

Assessment of Efficacy of Immediate Complete Denture, Tooth and Implant Supported Overdenture on the Maintenance of Vertical Dimension: A Comparative Study

T Shankar^{1*} Sidhant Sudan² Rahul Puri Goswami³ Roshani M Chawla⁴ NP Swathi⁵ Vishal Singh⁶

¹Professor and Head, Department of Prosthodontics, Kalinga Institute of Dental Sciences, Bhubaneswar, Odisha, India.

²Private Consultant, Sudan Dental Clinic, Udampur, India.

³Senior Resident, Department of Dentistry, J.L.N. Medical College, Ajmer, Rajasthan, India.

⁴Senior Lecturer, Department of Public Health Dentistry, Vidarbha Youth Welfare Society's Dental College & Hospital, Amravati, India.

⁵PG Student, Department of Prosthodontics, CKS Dental College, Tirupathi, India.

⁶Reader, Department of Prosthodontics, Vananchal Dental College & Hospital, Ranchi, Jharkhand, India.

ABSTRACT

Background: Edentulous patients suffer from a variety of problems with their dentures, especially with regard to the lower denture, such as insufficient stability, retention and pain during mastication. For many years, traditional complete denture designs have been modified to gain additional support and stability from a few retained and suitably prepared natural teeth. Hence; the present study was planned to evaluate the extent to which immediate tooth and implant-supported overdentures would aid beneficially to preserve occlusal vertical dimension.

Materials & methods: For the study, 9 patients were selected having age range of 44-67 years, with mean age of 56 years. The selected patients were randomly grouped into three groups with 3 patients in each group. Group 1: three patients receiving conventional acrylic immediate complete mandibular denture (mucosal-supported); Group 2: three patients who will be receiving acrylic immediate complete mandibular denture supported by reduced root canal treated canines (tooth-supported). Group 3: three patients who will be receiving acrylic immediate complete mandibular denture supported by osseo-integrated fixtures in the canines region (implant-supported). For determination of changes in occlusal vertical dimension for patients in all groups; lateral cephalometric radiographs were taken to detect occlusal vertical dimensional changes. The data collected from different groups was analysed using SPSS software for windows.

Results: The analysis of the mean differences in occlusal vertical dimension for all groups, i.e., Group 1, Group 2, and Group 3 was done at Time 1, Time 2 and Time 3 with the help of lateral cephalometric radiographs taken at different intervals. The mean occlusal vertical dimension changes in Group 1 were -0.43 ± 0.076 in time 1, -0.84 ± 0.217 in time 2, and -3.02 ± 0.521 in time 3; in Group 2 were -0.39 ± 0.079 in time 1, -0.80 ± 0.221 in time 2, -1.43 ± 0.193 in time 3; in Group 3 were -0.41 ± 0.154 in time 1, -0.82 ± 0.216 in time 2, -2.23 ± 0.324 in time 3.

Conclusion: The biting force of masticatory muscle is functionally dependent on maintenance of muscle health and occlusal vertical dimension.

Keywords: Immediate, Implant, Over-Denture.

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*Correspondence Dr. T Shankar.

Department of Prosthodontics, Kalinga Institute of Dental Sciences, Bhubaneswar, Odisha, India.

Email: shankart@gmail.com

INTRODUCTION

Edentulous patients with complete dentures are generally satisfied but up to 30% of the patients have complaints.¹ They suffer from a variety of problems with their dentures, especially with regard to the lower denture, such as insufficient stability, retention and pain during mastication. The immediate denture is a dental prosthesis constructed to replace the lost dentition, associated structures of the maxillae and mandible and inserted immediately following removal of the remaining teeth. It was reported that the interim immediate denture show numerous advantages as preservation of facial appearance and height, muscular tone, phonetic and reduction of post-extraction pain.²

The classical treatment plan for the edentulous patient is the complete removable maxillary and mandibular denture. This treatment is relatively inexpensive in comparison with fixed implant-supported prostheses, but it has several drawbacks. Like all dental restorative procedures, a complete removable denture requires extensive attention to detail if an excellent clinical result is to be achieved. Depending on the shape of the regional ridge, the denture may be unstable or inadequately retained, leaving the patient dissatisfied with the functional result. The rate of residual ridge resorption in edentulous patients who do not have tooth replacements is highly variable and may be as much as several millimeters per year. This resorption can render the current prosthesis inadequate in terms of both function and esthetics and can lead to the necessity of fabricating a new denture.

For many years, traditional complete denture designs have been modified to gain additional support and stability from a few retained and suitably prepared natural teeth. Mericske-Stern et al. attested to the effectiveness of such tooth-supported complete dentures or overdentures as alternative to complete dentures.³ Roots maintained under the denture base preserves the alveolar ridge, provide sensory feedback and improve the stability of the dentures.

The implant-supported overdenture has many advantages. Although as few as two to four implants may be used for support, it is beneficial to

use more than two implants in the unlikely event that one of the implants fails to function during the patient's life span. Many options are available for retention of the prosthesis, including magnets, clips, bars and balls. The resultant implant-supported denture has good stability and retention, and patients who have received them have reported improved function and satisfaction.⁴ Another benefit of implant supported prostheses is suggested by preliminary data indicating that after receiving implants, patients may eat a diet with more fiber. If this is proven, the implant-supported denture would make an important contribution to general health and well-being.⁵ Other studies have measured the rate of residual ridge resorption in the five years after implant placement. The rate of resorption is decreased significantly from the rates seen with conventional dentures, and recent research has shown that the height of the posterior ridge increases with continued use of implant-supported prostheses.⁶ So, the present study was planned to evaluate the extent to which immediate tooth and implant-supported overdentures would aid beneficially to preserve occlusal vertical dimension.

MATERIALS AND METHOD

The study was conducted in the Department of Prosthodontics in the institution. For the study, 9 patients were selected having age range of 44-67 years, with mean age of 56 years. Inclusion criteria for the selection of patients was as follows:

1. No signs and symptoms of TMJ dysfunction;
2. No history of systemic diseases;
3. No previous history of prosthesis wearing;
4. Angle's class I maxillo-mandibular relation.

An informed written consent was obtained from each patient after informing them about the procedure and aim of the study. The selected patients were randomly grouped into three groups with 3 patients in each group.

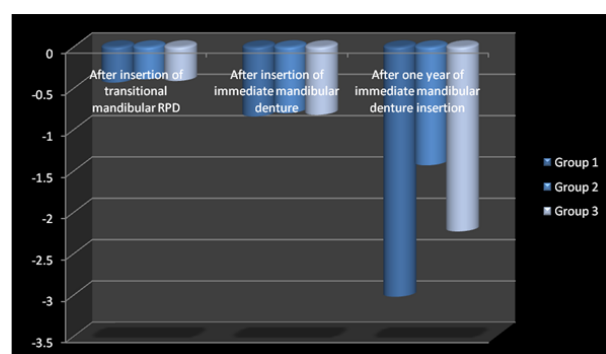
- Group 1: three patients receiving conventional acrylic immediate complete mandibular denture (mucosal-supported);
- Group 2: three patients who will be receiving acrylic immediate complete mandibular denture supported by reduced

root canal treated canines (tooth-supported).

- Group 3: three patients who will be receiving acrylic immediate complete

Table 1: Comparison between the mean differences in occlusal vertical dimension changes measured in millimeter for patients with immediate mandibular complete dentures, mucosal (Group 1), tooth (Group 2) and implant (Group 3) supported overdentures.

Groups	After insertion of transitional mandibular RPD (TIME 1)	After insertion of immediate mandibular denture (TIME 2)	After one year of immediate mandibular denture insertion (TIME 3)
Group 1	-0.43 ± 0.076	-0.84 ± 0.217	-3.02 ± 0.521
Group 2	-0.39 ± 0.079	-0.80 ± 0.221	-1.43 ± 0.193
Group 3	-0.41 ± 0.154	-0.82 ± 0.216	-2.23 ± 0.324



Graph 1: Comparison between the mean differences in occlusal vertical dimension changes measured in millimeter for patients with immediate mandibular complete dentures, mucosal (Group 1), tooth (Group 2) and implant (Group 3) supported overdentures.

For determination of changes in occlusal vertical dimension for patients in all groups; lateral cephalometric radiographs were taken to detect occlusal vertical dimensional changes. Radiographic exposures were made at four occasions:

1. Before dental extraction with only bilateral upper and lower second premolars maintaining centric occlusion, vertical and horizontal relation.
2. Two weeks after transitional removable partial denture insertion (Time 1).
3. Two weeks after complete immediate mandibular denture insertion (Time 2).
4. One year after immediate denture insertion (Time 3).

mandibular denture supported by osseointegrated fixtures in the canines region (implant-supported).

The data collected from different groups was analysed using SPSS software for windows. The statistical significance was pre-determined to be $P < 0.05$.

RESULTS

The analysis of the mean differences in occlusal vertical dimension for all groups, i.e., Group 1, Group 2, and Group 3 was done at Time 1, Time 2 and Time 3 with the help of lateral cephalometric radiographs taken at different intervals. The comparison of mean differences in occlusal vertical dimension was done. It was observed that there is non-statistically significant difference between the mean difference occlusal vertical dimension for the tested groups at Time 1 and Time 2 ($p > 0.05$) whereas at Time 3, it was statistically significant with $p < 0.05$ [table 1, figure 1].

The mean occlusal vertical dimension changes in Group 1 were -0.43 ± 0.076 in time 1, -0.84 ± 0.217 in time 2, and -3.02 ± 0.521 in time 3; in Group 2 were -0.39 ± 0.079 in time 1, -0.80 ± 0.221 in time 2, -1.43 ± 0.193 in time 3; in Group 3 were -0.41 ± 0.154 in time 1, -0.82 ± 0.216 in time 2, -2.23 ± 0.324 in time 3. Comparison between mean differences in occlusal vertical dimension for tested times were statistically significant at $p < 0.05$ [table 1, figure 1].

DISCUSSION

For this study, twelve patients were selected and the patients were borderline cases for whom a particular form of treatment with immediate overdentures or immediate complete dentures was not clearly indicated. Mandibular canines were retained in tooth-supported overdenture group and used as overdenture abutments, because the mandibular canines are usually amenable to endodontic treatment, have strong roots and are strategically located at the corner of the arch.

The results of this study demonstrated that there was significant decrease of the occlusal vertical dimension in the complete denture group, compared with the overdenture groups (tooth and implant-supported), in the first year after extraction of the last remaining teeth and after insertion of the dentures. A greater decrease of occlusal vertical dimension for Group 3 than that for Group 2 can be because of the sensory feedback input of tooth which preserves alveolar bone, while the absence of such tooth sensory feedback in implant-supported overdenture group may contribute to more alveolar bone resorption.

Van Waas MA et al. in a randomized controlled clinical trial, studied 74 patients who required immediate dentures, randomly treated with immediate overdentures on two lower canines or with immediate complete dentures. Mandibular bone reduction was measured by use of oblique lateral cephalometric radiographs made at baseline and the results compared with those of one year and two years after denture treatment. Analysis of the data showed that the average bone reduction in the lower canine regions in the first year was 0.9 mm in the immediate-overdenture group and 1.8 mm in the immediate complete-denture group. In the posterior parts of the mandible, the bone reductions were, respectively, 0.7 mm and 1.9 mm. The differences were statistically significant in all measured regions. During the second year, no significant differences in bone reduction were found. The sums of differences in the first two years were significant in all regions except the molar region, preserving the initial difference. Retention of roots of canines beneath a mandibular denture in immediate denture patients, even when they were in poor condition, reduced the collapse of the alveolar processes in all regions of the mandible.⁷

Garrett NR et al. conducted a randomized clinical trial to compare masticatory functional effectiveness of mandibular implant-supported overdentures and conventional dentures in diabetic denture wearers with clinically acceptable metabolic control. A total of 102 edentulous diabetic patients, treated with or without insulin, were randomized to receive a new maxillary and either a mandibular conventional denture or an implant-supported overdenture. Treatment was completed in 89 patients, 37 with conventional dentures and 52 with Hader bar-clip attachment overdentures supported by two IMZ implants. Besides data from medical and dental histories, oromaxillofacial examinations, and questionnaires, masticatory tests were performed by patients before and at 6 and 24 months after treatment completion. Although 78 patients (28 in the conventional, 50 in the overdenture group) performed tests at 6 months after treatment, 68 (25 in the conventional, 43 in the overdenture) had performance data for both entry and 6-month posttreatment intervals. The two treatment groups were highly comparable in terms of general characteristics, quality of original dentures, tissue support, and past denture experience. No significant differences were found. It was concluded by the authors that the implant-supported overdenture showed no significant advantage over the conventional denture for improving the ability to comminute food in this group of diabetic patients with higher than average initial functional levels observed for other groups of denture wearers in previous studies.⁸

Payne AG performed a study on mandibular implant-supported overdentures using more than 2 Brånemark implants splinted with multiple round bars evaluated a hypothesis that unnecessary prosthodontic maintenance would result from the contravention of accepted biomechanical principles. A randomized prospective trial on 59 edentulous patients details prosthodontic maintenance and complications of 52 mandibular overdentures (11 unsplinted, 41 splinted) over a 3-year period. Prosthodontic maintenance was greater in the first year than in subsequent years, regardless of design. Comparison between the splinted designs with round bars revealed no statistically significant difference with either retentive clip activation or fractures. More than 70% of the retention clips in the 2-implant (single round bar) design needed

activation, as compared to 44% of those with the 3-implant (double round bar) or 4-implant (triple round bar) design. Retention clip fracture occurred in 30% of patients with 3 or 4 implants and 16% of those with 2 implants. Relining the overdentures, regardless of design, revealed an excessive maintenance burden in 40% of overdentures. Remaking of overdentures was necessary in 21% of patients. Multiple round bars splinting 3 or 4 implants can still be a treatment concept in mandibular overdenture treatment. Results from prospective evaluation of this design indicate less prosthodontic maintenance of clip activation but more clip fractures than with 2 implants splinted with single round bars, although not at statistically significant levels.⁹

CONCLUSION

Immediate fabrication of implant overdenture prosthesis can be successful with increased clinical efficiency under specific clinical situations. The biting force of masticatory muscle is functionally dependent on maintenance of muscle health and occlusal vertical dimension.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. van Waas MA. The influence of psychologic factors on patient satisfaction with complete dentures. *J Prosthet Dent*. 1990;63:545-548.
2. Seals RR, Kuebker WA, Stewart KI. Immediate complete dentures. *Dent Clin North Am*. 1996;40:151-167.
3. Mericske-Stern R, Steinlin Schaffner T, Marti P, Geering AH. Peri-implant mucosal aspects of ITI implants supporting overdentures. A five-year longitudinal study. *Clin Oral Implants Res*. 1994;5:9-18.
4. Awad MA, Lund JP, Dufresne E, Feine JS. Comparing the efficacy of mandibular implant-retained overdentures and conventional dentures among middle-aged edentulous patients: satisfaction and functional assessment. *Int J Prosth* 2003;16:117-22.
5. Reddy MS, Geurs NC, Wang IC, et al. Mandibular growth following implant restoration: does Wolff's law apply to residual ridge resorption? *Int J Periodontics Restorative Dent* 2002;22(4):315-21.
6. Jeffcoat MK, McGlumphy EA, Reddy MS, Geurs NC, Proskin HM. A comparison of hydroxyapatite (HA)-coated threaded, HA-coated cylindric, and titanium threaded endosseous dental implants. *Int J Oral Maxillfac Implants* 2003;18:406-10.
7. Van Waas MA, Jonkman RE, Kalk W, Van't Hof MA, Plooi J, Van Os JH. Differences two years after tooth extraction in mandibular bone reduction in patients treated with immediate overdentures or with immediate complete dentures. *J Dent Res*. 1993;72:1001-1004.
8. Garrett NR, Kapur KK, Hamada MO, Roumanas ED, Freymiller E, Han T, Diener RM, Levin S, Chen T. A randomized clinical trial comparing the efficacy of mandibular implant-supported overdentures and conventional dentures in diabetic patients. Part II. Comparisons of masticatory performance. *J Prosthet Dent*. 1998 Jun;79(6):632-40.
9. Payne AG, Solomons YF. Mandibular implant-supported overdentures: a prospective evaluation of the burden of prosthodontic maintenance with 3 different attachment systems. *Int J Prosthodont*. 2000 May-Jun;13(3):246-53.