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Original Article

Clinical evaluation of overdenture retention using indigenous dental implants

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ABSTRACT

Background: The continuous resorption of the alveolar ridge after extraction of all the teeth can eventually result in a jaw anatomy which offers inadequate support for the dentures. This resorption can render the prosthesis inadequate in terms of both function and esthetics.

Methods: A study was conducted where 50 edentulous, denture-wearing patients, of either sex, were given mandibular implant overdentures, using their existing denture. The implants used were one piece implants with an integrated ball and socket joint for retention. A healing time of 3–4 months was given before loading.

Results: Implant failure was seen in 11 cases during the healing phase. A success rate of 78% was seen in this study during an observation period of 6 months. This success rate is significantly low as compared to global records where a success rate of 87–98% is documented. The patients were asked to grade the overdenture as poor, satisfactory, good and excellent in categories of masticatory efficiency, speech and overall comfort. 71.79% patients rated the overall comfort as excellent and the same percentage of patients rated the speech as good.

Conclusion: Implant retained overdentures help in improving the masticatory efficiency, speech and overall comfort of the patient as compared to conventional dentures.

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Introduction

The continuous resorption of the alveolar ridge after extraction of all the teeth can eventually result in a jaw anatomy which offers inadequate support for the dentures. Specially when the mandibular alveolar ridge has become severely reduced.

The rate of residual ridge resorption in edentulous patients 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. Over a period of time, occlusion, esthetics and function may be compromised. Patients often complain about instability, pain and inability to chew hard food.

To improve denture retention and stability, preprosthetic surgical techniques such as ridge augmentation, vestibuloplasty and lowering of the floor of the mouth were used earlier with varying rates of success. Currently osseointegrated implants seem to have become a more reliable form of treatment for these patients.

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A high rate of success has been documented in long-term studies for the osseointegrated implants supporting fixed prostheses in edentulous jaws. Little attention, however, is paid to implant retained overdentures. Short-term results as well as results of 5-year-longitudinal studies seem to be comparable to those of implant supporting fixed prostheses.

Today's patients have high expectations for oral health. Providing a traditional denture that eventually becomes an ill-fitting prosthesis does not help meet these expectations. The implant-supported denture is one solution to these problems.

Materials and methods

A total of 50 complete edentulous cases were selected for placement of dental implants for overdenture retention. The cases selected were old denture wearers who had compromised lower denture retention (Fig. 1). The criteria of compromised lower denture retention were purely subjective. The selected patients were of varied age and either sex. Cause of loss of teeth was not documented by the patients, but a history taking suggested that it was mainly because of poor periodontal health. A standard education program was conducted for making the patients aware of the treatment procedure, advantages, risk factors, limitations and post-operative/post-insertion care. Once the patients were motivated toward the treatment only then they were selected for treatment and a consent form was filled up to obtain their willingness.

The pre-op preparation of the patient included, an OPG, routine urine examination and blood examination to check, Hb%, TLC, DLC, bleeding time, clotting time and sugar levels. Patients with uncontrolled diabetes were not selected for the procedure.

The indigenous implants were of commercially pure titanium, screw type, cylindrical, ball and socket, single piece implants. A standard protocol was followed to place 2 implants in the lower canine region, one on either side of the midline (Fig. 2). A standard physiodispensor was used with torque of 25 N and speed of 1300 rpm.

Fig. 1 – The edentulous mandibular arch.

Fig. 2 – Ball and socket implants placed in the mandible.

The procedure followed was as follows. The existing lower denture was used as a template for implant placement (Fig. 3). The implant site was identified on the OPG as well as intra-orally. A radiographic grid 1:1.25 was used for selection of size of the implant. An opening was drilled in the lower denture coinciding with the implant site. 2–4 ml of 2% lignocaine was injected to attain local anesthesia at the implant site. A bleeder point was marked on the mucosa at the implant site through the opening in the lower denture. A tissue punch was used to neatly incise the mucosa. This was followed by a 2 mm round bur to mark the bone and make a divot so that the pilot drill could be correctly placed. Care was taken with the pilot drill to proceed in the predetermined direction and depth. A depth gauge was used to arrive at the predetermined depth. The diameter of the implant site was gradually increased with implant drills to arrive at the final diameter, coinciding with the chosen implant as per the manufacturer's instructions. Care was taken to drill intermittently, at slow speed so that heat production was reduced at the implant site. Once the implant site was ready, the implant was removed from the presterilized packing and inserted. The second implant was also placed in a similar manner. An immediate intraoral peri-apical radiograph was taken to check the length and direction

Fig. 3 – Relief provided in the existing denture.

of the implants. The lower denture was placed intraorally to check any interference with the abutment portion of the implant. Adjustments were made accordingly.

The patient was instructed to discontinue wearing the lower denture for a week, and follow standard oral hygiene measures. The patient was recalled after a week for follow up and the lower denture was placed. Further relief for the abutment head was provided in the denture if required. The opening in the lower denture was closed from the finished surface and not from the fitting surface. The patient was allowed to use the lower denture.

The patient was recalled every 2 weeks for the first month and every month for the next 2 months. A healing period of 3 months was allowed for osseointegration. On completion of 3 months an intraoral periapical radiograph was taken to check both the implants for osseointegration, by ruling out any fibro-osseous integration. The implants were checked manually for any mobility. Percussion on the implant was done to hear for a sharp sound. In case of doubt, the patient was recalled after 4 weeks. A combination of radiograph, percussion and manual mobility check was done for determining osseointegration. On ascertaining osseointegration the patient was taken up for loading the implants.

The socket portion of the abutment assembly was fixed on the ball of the abutment (Fig. 4). The lower denture was filled with self-curing acrylic resin, restricted to the relief area on the fitting surface. The lower denture was then positioned on the basal seat over the implants and maintained in this position for 5 min. During this time the acrylic resin was supposed to be acrylised. The lower denture was now carefully removed. The socket assembly was seen to be picked-up by the denture (Fig. 5). Excess resin was removed and the denture was finished (Fig. 6). The patient was trained to insert and remove the denture, and get used to the snap fit sound on complete seating of the denture on the basal seat (Fig. 7).

Results

27 male and 23 female patients were selected for implant retained mandibular overdenture, making the total to 50

Fig. 4 – Socket portion inserted on the ball before self-cure pick-up.

Fig. 5 – Socket portion picked-up by the lower denture.

edentulous patients. The existing dentures were 03 months–18 months old. The male patients were between the age group of 56–76 (Table 1) and female patients were in the age group of 55–79 (Table 2). In 07 male patients, implants failed at various stages during healing phase where as 04 failures were seen in female patients. Out of the 07 failed cases of male patients, 04 were smokers and even after motivation could not give up smoking. It was noted that in all the failed cases, both the implants failed during the healing phase, because of peri-implantitis. These patients continued with their conventional dentures. The peri-implant status of the remaining patients was good. Since the patients were already motivated toward maintenance of oral hygiene, there seemed no significant difference between oral hygiene of patients whose implants failed.

A total of 39 patients were provided with overdentures. During the follow-up period these patients were asked to grade the overdenture as poor, satisfactory, good and excellent separately in the categories of masticatory efficiency, speech and overall comfort (Table 3). None of the patients graded the treatment as poor. Majority of the patients graded the treatment as good and excellent.

Fig. 6 – Lower denture seated on the implants.

Fig. 7 – The upper and lower dentures in situ.

Discussion

Approximately one-third of patients older than 65 years of age are fully edentulous, requiring replacement of missing teeth. While the conventional denture may meet the needs of many patients, others require more retention, stability, function and esthetics, especially for the mandibular dentures. The implant-supported prosthesis is a better alternative to the conventional complete denture.

The implant-supported overdenture has many advantages. Although as few as 2–4 implants may be used for support, it is beneficial to use more than 2 implants in the unlikely event that one of the implants fails during the patient's life span.

Meijer et al¹ conducted a finite element analysis of 2 versus 4 implants placed in the interforaminal region of the mandible. In neither of the models was a reduction of the principle stresses clearly demonstrated if the load was uniformly distributed. Furthermore, in a prospective 12-month study, Batenburg et al² evaluated 60 mandibular overdenture patients divided into 2 groups. One group treated with 2 implants and the other with 4 implants. They found no significant differences in the peri-implant health. These studies were consistent with Mericske-Stern's³ retrospective work on 67 patients divided into 3 groups, 29 with 2 implants connected with a bar, 27 with 2 solitary ball anchors, and 11 with 3 or 4 implants splinted with a bar. She concluded that retention, stability, and occlusal equilibration of the dentures improved only slightly with an increasing number of implants.

Implant placement surgery is relatively simple to perform and, in experienced hands, may take less than an hour. 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.

A number of authors^{4–7} have hypothesized that it is appropriate to use 2 implants with an interconnector parallel

Table 1 – Details of male patients.

S. No	Age	Diameter/length of both implants	Healing time	Result	Masticatory efficiency	Speech	Overall comfort
1	57	3.8/10	3 months	Failure	NA	NA	NA
2	56	3.8/10	3 months	Successful	Good	Good	Good
3	67	3.8/12	3 months	Successful	Excellent	Excellent	Excellent
4	70	3.8/10	4 months	Successful	Good	Good	Excellent
5	59	4.2/10	3 months	Successful	Good	Good	Good
6	65	3.8/12	3 months	Successful	Good	Satisfactory	Good
7	64	3.8/10	3 months	Failure	NA	NA	NA
8	71	3.8/10	4 months	Successful	Good	Good	Good
9	67	4.2/12	4 months	Successful	Satisfactory	Good	Good
10	65	3.8/12	3 months	Successful	Good	Good	Excellent
11	59	3.8/12	3 months	Successful	Excellent	Excellent	Excellent
12	67	3.8/12	3 months	Successful	Satisfactory	Good	Good
13	76	3.8/12	4 months	Failure	NA	NA	NA
14	68	4.2/12	3 months	Successful	Good	Good	Excellent
15	69	3.8/10	4 months	Successful	Good	Good	Excellent
16	65	3.8/12	3 months	Successful	Excellent	Excellent	Excellent
17	66	3.8/12	3 months	Failure	NA	NA	NA
18	78	3.8/12	4 months	Successful	Excellent	Good	Excellent
19	67	3.8/10	3 months	Successful	Good	Good	Excellent
20	56	4.0/12	3 months	Failure	NA	NA	NA
21	60	3.8/12	3 months	Successful	Good	Excellent	Excellent
22	79	4.2/10	4 months	Failure	NA	NA	NA
23	61	4.2/10	3 months	Successful	Good	Good	Excellent
24	71	3.8/10	4 months	Successful	Excellent	Excellent	Excellent
25	64	4.2/10	3 months	Successful	Good	Good	Excellent
26	61	3.8/10	3 months	Successful	Good	Good	Excellent
27	65	4.2/10	3 months	Failure	NA	NA	NA

Table 2 – Details of female patients.

S. No	Age	Diameter/length of both implants	Healing time	Remarks	Masticatory efficiency	Speech	Overall comfort
1	67	3.8/10	4 months	Successful	Good	Good	Good
2	61	4.2/12	3 months	Successful	Good	Good	Good
3	57	3.8/12	3 months	Successful	Excellent	Good	Excellent
4	60	3.8/10	3 months	Successful	Good	Good	Excellent
5	59	4.2/10	3 months	Successful	Satisfactory	Good	Good
6	66	3.8/12	3 months	Successful	Good	Good	Excellent
7	65	3.8/10	3 months	Successful	Excellent	Good	Excellent
8	61	3.8/10	4 months	Failure	NA	NA	NA
9	67	3.8/10	4 months	Failure	NA	NA	NA
10	65	3.8/12	3 months	Successful	Good	Good	Excellent
11	55	4.2/12	3 months	Successful	Excellent	Good	Excellent
12	67	3.8/12	4 months	Successful	Satisfactory	Good	Good
13	76	3.8/12	4 months	Successful	Good	Excellent	Good
14	68	4.2/12	3 months	Successful	Good	Good	Excellent
15	59	3.8/10	3 months	Successful	Good	Good	Excellent
16	65	4.2/12	3 months	Successful	Good	Excellent	Excellent
17	66	3.8/12	3 months	Failure	NA	NA	NA
18	61	3.8/12	3 months	Successful	Excellent	Good	Excellent
19	67	3.8/10	3 months	Successful	Good	Good	Excellent
20	66	4.0/12	3 months	Successful	Satisfactory	Satisfactory	Good
21	70	3.8/12	3 months	Successful	Excellent	Excellent	Excellent
22	79	4.2/10	4 months	Successful	Excellent	Excellent	Excellent
23	61	3.8/10	3 months	Failure	NA	NA	NA

to the hinge axis and a resilient overdenture on an ovoid or round bar. Their aim was to enhance free rotation during dorsal loading with twist-free load transmission to the implants. However, a review of mandibular overdenture treatment concepts proposes that these concepts were based on empirical data, and the use of a rigid versus moveable retention mechanism remains controversial.^{8,9}

It has been seen that solitary ball attachments are less costly, less technique sensitive¹⁰ and easier to clean¹¹ than bars. Moreover, the potential for mucosal hyperplasia reportedly is more easily reduced with solitary ball attachments.¹² Bars, however, have been shown to be more retentive.¹³

No surgical procedure, including the placement of implants, is without risk. The risks associated with implant placement include post-operative bleeding, numbness, infection and lack of osseointegration. The risks can be minimized with proper training and experience. Case selection is the key to success with implant procedures, as with all dental procedures.

Other risk factors also may affect the outcome of the implant-supported prosthesis. Smoking is a risk factor for long-term implant success. Patients, who smoke, are more

likely to experience infection and/or progressive alveolar bone loss, which ultimately may lead to implant loss. Untreated periodontitis is also a risk factor for the failure of dental implants. Fully edentulous patients do not have periodontitis, but even after the extraction of a single tooth with periodontal disease, the site may harbor pathogenic bacteria that may lead to peri-implantitis.

Factors that may influence the healing or potential infection of the implant recipient site also may affect the outcome. Uncontrolled diabetes and use of drugs such as steroids need to be carefully considered in the treatment plan, and the clinician may need to adjust time to loading accordingly. Anatomy and bone quality also affect the outcome and ease of surgical placement of implants. Implants need adequate bone height and width for placement. If the native bone at the recipient site is inadequate to accept the implant, bone grafts with or without guided bone regeneration must be considered. Bone quality, which is related to density of the trabecular bone, usually is not a problem in the anterior mandible. Other segments of the alveolar bone, such as the posterior maxilla, are more likely to have lower bone density, which can limit implant stability and osseointegration.

Table 3 – Overall patient feedback.

S. no	Performance ⇄ Category⇓	Poor	Satisfactory	Good	Excellent
1	Masticatory efficiency	Nil	5 (12.82%)	23 (58.97%)	11 (28.2%)
2	Speech	Nil	2 (5.12%)	28 (71.79%)	9 (23.07%)
3	Overall comfort	Nil	Nil	11 (28.20%)	28 (71.79%)

Conclusions

The following conclusions can be drawn from this study.

1. Implant retained overdentures help in improving the masticatory efficiency, speech and overall comfort of the patient as compared to conventional dentures.
2. Indigenous dental implants have a low success rate as compared to global success rates.
3. A co-relation between smoking and failure of implant osseointegration can be established.
4. It is possible to provide an implant retained overdenture in any dental center with an implant armamentarium and a dental laboratory.
5. Personality of the selected patients in self-assessment of the dentures was not recorded, which may have affected the results.
6. Further studies using a larger sample size, with more criteria and a longer observation period is recommended.

Conflicts of interest

All authors have none to declare.

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