supervision. For the CGPC, standard preparations were made with functional cusps removed and replaced along with a butt joint and the non-functional cusps beveled. The final restoration was cast in Degulor-C alloy and luted with zinc phosphate cement. For the PCC, similar preparation methods were employed with the non-functional cusp left uncovered, if possible. The final restoration was milled using CEREC III and cemented with variolink resin cement. Analysis of the restorations was done by a single dentist not involved in the placement of the restorations at baseline, 1, 2, and 3 years. The restorations were evaluated based on hypersensitivity, anatomic form, marginal adaptation, marginal discoloration, and surface texture. The results showed that at 3 years, failure of CGPC was 0% and PCC was 6.9%. Post operative sensitivity also declined for both CGPC and PCC. The anatomic form of the CGPC was rated highly after 3 years, while the PCC demonstrated a decline in ratings over the 3 year observation period, although none of the aforementioned results were statistically significant. The CGPC group also showed good marginal adaptation after 3 years in contrast to the PCC group ,which showed a decrease in the marginal adaptation and an increase in discoloration at the margins, which could be due to an increase in luting space, marginal excess, and wear of composite. The conclusion was that the PCC had met ADA guidelines and PCC can be recommended for clinical use with the luting material being the apparent major area for improvement.

Federlin M, Wagner J, Männer T, Hiller KA, Schmalz G. *Clin Oral Investig* 2007;11:345-352. **References:**35 **Reprints:** M. Federlin , Department of Operative Dentistry and Periodontology, Dental School , Universoty of Regensburg, Franz Josef strauss Allee 11, 93042 Regensburg, Germany—*Seetoh YL, Singapore*