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A comparative evaluation of clinical and radiological outcomes of immediate and delayed dental implant placements in mandibular premolar and molar sites: A prospective study

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ABSTRACT

Aim and objectives: To evaluate and compare the effectiveness of immediate implant placement versus delayed implant placement in mandibular premolar and molar site with respect to peri-implant bone loss and the soft tissue changes adjacent to implant.

Material and methods : The study comprised of 20 patients (13 male and 7 female).Group–1, Delayed and Group–2, immediate both consists of 10 patients eachwith implants placed ineither premolar or molar region.

Results: Clinical parameters like plaque index, modified bleeding index and probing depth improved significantly in both the groups from crown placement to the end of 6 months. Peri implant bone loss increased slightly in both groups from crown placement to the end of 6 months but the difference was found to be statistically non significant.

Conclusion: Marginal bone loss values for immediate and delayed implants appear similar for mandibular premolar and molar sites. Therefore immediate implant protocol may be adopted whenever feasible to decrease the morbidity in patients.

INTRODUCTION

Inspite of improvement in dental health care and availability still most of the population suffer tooth loss. When tooth is lost the lack of stimulation to the residual bone cause a decrease in trabeculae and bone density in the area along with loss of external width, height of the bone[1]. There is a 25% decrease in width of bone during first year after tooth loss. Now in the era of technology various treatment options are available to replace the tooth removable and fixed prosthesis, implant and implants supported prosthesis etc. Removable dental prosthesis does not stimulate and maintain bone level, rather over the time it accelerate bone loss as load from the mastication is directly transferred to the underlying bone surface only, not to the whole bone. Management with fixed dental prosthesis over time has been reported to cause caries and endodontic failure of the abutment teeth, which leads to loss of abutment[1]. Therefore Oral implants have become a reliable alternative to replace lost teeth as they have a very high survival rate i.e. above 90%[2].

Osseo integrated implants are placed traditionally following a two stage protocol, wherein implants are kept load free and left for submerged healing for 3-4 months in mandible and 6-8 months in maxilla[3]. The newly formed bone has features of normality with marrow spaces filled with blood vessels[4].

The best time to initiate implantation after dental extraction is a matter of controversy[2]. Since the first report of placement of dental implant into fresh extraction socket, there has been increasing interest in this technique of implant treatment.

Immediate implants are placed in dental sockets just after tooth extraction. Immediate delayed implants are those implants inserted after weeks up to about couple of months to allow for soft tissue healing. Delayed implants are those placed thereafter in partially or completely healed bone.

Immediate implant placement after tooth extraction seems to offer several advantages over delayed ones such as reduced number of surgical interventions and shorter treatment time along with conservation of the crestal bone. However, it has been reported that immediate implant placement be adversely affected by the presence of local infection and lack of soft tissue closure and flap dehiscence over the extraction site, particularly when barrier membranes have been used for guided bone regeneration.[3] Delayed placement is usually associated with buccolingual ridge reduction of about 50% of the initial ridge width over a 12month period, and two thirds of this bone loss takes place during first 3 month of healing. Moreover, concomitant vertical bone remodelling of 3-4 mm approximately 50% of initial socket height has been reported by some authors at 6 month post extraction. Therefore, delayed implant placement in healed site is not always recommended, as this may eventually necessitate advanced bone augmentation procedures[6]. Most studies on immediate implant placement describe cases in anterior regions. Very few studies compare immediate and delayed implants in posterior region in mandibular arch.

The current study aimed to compare immediate and delayed implants in mandibular premolar and molar region with respect to crestal bone loss, soft tissue changes to establish the consensus toward immediate and delayed Implants in mandibular molar and premolar region.

MATERIALS AND METHOD

20 patients undergoing surgery for implant placement using immediate and delayed placement, were selected from the outpatient department of Oral and Maxillofacial Surgery, PGIDS Rohtak, Haryana.The inclusion criteria for implant placement were teeth indicated for extraction due to: non-restorablecarious lesion,rootresorption,endodontic complications,advanced clinical attachment loss,root fracture,poor aesthetics and presence of at least 3-4 mm of bone apical to apex of the tooth to be extracted, in cases selected for immediate implant placement.

STUDY DESIGN

The present study included 20 patients (13 males and 7 females) divided into two groups. The first group(group-1)which is the delayed group included 10 patients, 6 males and 4 females .The second group (group - 2) which is the immediate group included 10 patients, 7 males and 3 females, with mean age of 43.53 years in both groups. A standardized implant integration protocol for each site was followed that comprised of case selection, case evaluation, treatment planning, pre-operative preparation, optimal implant placement and implant specified definitive restoration.

a. Medical and Dental history of the patient was obtained.
b. A written consent form signed by the patient, was obtained.
c. Case evaluation was done which included cast (study model), photographs, standardized intra oral periapical radiographs and CBCT
   Type of bone was assessed radiographically and classified as D1,D2,D3,D4 (Misch[25])
d. Evaluation of surrounding soft tissues and presence of adequate amount of bone clinically and absence of bony defect radiographically was done.
e. Patient education and motivation for maintaining optimum oral hygiene.

Based on the case evaluation, selected patients were placed into the following of the two groups.

Group 1 -Delayed implant placement: Implant placed after 8-14 weeks of healing period have elapsed.
Group 2 -Immediate implant placement: Implant placed immediately after the extraction into the extraction socket.

Surgical and prosthetic procedure

1. Antibiotic cover was started 1 hour before the surgical procedure for all the patients and was continued for 5 days post-operatively. Antibiotic regimen included the following:

   - Amoxycillinclavulanic acid 625 mg T.D.S.
     Non-steroidal anti-inflammatory agent like ibuprofen 400mg B.D will be continued for 5 days.

2. Patient asked to do mouth rinse with 0.2% chlorhexidinegluconate for 30 seconds to avoid local wound contamination and infection.
3. Local anaesthesia was administered using 2% Lignocaine hydrochloride with 1:80,000 adrenaline.
4. A crestal/sulcular incision was given along with vertical releasing incisions mesial and distal to the site and a mucoperiosteal flap is elevated.
5. In cases selected for Immediate implant placement, atraumatic tooth extraction was performed and thorough socket debridement and irrigation of the socket was done.
6. Evaluation of the extraction socket for buccal and lingual or palatal defect was done. Implant dimensions are selected on the basis of clinical evaluation of recipient site and preoperative radiographs.
7. Two stage surgical approach was followed for both the groups:

Phase I Surgery: Implant osteotomy site was prepared by using series of drills incrementally as per the site and manufacturer's instructions, with profuse irrigation. Proper positioning of the implant was checked with the help of depth gauge or paralleling pins. Implant body was inserted using torque controlled wrench, achieving primary stability with torque values of upto 35 Ncm, followed by placement of cover screw. The flap margins were repositioned and closed by placing tension free sutures with 3-0 braided mersilk.

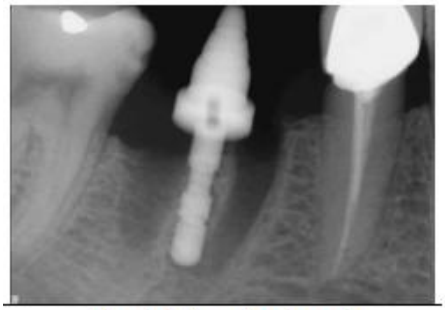
Phase II Surgery - Following Implant placement, another surgical procedure was performed in the patients at 3 months. A circular incision was given to expose the implant. Cover screw replaced with healing abutment.

Once the physiologic contour of the soft tissue is achieved (2weeks), impression was taken for the fabrication of implant specific definitive restoration for both the test group sites. A preliminary irreversible hydrocolloid or elastic impression made of the implant. The indirect impression transfer coping or abutment for cement or screw retained was removed and the second stage permucosal extension replaced. The indirect transfer coping and/or implant abutment analog placed into the preliminary impression, which was poured with dental stone. The purpose of this step is to fabricate the final impression tray and begin the fabrication of transitional prosthesis when a fixed prosthesis was indicated. The dental laboratory fabricated porcelain fused to metal prosthesis.

Implant kit used for implant placement

Instrument used for implant placemen

IMMEDIATE IMPLANT PLACEMENT



Paralleling pin placed

Osteotomy done with final drill

Healing cap placed

Final implant in position

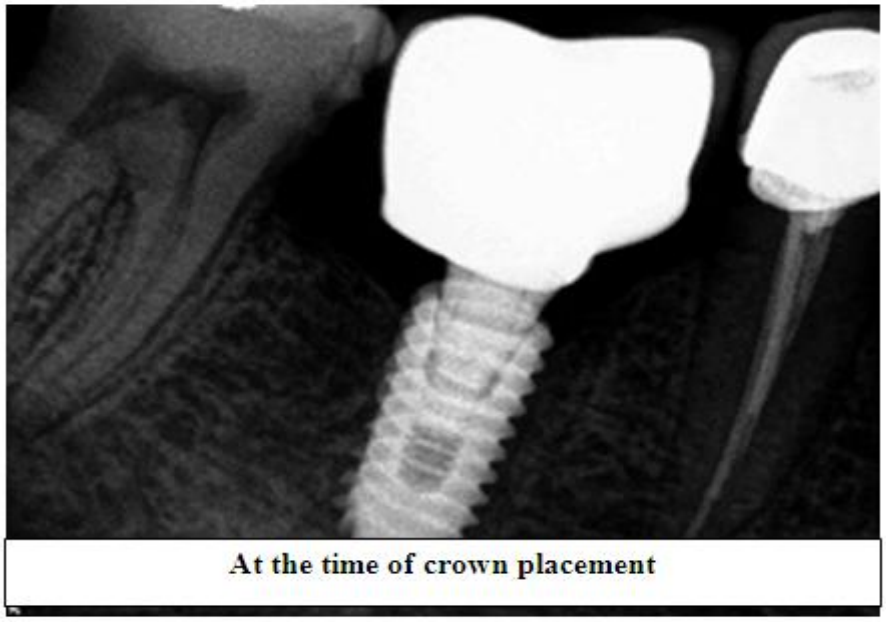
Final prosthesis in position

Patient occlusion at maximum intercuspation

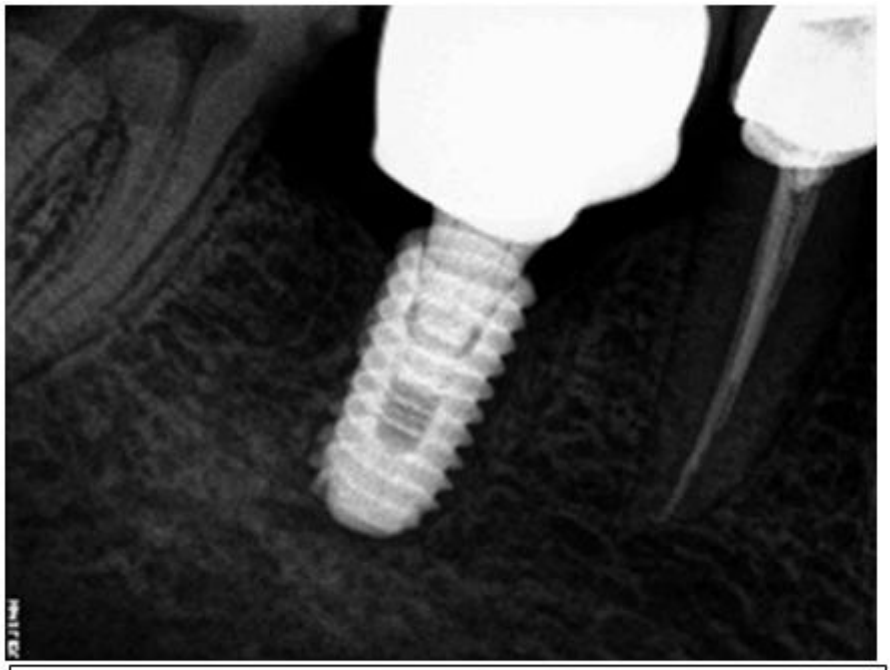
Right side occlusion

Right side canine guided occlusion

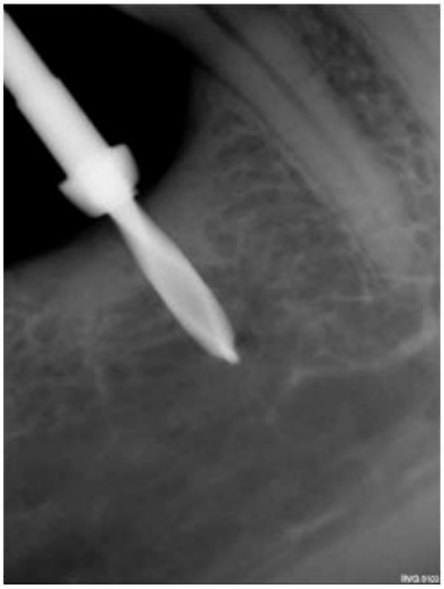
Left side occlusion



At the time of crown placement

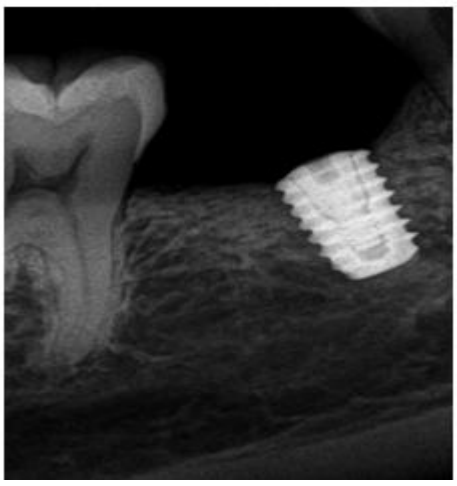


3 month after crown placement



Lence drill placed for delayed implant placement

Healing cap placed



At the time of implant placement

At the time of crown placement

3 month after crown placement

Clinical parameters recorded for evaluation of dental implants

Clinical parameters recorded for evaluation of dental implants

Patient occlusion at maximum interception

Protrusive occlusion

Right side canine guided occlusion

Right side occlusion

Left side canine guided occlusion

Left side occlusion

STATISTICAL ANALYSIS

- All the collected data was subjected to statistical analysis using Statistical package for social sciences (SPSS v 21.0, IBM). Statistical analysis done using t test.

RESULTS

Plaque index

In the delayed group(group 1)the mean plaque index score at crown placement, was 1.1±.42 that remained almost same to 1.0±.47 at the end of 6 months.

In the immediate group(group 2), at crown placement, it was 1.35±.50, decreasing to 0.875±.29 at the end of 6 months. On comparison between the delayed and immediate groups, it was not statistically significant (P>0.05).

Modified Bleeding index

In the delayed group(group 1)the mean modified bleeding index score at crown placement, was .72±.50 that decreased to .40±.41 at the end of 6 months.

In the immediate group(group 2), at crown placement, it was 1.2 ±.69, decreasing to 0.55±.66 at the end of 6 months. On comparison between the delayed and immediate groups, it was not statistically significant (P>0.05).

Probing depth (PD)

Delayed group

The mean probing depth atcrown placement was found to be 2.47±0.29 mm that decreased to 2.37±0.3 mm at the end of 6 months .

Immediate group
The mean probing depth atcrown placement was found to be 2.7±0.38 mm that decreased to 2.6±0.35 mm at the end of 6 months.

Peri-implant bone loss
In the delayed group, the mean peri-implant bone loss at crown placement,was 0.22±.28 mm that increased to 0.28±.30 mm at the end of 6 months on mesial surface whereas it was .43±.42 mm at crown placement and increased to .57±.31 mm at the end of 6 months on distal surface.

In the immediate group, it was found to be 0.46±.15 mm at crown placement that increased to 0.57± .19 mm at the end of 6 months on mesial surface whereas it was 0.40±.11 mm at crown placement that increased to 0.51±.15 mm at the end of 6 months on distal surface.

On comparison between the delayed and immediate groups, there were no statistically significant differences (P>0.05).

DISCUSSION

From 1993 to the present time, single – tooth implant survival reports have validated implant procedure as the most predictable method of tooth replacement. Fugazzotto[9] evaluated 1472 implants over 13 year period and found 97% survival rate during that period. In 2008, Misch[25] et al reported on more than 1300 implants over a 10 year period and found over a 99% survival rate.

Several authorshave reported placement of implants into extraction sockets.[11,12,13]The entire concept of immediate implants depends heavily on maintaining integrity of buccal cortical plates. Implants immediately placed into extraction sockets have predictable healing in a submerged environment .Preoperative radiographic evaluation helps to determine the height and width of the bone available for implant insertion.

Inclusionof CBCT in pre-operative planning helped in avoiding encroachment of the inferior alveolar nerve. In posterior mandible, Froum et al.[14] suggested that safe placement of an IMI is likely if the distance from root apices to the nerve canal is at least 6 mm as measured on CBCT, accepting that up to 4mm of apical bone must be engaged to ensure sufficient initial IMI stability to avoid micro-movements.[15]

In our study we have made an effort to determine the survival rate of Osstem dental implants placed in healed extraction site (Delayed Implant) and immediately into fresh extraction sockets (Immediate Implant) in 20 patients with a mean age of 43.53 years in the age group of 18-60 yrs.

During preparation of the implant bed, care was taken to prevent damage to buccal cortical plate by angulating the drill towards the lingual plate and care was taken to minimize the thermal damage by using saline irrigation. implants were placed into the prepared socket and primary stability was achieved in all cases.

we have used OsstemTS III dental implants sand blasted with alumina and acid etched, on surface combination of crater and micro-pit present and have surface roughness Ra 2.5-3.0 µmhavingself tapping and aggressive threads with tapered design implants . When implants are placed into extraction sockets, a partial incongruency between the outer surface of the implant and the bony walls of the socket often results in a bone deficit in the peri-implant area. This space is known as jumping distance or critical space.

Even though primary stability was achieved at apical part of the implant, 5 cases showed existence of space between implant and socket wall at the coronal ends, which was covered with bone graft material (Bioss) and flap was adapted snuggly to the implant and then interrupted sutures were placed.

During healing period, we noticed partial exposure of the cover screw, in 2 cases. However no inflammation of the soft tissues was noted over the implant. This may be attributed to the regular checkups, reinforcements regarding oral hygiene and excellent plaque control by the patient. In one patient, abscess was noted in the marginal gingiva due to improper brushing. The abscess was drained and patient was put on antibiotics.

During follow up of the prosthesis, screw loosening was noticed in 1 case, which is a common problem in implant supported prosthesis.This can be due to various reasons.[16]In our study screw loosening may be due to inadequate tightening of the screw or non-passive frameworks. Screw loosening was corrected by replacing the old prosthesis.

The original Plaque Index[17] has been slightly modified to assess plaque formation in the marginal area on IT1 implants (mP11) and for Branemark-type implants.[18,19] Modified plaque and bleeding indices are recommended for the evaluation oforal hygiene practices and the status of the peri-implant mucosa.

In our study, the mean plaque index for Delayed Group I at 3 month was 1.100 and at 6 month was 1.000 .In immediate Group II implant mPI at 3 month was 1.3500 and at 6 month was 0.8785. In both delayed and immediate group mPIdecreased from 3 months to 6 months. However mean mPI score comparison between delayed and immediate group was non-significant.This can be attributed to the plaque control by the patient and the repeated reinforcements of oral hygiene measures given to the patient by the clinician. This is in similarity to the earlier conducted studies.[20,21,22]

A modification of the Sulcus Bleeding Index (mBI) has been used in longitudinal trials on IT1 implants.In case of a peri-implant site absence of bleeding on probing is considered healthy and stable.[23]In our study modified Sulcus Bleeding Index (mSBI) of Delayed group I was found 0.7250 at 3 month and at the end of 6 month mean mSBI was 0.4000 . In Immediate implant Group II mSBI at 3 months was 1.200 and at the end of 6 month mean mSBI was 0.5500 .In both groups mSBI decreased from 3 month to 6 month.On comparison between Delayed Group and Immediate groups, it was not statistically significant.

Quirynen et al[24] found a correlation between the level of bone as seen on radiographs and the extent of peri-implant probe penetration. If periimplantitis is associated with a marginal recession, then probing depth alone may not accurately reflect peri-implant bone loss, whereas increasing loss of attachment is a definite sign of peri-implant pathology.In both study groups pocket depth decreased from 3 month to 6 month but decrease was not statistically significant. On comparison between Delayed Group and Immediate groups, it was not statistically significant.

Radiographic evaluation of bone forms a very important and viable means of detecting health and stability of bone around the peri-implant hard tissue. IOPAradiographs weretaken at time of crown placement and 3 month after crown placement using long cone paralleling techniques.These radiographs were subjected to radiographic analysis using Image J software. After selecting the region of interest (ROI) the bone height from a fixed reference point on the implant was assessed. In our study the lower border of the crest module of implant was taken as a fixed reference point and the bone height on the mesial and distal sides were assessed. In Delayed group I at the time of Crown placement(CP) mean radiographic bone loss on mesial side was 0.220mm and distal side was 0.430mm and 3 month after crown placement bone loss on mesial side was 0.280mm and distal side was 0.570mm. In Immediate group II bone loss at the time of crown placement on mesial side was 0.460mm and distal side was 0.570mm ,3 month after crown placement on mesial side 0.400mm and distal side 0.510mm.After subjecting these results to statistical analysis, it was found that statistically highly significant bone resorption occurred on both mesial and distal sides. From crown placement (CP) to 3 month after crown placement in both groups statistically significant values found. But the bone loss was statistically non-significant between immediate and delayed group.

Clinically visible mobility of an implant after healing period indicates failure to achieve osseointegration.[25]All the implants evaluated in our study at 3 months did not show any amount of mobility and at all stages were grouped into Grade 0 mobility. This is in concordance to the studies conducted by other researchers.[22]

CONCLUSION

Immediate placement ofsingle tooth implants into fresh extraction sockets could be considered a valuable option to replace a hopeless tooth in mandibular molar and premolar region.

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