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RESEARCH ARTICLE

Resorbable *vs* Non-resorbable Barriers with Immediate Implantation after Functional Loading under Overdenture

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ABSTRACT

Aim: The aim was to evaluate the bone height and bone density of the peri-implant area with resorbable and non-resorbable barriers as guided tissue regeneration with immediate implants after functional loading under mandibular overdenture.

Materials and methods: Eight male patients (the age ranged between 45 and 60 years old), who had the upper jaw as fully edentulous and the lower jaw with only two remaining canines and indicated for extractions, were selected. Each patient received two immediate implants after extraction of remaining canines and were divided into two groups: Group I: The left side received non-resorbable barrier and group II: The right side received resorbable barrier. Radiographic evaluation was done for marginal bone height loss and bone density immediately after overdenture insertion and 6 months later.

Results: Mean marginal bone loss with non-resorbable barriers was 0.7 ± 0.16 mm and with resorbable barrier was 0.6 ± 0.1 mm, with nonsignificant difference between the two groups. There was significant increase in bone density with resorbable barrier after 6 months of functional loading, with significant difference between the two groups.

Conclusion: There was no difference in marginal bone height changes between resorbable and non-resorbable barriers with immediate implant under overdenture. However, after 6 months of functional loading, bone density increased with the use of resorbable barrier over non-resorbable barriers. Using of resorbable barrier with immediate implantation did not require second stage surgery for removing the barrier as with the non-resorbable one.

Keywords: Immediate implant, Non-resorbable barrier, Overdenture, Resorbable barrier.

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INTRODUCTION

Immediate implantation has a great benefit that the healing of the extraction socket and osseointegration of dental implant could occur at the same time. So, there is no need for waiting for 6 to 8 months for complete healing of extraction socket and for 2 to 6 months for osseointegration of dental implant.[1,2]

The ideal extraction site for immediate implant placement is one where there is little or no periodontal bone loss on the tooth, i.e., to be extracted. In other words, a tooth extracted due to endodontic involvement, root fracture, root resorption, peri-apical pathology root perforation, or unfavorable crown-to-root ratio (not due to periodontal bone loss) is considered for implant placement.

In all studies,[3-5] the investigators recommended three to four bony walls were sufficient desiring at least 3 or 5 mm of bone beyond the apex and a bony length of 10 mm or greater for immediate implant placement. There is general consensus that bony defects with two and three walls missing or severe labial and circumferential defects are not suitable.[3-5]

The space between the implant and socket wall has been an issue of concern and controversy. Numerous studies[6-11] have shown that close adaptation of the implant to socket wall promotes greater osseointegration. Additionally, in areas where there is a wide space from the implant to socket wall, better bone healing is achieved when an occlusive membrane is placed over the socket. In clinical studies, investigators have utilized a wide variety of techniques, including the use of a bone graft to fill the gap and/or the use of an occlusive membrane to prevent epithelial proliferation into the space between the implant and the socket wall, to aid in the healing of this space.

Current research[12,13] favors the use of a barrier if a significant gap exists between the implant and the socket wall. Numerous occlusive barriers have been used, both resorbable and non-resorbable, to prevent epithelial migration into the socket area.

The aim of current study was to evaluate the effect of resorbable *vs* non-resorbable membrane on bone height and bone density of peri-implant area with immediate implants after functional loading under mandibular overdenture.

MATERIALS AND METHODS

Patient Selection Criteria

Eight male patients with age ranging between 45 and 60 years were included.

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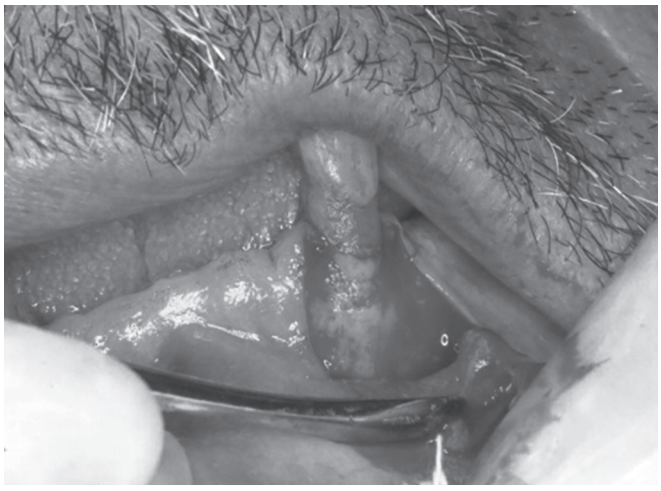

Fig. 1: Vertical incisions were made and one horizontal incision along free gingiva of remaining canine and reflection of labial periosteum

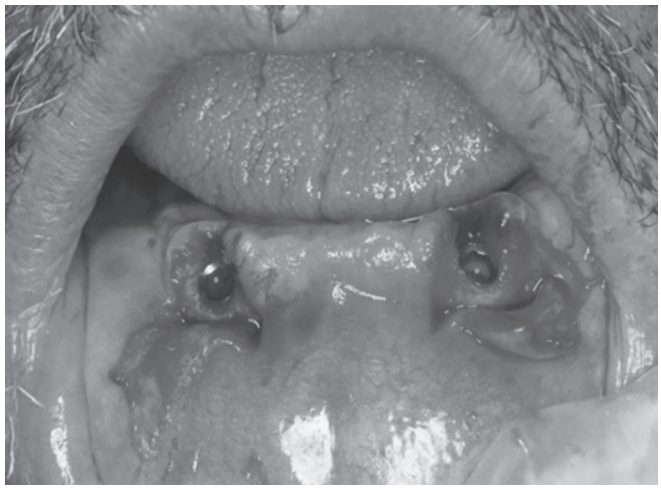

Fig. 2: Two implants installed in osteotomy sites

Inclusion Criteria

The upper jaw was fully edentulous and the lower jaw had only two remaining canines that were indicated for extraction. Sufficient bone (3–5 mm) beyond the tooth apex was indicated to achieve the critical element of primary fixture stability and class I occlusion.

Exclusion Criteria

Patients with chronic or acute systemic disorders, such as uncontrolled diabetes, hemorrhagic disorders, and general or autoimmune deficiency were excluded.

Patient Grouping

Each patient received two different modalities

Group I: the left side of each patient that received nonabsorbable barrier

Group II: the right side of each patient that received absorbable barrier

First Stage of Treatment

Local anesthesia was administrated, two vertical incisions were made along with one horizontal incision along free gingiva of remaining canine, reflection of labial periosteum was done, and removal of sharp edges of bone and remaining soft tissues performed (Fig. 1).

Atraumatic extraction was done using periotome; degranulation of the socket was carried out by the use of the spoon-shaped curette with frequent irrigation by saline.

Pilot drill 2.3 mmD was used for preparing the osteotomy site for placement of the implant. The tip of the implant engaged at least 3–4 mm depth of the bone beyond the apical end of the original socket, intermediate drill 2.8 mmD was used followed by final drill 3.4 mmD.

Insertion of the implant [Zimmer Implants, Screw-Vent SD (TSV)] was performed by initial self-tapping with the attached plastic carrier; complete insertion was done with hex tool (Fig. 2).

The left side of each patient received non-resorbable membrane (Gor-tex), a hole was prepared at the membrane with a punch and fixed to the coverscrew of the implant.

The right side of each patient received a collagen resorbable membrane (Bio-mend) that was trimmed with the membrane former to the suitable length and width, a hole was prepared by a punch and was screwed by the coverscrew of the implant (Fig. 3). The flap was sutured by interrupted suture by silk-sutured materials.

Antibiotic was prescribed (Amoxicillin 500 mg antibiotic t.d.s.) along with chlorhexidine mouthwash (twice daily) until suture removal at 2 weeks. This was followed by chlorhexidine application with a cotton tip applicator until non-resorbable barrier removal.

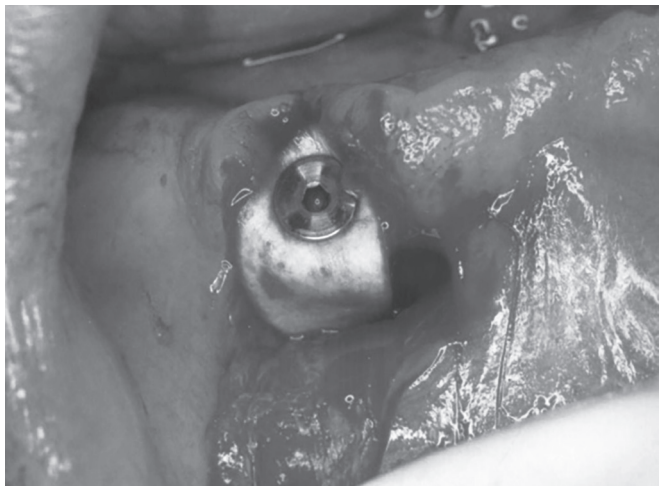

Fig. 3: A hole was prepared in the barrier and fixed to the coverscrew of the implant

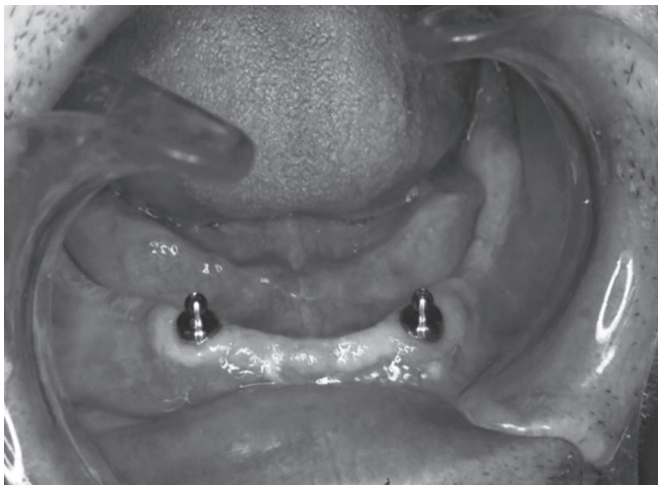

Fig. 4: Ball abutments

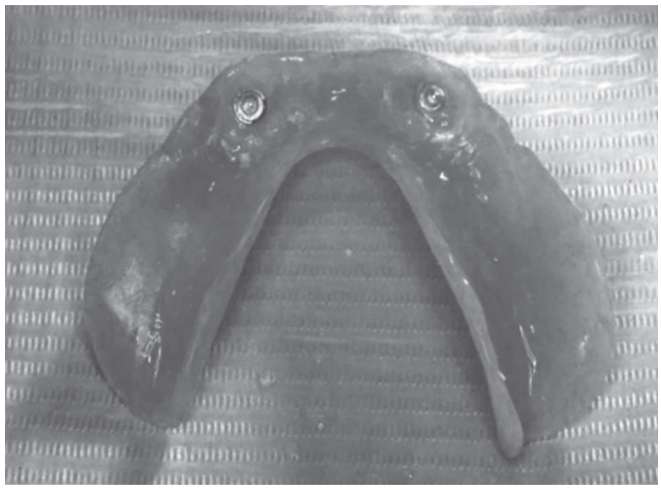

Fig. 5: Housings in the fitting surface of the denture

Second Stage

After 6 months, the implant was exposed. The non-resorbable barrier was retrieved and the coverscrew was replaced by transmucosal cover at the two sides healing collar. The gingiva was left to heal around the transmucosal coverscrew for 15 days.

New dentures were constructed. The yellow cap attachment transfers were snapped on the ball abutments (Fig. 4) and the stainless steel housings were placed over the transfers. The housing was marked with an ink marker. The denture was partially seated into the housings to transfer the position to the base of the fitting surface of the denture. These areas were relieved until the denture was seated completely without contacting the housings. Any undercuts around the base of the stainless steel housings were blocked out with composite filling.

Autopolymerizing resin was placed in the dried relieved areas within the denture base. A small amount of resin could also be placed directly on the tops of the housings. The denture was placed and stabilized by having the patient occlude with the opposing dentition. The resin was allowed to set and the denture was removed. The yellow transfers were removed from the stainless steel housings (Fig. 5). The insertion instrument was used to place the nylon liners in the housings and denture delivered to the patient (Fig. 6).

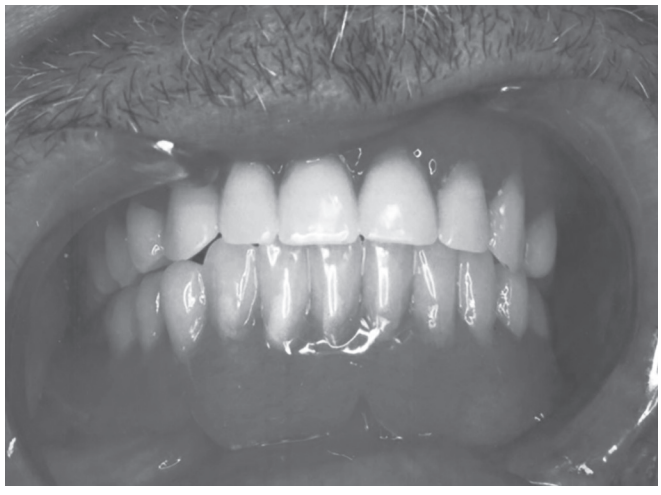

Fig. 6: Denture in a patient's mouth

Radiographic Examination

Intraoral per apical radiograph were taken immediately after overdenture insertion and 6 months postinsertion.

Standardization of Exposure

Standardization of the technique was achieved by utilizing the extension cone paralleling technique in combination with specially customized acrylic template being fabricated for each patient.

The film holder was positioned by self-cure acrylic resin on the template, so it could provide reproducible parallel relation between the X-ray cone and the film and the long axis of the examined area at each examination time.

The acrylic templates were finished, polished, and tried in the patient's mouth. The templates were kept in water to be used throughout the study period.

Radiographic Exposure and Processing of the Intraoral Film

The exposure parameters were kept fixed for all patients for the baseline as well as for the follow-up images. All films were stored in a refrigerator and processed together at one session at the end of the follow-up period by an automatic process to avoid any contrast and density variations that might result from the processing chemicals.

Image Analysis

Linear (Bone Height) Measurements

A specially designed software (Image) was used to perform the linear measurements representing the bone loss. This was done on both of the mesial and distal aspects of each implant starting from the apex of each implant to the height level of the alveolar crest at overdenture insertion time and 6 months after functional loading.

Radiometric (Bone Density) Measurements

Using the same software, the bone density changes of the newly formed bone at the gap between the implant and socket walls were detected by drawing three lines parallel to each other and 1 mm apart from each other. This procedure was repeated on the mesial and the distal sides of the implant.

The first line was drawn from the first flute of the implant to the base of the implant passing just tangential to the flutes. Bone density along each of the three lines was recorded; then the mean value of the three readings was calculated for further evaluation.

RESULTS

Clinical Results

Group I

All implants were placed within bony envelope and covered by non-resorbable barrier.

The implants were clinically immobile throughout the observation period (6 months).

In four patients, the barriers were exposed at different time intervals between 2 and 3 weeks after the insertion of the implants.

The patients were instructed to maintain their oral hygiene high by administration of chlorhexidine mouthwash and the patients were observed frequently to detect any signs of inflammation.

The exposed barriers were left for the period of 8 weeks and after that they were retrieved.

Group II

All implants were placed within a bony envelope and covered by resorbable barriers (collagen).

The implants were clinically immobile throughout the observation period (6 months).

Radiographic Results

Alveolar Crest Bone Loss

After 6 months of functional loading, there was no statistically significant difference in alveolar crest bone loss around dental implant with groups I and II (Table 1).

Table 1: Comparison of alveolar crest bone loss with groups I and II after 6 months of functional loading

	Bone height	
	Group I	*Group II*
	Alveolar crest bone loss	*Alveolar crest bone loss*
Mean	0.7125	0.6625
Standard deviation	0.1642	0.1061
T	0.723	
P	0.481	

Statistically not significant

Bone Density

At the time of insertion of prosthesis, there was significant increase in bone density with groups I and II with no significant difference between the two groups (Table 2).

After 6 months of functional loading, there was significant increase in bone density with group II over group I (Table 3).

DISCUSSION

Immediate placement of dental implants into fresh extraction sockets offers significant reduction in treatment time for the patient. Treatment time of prosthodontic procedures can be started as early as 6 months after extraction with relevant satisfaction for the patient.[14,15]

The space between the implant and socket wall has been an issue of concern and controversy. Numerous studies[6-11] have shown that close adaptation of the

Table 2: Comparison of bone density with groups I and II at insertion time of prosthesis

	Bone density	
	At the time of insertion of prosthesis	
	Group I	*Group II*
Mean	57.83	61.09
Standard deviation	2.09	4.26
T	1.943	
P	>0.05	

Statistically not significant

Table 3: Comparison of bone density with groups I and II after 6 months of functional loading

	Bone density	
	After 6 months of function	
	Group I	*Group II*
Mean	64.26	68.7
Standard deviation	2.29	3.49
T	3.012*	
P	<0.01	

*Statistically significant at p < 0.001

implant to socket wall promotes greater osseointegration. Additionally, in areas where there is a wide space from the implant to socket wall, better bone healing is achieved when an occlusive membrane is placed over the socket.

Numerous occlusive barriers have been used, both resorbable and non-resorbable, to prevent epithelial migration into the socket area, separate tissues during healing, maintain the necessary space for bone ingrowth (tenting), and to protect the graft material in the defect.[16]

The choice between a resorbable and non-resorbable barrier will depend mostly on how long it is planned to stay *in situ*. This, in turn, depends on the estimated time required for healing.[17] Generally, adequate time must be given to regenerate the required bone mass. Systemic diseases, namely diabetes, osteoporosis, hyperparathyroidism, osteomalacia, Paget's disease, and thyrotoxicosis, modulate the healing ceremony.[18-20]

In the present study, all patients were males with an age that ranged between 45 and 60 years to guard against hormonal changes that affect bone remodeling process in females, especially after menopause.

The patient selection criteria were formulated to avoid systemic disease that may affect bone healing process like diabetes, hemorrhagic disorders, and endocrine disturbances.[21]

In the present study, 6 months was allowed to pass before starting the second stage. It was reported that woven bone can grow at a rate of 60 µm each day.[22,23] That is to say, we needed about 100 days to regenerate a 6 mm mass of woven bone. Therefore, as a rule, graft sizes of less than 5 mm thickness require a healing period of 4 to 6 months.[22,23] It is suggested that the use of resorbable barriers should be limited to the cases where their effect is required for less than 3 months. Longer healing periods entail a non-resorbable barrier.[24]

In the present study, collagen barrier was 100% type I collagen (bovine tendon), which resorbs within 8 weeks as manufacturer notes.

During the period of healing, three of non-resorbable barriers were exposed within the period of 2 to 3 weeks after installation of the implants and the efforts were done to maintain oral hygiene. The exposed barriers were left for another 6 weeks and after that they were retrieved. Membrane exposures have been reported previously in many reports.[25,26] The disadvantages of non-resorbable membrane are liability to exposure and contamination and being removed,[27] while resorbable membrane does not have to be removed and does not have primary closure.

In the present study, the results showed no significant difference between the two groups in the bone height measurements. Zitzmann et al[28] found that the changes in the defects surface for both types of membranes were statistically significant; however, no statistically significant difference could be detected between the two types of membrane.

In the present study, it was found that the mean value of bone height loss after 6 months of functional loading under overdenture with the first group that received non-resorbable barrier membrane was 0.7 mm.

The mean value of bone height loss after 6 months of functional loading with the second group that received resorbable barrier membrane was 0.6 mm. There was no statistically significant difference between the two groups. Lorenzoni et al[29] evaluated the clinical and radiographic parameters of dental implants placed in combination with guided bone regeneration with barrier membrane; all implants functioned well up to 60 months.

The radiographic evaluation yielded mean bone losses 0.8 mm after 6 months of loading and 1.25 mm after 1 year of loading. Premature exposure resulted in significantly higher bone loss in a period up to 24 months.

In the present study, there was increase in bone density at insertion time of prosthesis with groups I and II with no significant difference.

After 6 months of functional loading, there was statistically significant increase in bone density in group II that received resorbable membrane over group I.

Zhang et al[30] evaluated the porous collagen membrane in guided tissue regeneration in which the implant was put on the buccal lateral deficiency of implantation cavity wall and covered with collagen membrane and then observed after 3 to 6 months individually. The results of animal experiments proved that the collagen could guide osseous tissue regeneration around the bone integral implant, which was implanted in the fresh tooth extraction fossa, increase the bone contact around the implant significantly, and improve the structure of new bone to a certain extent.

Lu[31] studied guided bone regeneration using non-resorbable membrane combined with a one-stage implant into recent extraction site. After a 24-month follow-up, radiopacity was seen in the extraction site and the implant was still clinically stable.

CONCLUSION

Collagen barrier with immediate implant in fresh extraction socket could increase bone implant contact, improve bone density around implant with no risk for barrier exposure infections, no re-entry for barrier retrieving and lastly patient satisfaction.

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