COMPARATIVE EVALUATION OF CRESTAL BONE CHANGES IN IMMEDIATE PLACEMENT AND DELAYED PALCEMENT OF DENTAL IMPLANT : A CLINICO-RADIOGRAPHICAL STUDY

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Abstract

Background : To compare crestal bone changes after placement of immediate versus delayed dental implant

Aim and Objective : Comparative evaluation of crestal bone changes in immediate placement and delayed palcement of dental implant: A clinico-radiographical study.

Methods : A coparative study was conducted in total 20 implant sites in patients within the age group 20-60 years comprising both male and female visiting Out-patient Department of Periodontology and Implantology ,D J College of Dental Science and Research Modinagar (U.P). Clinical parameters were recorded at baseline ,3 months ,6 months; they included pain, mobility, radiographic assessment for crestal bone changes.

Results : On intergroup comparison, the mean difference of the pain and mobility between Group A and GroupB showed that there was no significant result. On intergroup comparison, the mean difference of the crestal bone changes between Group A and Group B showed that Group B had slightly higher bone loss than Group A during baseline to 6th month period.

Conclusion : Within limitations of this study, it can be concluded that there was significant crestal bone loss in Group A (Immediate implantation) at both mesial and distal surface during baseline to 6th month observation period. Furthermore, a continuous bone resorption was observed over the time in both the groups. Due to small sample size, short duration, and CBCT assessment of crestal bone loss during follow-up in the study long-term survival of two-piece implants in both the groups cannot be determined; so, further studies are required to be done.

Keywords: Crestal bone loss, dental implant, osseointegration

Introduction

Oral health and care are very important to maintain proper speech, mastication, digestion, appearance, and psychological well being. Patients present with compromised teeth which are unrestorable and require extraction. The target of advanced implant dentistry is to prevent tooth loss which provide a healthy dentition with optimal functional efficiency, aesthetic harmony and structural balance.

Most modern and advanced way to replace missing teeth is dental implant which is designed to replicate the natural

tooth root and crown of the natural tooth. Conventional placement of dental implant involves extraction of offending tooth, 2-4 months waiting for extraction socket to heal, insertion of dental implant and again 3-6 months waiting for integration of dental implant with surrounding bone; after this procedure, second surgery is necessary to expose the dental implant and to place a prosthetic abutment. Due to prosthetic treatment, the patient has to wait upto 8-12 months for a lost tooth to be replaced. Because of these limitations related to conventional

placement of dental implant, strategies were developed to substantially shorten the entire treatment by placement of dental implant immediately after extraction of tooth and maintain the hard and soft tissue harmony.¹

Tooth extraction results in alveolar ridge resorption or collapse. Insertion of implants at the time of extraction might contribute to alveolar bone preservation.² The physiological process of healing of extraction sockets starts immediately after tooth extraction and eventually results in a reduction in height and width of alveolar process.³ To preserve the crestal bone. Immediate implant placement has been suggested

Advances in implant treatment have simplified and shortened the course of treatment and include flapless surgeries, immediate implant placement, and immediate loading.⁴ W Schulte and Heimke first reported placement of a Tubingen dental implant into a fresh extraction socket in 1976.³

Immediate dental implant placement has several advantages, such as reduced number of surgical intervention, reduction of time between tooth extraction and replacement of definitive prosthetic restoration, prevention of bone resorption, and preservation of alveolar ridge in terms of height. Early loading of implants facilitates formation of interproximal papillae, helps in maintaining the gingival margin levels and achievement of an appropriate clinical crown height and width.⁵

Thus, the aim of the present study was to clinically evaluate the periodontal parameters of osseointegrated immediate and delayed dental implants and by CBCT to evaluate the difference in the crestal bone height resorption after immediate and delayed placement of dental implant.

Materials and Methods:

Source of data:

20 patients was selected from outpatient Department of Periodontology and Implantology, D.J College of Dental science and Research Modinagar,(U.P). Approval for the study had been obtained from ethical committee.

Inclusion criteria :

- Patient in age group of 20-60years.
- Patients with good oral hygiene.
- Patients in good systemic health.
- Patients with a tooth indicated for extraction in anterior and posterior area.
- Normal occlusion and parafunctional habits

Exclusion criteria :

- Patients with systemic diseases that can interfere with implant success.
- Patients with progressive periodontitis.
- Patients allergic to drugs and anaesthetics.
- Patient with habit of smoking or alcohol consumption.

- Presence of active infections or chronic sinus tracts at the site of extraction.

Pre-Treatment Records:

- Detailed medical and dental history.
- Routine blood investigations.
- Periodontal assessment using clinical parameters.
- Diagnostic casts.
- CBCT
- Clinical photos.

Presurgical Technique:

After assessing the pre-treatment records, the presurgical procedure was start with the patient and scheduled for implant surgery after Phase I therapy. Facial skin all around the oral cavity was scrubbed with povidone iodine solution (5%), and the patient was made to rinse with 0.2% chlorhexidine digluconate mouthrinse for 1 min before surgery. The area of surgery was anesthetized using 2% lignocaine with adrenaline concentration of 1:80000

Surgical Technique:

Immediate group (Group A)

Following administration of local anesthesia, a sulcular incision along the

buccal aspect of the planned implant site and a vertical beveled releasing incision to spare the adjacent papillae was given. A full-thickness flap was elevated and extended beyond the anticipated apical extension of the preplanned implant length. This method will permit careful evaluation of any pathology present at the periapical region of the tooth to be extracted. The tooth in question was then extracted using a method involving minimal trauma to the bone and surrounding soft tissues. This extraction was accomplished using a periotome taking care to avoid fracturing the buccal plate. A forceps of anatomic design was used to rotate the tooth root in a clockwise-counter clockwise fashion to retrieve the root from alveolus. Following extraction, the socket was then thoroughly degranulated with curettes and to remove all remnants of the periodontal ligament and granulation tissue.(Fig.1 – Fig.4)

Delayed group (Group B)

After achieving profound anesthesia, the mucoperiosteal flap was elevated with a crestal incision located approximately 2–3 mm toward the lingual aspect and extended to the sulcus of adjacent teeth by an intrasulcular incision. This incision avoids the formation of scar tissue in the midcrestal area.(Fig.9-Fig.11)

Procedure for both the dental implant placement (Fig.5-Fig.8 and Fig.12-Fig.15)

The buccolingual and mesiodistal implant position was partially determined by the morphology of the alveolus, and the site for implant placement was then marked with a

surgical round bur. After marking the site, pilot drill was put to use for creating the osteotomy site of approximate depth for implant placement. When approximate depth was reached with the pilot drill, the implant probe was used for tactile perception of intact bony plates and for perforations and for the desired osteotomy depth. Once desired depth was confirmed, paralleling pins were placed to check the proper alignment of the implant with adjacent teeth and opposing occlusion. After confirmation of depth and angulation, the osteotomy site was prepared with Tri-Spade (twist) drills to create the desired osteotomy width. The round drills and the twist drills were operated at maximum 800 rpm (revolutions per minute) as per manufacturer's instructions. The implant site was generously irrigated with sterile saline to remove any residual bone chip/other residue following preparation. The depth of implant osteotomy site was ascertained with implant depth probe. The implant was removed from the sterile vial using insertion tool and delivered into the osteotomy site. The implants were then placed into the prepared site with manual pressure aided by the insertion mount and insertion tools attached to the implant head. Following which, the insertion mount was removed, and hex driver was placed into the implant internal hex and ratcheted with torque-controlled implant ratchet. Care was taken not to allow excessive force application while insertion. Implant was checked for stability by applying gentle pressure to determine if it could be depressed or rotated. Furthermore, primary stability was assessed with the torque controlled ratchet. All implants were placed within the alveoli confines and were clinically stable at the time of insertion. The grafts were placed as per the requirement. And a

definitive abutment is placed only at the time of insertion so as to gain the advantage of on abutment one implant concept. Then, the primary closure of the wound was achieved by stabilization of the flap using simple interrupted sutures. The patients in both groups were recalled after 7 days for the suture removal. The patient was then recalled after 1st, 3rd, and 6th month for recording the clinical parameters

Clinical Parameters :

- Pain was assessed using VAS scale
- Implant mobility was assessed clinically and graded according to clinical implant mobility scale (Misch, 1999)

Radiographic parameters:

CBCT was taken and assessed preoperatively and after 6 months (at baseline and 6 months) for assessment of crestal bone levels (CBL).

Statistical Analysis:

All the clinical and radiographic parameters was entered in the standard proforma drawn for this study and was subjected to statistical analysis

Results

On intergroup comparison, the mean difference of the pain and mobility (Table 1 and Table 2) between Group I and Group II showed that there was no significant result. On intergroup comparison, the mean difference of the crestal bone changes (Table 3) between Group I and Group II showed that Group II had slightly higher bone loss than Group I during baseline to 6th month period.

Table 1: Intergroup comparison of pain between Group A and Group B				
Mean±SD			Significance of difference using independent t-test	
	Group A	Group B	P value	Significance
Baseline	5±1.54	6±1.33	0.761	Nonsignificant
3 months	0.8±1.13	0.70±0.67	0.813	Nonsignificant
6 months	0.1±0.31	0.20±0.42	0.863	Nonsignificant

Independent t test at $p \leq 0.05$ is significant

GRAPH 1:

Table 2: Intergroup comparison of mobility between Group A and Group B				
Mean±SD			Significance of difference using independent t-test	
	Group A	Group B	P value	Significance
Baseline	0.0±0.0	0.0±0.0	1.00	Nonsignificant
3 months	0.2±0.42	0.20±0.42	1.00	Nonsignificant
6 months	0.3±0.48	0.60±0.84	0.34	Nonsignificant

Independent t test at $p \leq 0.05$ is significant

GRAPH 2

Table 3: Intergroup comparison of crestal bone loss between Group A and Group B				
Mean±SD			Significance of difference using independent t-test	
	Group A	Group B	P value	Significance
Baseline	0.36±0.25	0.18±0.07	0.047	significant
6 months	0.73±0.25	0.46±0.10	0.035	significant

Independent t test at $p \leq 0.05$ is significant

GRAPH 3

CASE 1: GROUP A (IMMEDIADTE DENTAL IMPLANT PLACEMENT)

Fig 1.Pre-operative view

Fig 2.Pre-operative CBCT(at baseline)

Fig.3.Atraumatic extraction

Fig 4.Extracted tooth

Fig.5.Implant placed

Fig 6.Suture placed

Fig.7.Suture removal after 7 days

Fig.8. CBCT After 6 months

CASE 2 GROUP B (CONVENTIONAL DENTAL IMPLANT PLACEMENT)

Fig 9.Preoperative view

Fig 10.Pre-operative CBCT(at baseline)

Fig.11.Flap elevated & paralleling tool placed

Fig 12.Implant placed

Fig 13.Suture placed

Fig 14.Suture removal after 7 days

Fig 15.CBCT After 6 months

Discussion

The advent and widespread use of dental implants has expanded the available options for single-tooth replacement to include endosseous dental implants.⁶ In fact, implants have been proposed to be the most suitable option for single-tooth replacement in most situations, both in posterior⁷ and anterior regions of the mouth.⁸⁻¹⁰ Dentists therefore increasingly consider this option for single-tooth replacement in addition to traditional replacement methods.¹¹⁻¹² It is demonstrated that major changes in bone volume takes place during the first 12 months after extraction, with a reduction of 50% of the initial volume, and two thirds of this reduction occurring in first 3 months as described by **Craig M. Misch**.¹³ The resorption of bone over the extended time period often led to situations where there was insufficient bone for routine implant placement. According to original **Branemark's**¹⁴ protocol for dental implant placement after tooth extraction recommendation for soft and hard tissue healing period is 3 months This always led to a prolonged waiting period. After extraction of teeth, alveolar bone resorption may be so severe if left uncontrolled which may lead to severe bone deficiency and therefore contraindicate the placement of an implant¹⁵

Immediate implants after extraction is one of the successful treatment modalities for dental restorations.¹⁶⁻¹⁷ The advantages of the immediate placement of implant into extraction sites are three folds, the significant reduction in treatment time for the patient, directly related to the greater bone volume resulting from ridge preservation.¹⁸⁻¹⁹ In recent years, there have been reports that immediate implant surgery is a predictable procedure with high success rates if patients are appropriately selected with appropriate width of available bone.

The quality of implant surface influences wound healing at the implantation site and subsequently affects

osseointegration.²⁰ Surface coated implant increases the surface area of the implant, therefore increasing the implant bone surface contact area and hence implant stability. Threaded implants are preferred over cylindrical implants because threads of screws maximize the contact area, improve implant stability and favour the dissipation of interfacial stress. In our study, implants were countersunk 1-2 mm below the alveolar crestal bone to achieve adequate bone level at the time of implant exposure. The major debate point is whether it is necessary to fill the gap between the implant and the extraction socket. According to **Becker et al** when immediate implants were placed within alveolar confines, without using graft material or barrier membrane, high survival rates were reported.²¹

In the present series of patients CBCT were evaluated to assess the crestal bone changes around the implant at time interval baseline and 6 month postoperatively to assess crestal bone changes. The change in the crestal bone level around peri-implant surface was radiographically evaluated by measuring the proximal distance between the implant shoulder to the most coronal aspect of the alveolar crest mesially and distally, and then mean crestal bone loss was calculated. There were no complications encountered postoperatively after 1, 3 and 6 months such as pain, infection, bony defect, peri-implantitis, mobility with the implants placed. The 20 implant sites which were examined after 1, 3 and 6 months were found to be asymptomatic and without any clinical evidence of mobility, pain and absence of radiolucency around the implant. No implants were lost and the survival rate of dental implants in the present study was 100%.

In present study the two-piece anti rotational internal hex abutment were used for replacing the crowns. Anti rotational internal hex abutment design provides the greatest stability to lateral and torsional forces occurring

during mastication as described by **Carl E. Misch**.²² Cement retained crown was fabricated of porcelain fused to metal and cemented with Glass Inomer cement.(GIC)

Postoperatively, at baseline for Group A mean crestal bone loss around implant was $0.36\text{mm} \pm 0.25\text{mm}$ and for group B was $0.18\text{mm} \pm 0.07\text{mm}$ which was statistically significant, after 6 months for Group A mean marginal bone loss around implant was $0.73\text{mm} \pm 0.25\text{mm}$ and for group B was $0.46\text{mm} \pm 0.10\text{mm}$ which was statistically significant.

Vijay Ebenezer et al²³ in their study, focused on the success rates, stability, and bone augmentation procedures with immediate placed implants in fresh extraction sockets. The study showed that immediately placed implants have a very high success rate, which was evaluated in our study. **Yasukazu Miyamoto et al**²⁴ measured thickness of labial alveolar bone at the cervical area of the implant (cervical width), for delayed implants it was significantly higher than that for immediate ones. Results indicate that resorption of labial alveolar bone during the postoperative period appears to progress in immediate implant cases. The level of vertical bone loss was also significantly greater in immediately placed implants as compared to delayed implants. Similar results were obtained in our study. **Lars Schropp et al**²⁵ compared bone healing and crestal bone changes following immediate versus delayed placement of titanium dental implants with acid-etched surfaces (Osseotite) in extraction sockets and found survival rates were 91% in the immediate placement of dental implant group and 96% in the delayed placement of dental implant group. **Günter Schultes, and Alexander**²⁶, **Sung-Kiang Chuang**²⁷ in their study showed that when implants were placed in freshly extracted socket, both the amount of osseointegration and bone height around the implants were significantly greater than in implants placed after healing of socket. This enhancement is probably due to the preservation of bone cortex. Result in our study also showed the good osseointegration and bone height around the implants. Complications occurring during treatment require an understanding of the biomechanical principles involved in surgical management of peri-implant tissues, attention to the many details involved with the diagnosis and treatment planning for the single tooth replacement and encouraging the patient towards strict maintenance of oral hygiene to increase the longevity of implant.²⁸

Summery and Conclusion

About 20 patients with non-restorable tooth were randomly selected and rehabilitated with titanium Dental implants; 10 were immediate dental implants after extraction of the tooth and 10 were delayed/conventional dental implants after complete healing of the socket. Most common cause of tooth loss was caries, failed endodontic treatment and trauma. Results of our study showed significant crestal bone changes after immediate placement of dental implant

into fresh extraction socket as compared to conventional placement but none of the implants failed so immediate implant placement can still be considered viable and predictable solution to tooth loss. Many reasons for marginal bone loss could be surgical trauma, occlusal overload, peri-implantitis, microgap, biologic width and implant crest module, and flapless or flapped procedures etc. Taking the results of the present study into account, it could be concluded that conventional implant placement is associated with more marginal bone loss when compared with immediate implant placement. Further long term studies with larger sample sizes are necessary to evaluate crestal bone loss in order to substantiate the basis of selection of the best implant placement protocol and it will enhance the success rates in long term.

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