A Comparison of Outcome of the Immediate Implant Placement of Implants When Used In the Replacement of Teeth with and Without Chronic Periapical Lesions

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Abstracts: Objectives: Thepurpose of this prospective controlled study wasto compare the outcome of the immediate placementof implantswhen used in extraction sockets with and without chronic periapical lesions, in an Indian population. Methods: 10 implants each were immediately placed in extraction sockets with chronic periapical lesions (Test group-TG), and non-infected extraction sockets (Control group-CG). Surgery was done under pre and post-operative antibiotic coverage and 0.2% chlorhexidine rinsing, with debridement of infected sockets. At baseline, 12 months and 24 months follow up, evaluations were carried out for implant survival, clinical parameters (probing depth-PD, modified plaque index-mPI, modified bleeding index-mBI, marginal gingival level-MGL, width of the keratinized mucosa-KM, and radiographic parameters -Marginal bone levels). To compare differences between CG and TGdata at every time point, a Student two-tailed t testwas adopted. Results: Both CG and TG showed 100% implant survival rate even at the end of 24 months. The clinical and radiographic parameters evaluated showed no statistical differences between CG and TG at baseline, 12 months or 24 months. Conclusion: If appropriate clinical measures like antibiotic prophylaxis, and meticulous cleaning to decontaminate the surgical sites are performed, immediate implant placement into extraction sockets with chronic periapical lesions give comparable results with those placed in non–infected sockets, as far as the clinical and radiographic parameters are concerned. [Manish K NJIRM 2017; 8(2):133-139]

Key Words: immediate implant, periapical pathology, treatment outcome

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Introduction: Placement of dental implants has made it possible to restore function in patients who are fully or partially edentulous[1, 2, 3, 4]. The original protocol described by Branemark and colleagues, required that the endosseous cylindrical implants be placed into healed bone[2].Over time, implant surgery protocols have evolved and Implant placement immediately after tooth extraction is now a widely accepted procedure revealing high survival rates ranging from 93.9% to 100%[5,6,7,8,9].The main advantages offered by immediate implant placement are to reduce the amount of surgical interventions, shortened treatment time and to possibly preserve the pre-extraction contours of the alveolar process[10,11,12,13].

It has been postulated that fresh-socketimplants are contraindicated in the presenceof periapical and periodontal lesionsbecause of the risk of microbialinterference with the osseointegrationprocess[14,15].Despite this, more recent clinical studieshave stated that immediate implant placement into infected post-extraction sockets are a predictable procedure with success rates close to 92%[16-20].According to Siegenthaleret al[21] andLindeboom et al[20], when compared to the immediate implant placement performed at non infected extraction sockets, those performed at sockets exhibiting periapical pathology did not lead to an increased rate of complications and rendered an equally favorable type of tissue integration of the implants.Novaes et al[17] confirmed that chronically infected sites, such as those showing the presence of periapical pathosis, may not be a contraindication for immediate implants if appropriate antibiotics are administered preoperatively and postoperatively, and if meticulous cleansing and debridement of the alveoli are performed before implant placement. Rosenquist and Grenthe[15] reported that the success rate was 92.0% for implants replacing teeth extracted because of periodontitis and 95.8% for implants replacing teeth extracted for other reasons such as root fractures or resorption.

There are very few prospective randomized studies regarding the feasibility of immediate implant placement in fresh sockets with periapical lesions and none have been published with respect to the same in an Indian population. Thepurpose of this prospective controlled study wasto compare the outcome of the immediate placementof implantswhen used in the replacement of teethwithand without chronic periapical lesions, in an Indian population.

Methods:A total of 15 Indian patients (11 males and 4 females; age range 28 to 54 years; mean age 41.9 years) were included in the study. A total of 20 implants were placed immediately in fresh extraction sockets of monoradicular or premolar teeth. Of these, 10 were placed in patients belonging to the test group TG (who had teeth indicated for extraction due to chronic periapical pathology and periapical radiolucencies but no signs of pain, suppuration or fistulas). 10 implants were placed in a control group CG (who had teeth indicated for extraction which were without periapical pathology, without acute or chronic periapical lesions, were with root caries or root fractures).

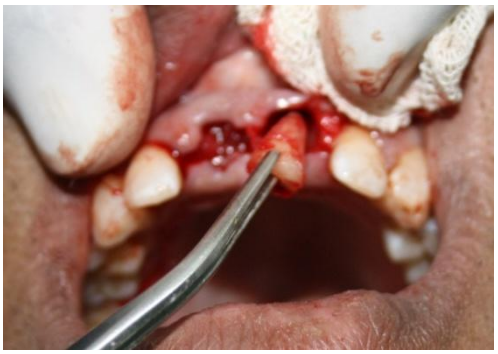
Inclusion criteria adopted for patient selection were: good general health, no chronic systemic disease, presence of hopeless teeth requiring extraction, presence of adjacent teeth, presence of four bony walls of the alveolus, and the presence of $\geq$ 4mm bone beyond the root apex. Excluded patients were those with uncontrolled diabetes, smoking $\geq$ 10 cigarettes/day, alcohol/drug abuse, coagulation disorders, presence of signs of acute infection around alveolar bone at the surgical site, the presence of fenestration or dehiscence of the residual bony walls and reduced compliance after oral hygiene sessions. All patients included in the study gave written informed consent for immediate implant placement in fresh sockets and the use of their clinical data for research purpose.

Surgical protocol: Once the patient was considered a candidate for immediate implant, a surgical guide was used to assure proper implant placement. One gram of Amoxicillin was administered 1 hour prior to surgery. 0.2% Chlorhexidine gluconate rinses were used prior to surgery.

All surgical procedures were carried out under local anaesthesia.The tooth was atraumatically extracted with a minimally invasive technique to preserve the socket.A non-invasive flapless approach for implant placement was opted for. The surgical approach involved intrasulcular incisions around the remaining tooth structure to be extracted. A curette was used to luxate the roots mesio-distally, avoiding luxation labio-lingually as excessive force in labio-lingual direction can damage the labial plate. The marginal tissues buccally and lingually were displaced to gain access to the surgical site and for the subsequent usage of the periotome. The periotome was gradually worked circumferentially around the tooth, to severe some of the periodontal ligament around its coronal aspect, taking care not to use it as an elevator. (Fig.1). This resulted in the extraction of the tooth, which then simply needed to be picked up from the socket. (Fig.2)A periodontal probe was then used to verify the integrity of the four walls of the fresh socket. Once the tooth root had been extracted, it was imperative to thoroughly debride the socket walls. This was undertaken with a surgical spoon curette. The socket was then rinsed using a physiologic solution.

Figure 1: Use of a periotome to severe periodontal ligament fibres for atraumatic extraction.

Figure 2: Tooth to be extracted being picked up from socket.



Osteotomieswere performed via standard protocols in all cases, including surgical stents, slow-speed sequentialdrills, and copious irrigation. The drill tip was positioned along the palatal wall of the extraction socket; 3mm to 5mm coronal to the apical end of the extraction socket. A tapered screw-type implant that maximized the use of the bone beyond the original root apex without perforating the buccal plate was selected as it can greatly enhance stability. The root-form roughened-surface implant with dimensions best suited to obtain primary stability (Nobel Replace RP, Nobel Biocare, Switzerland) was placed into the prepared site in an optimal prosthetic position.(Fig.3).

All implants were placed with a minimum insertion torque of 25 Ncm, which was assessed by a torque wrench. A post-operative periapical radiograph was then taken to assess the implant placement (Fig.4). Amoxicillin (500 mg 3 times daily) was to be continued for 5 days post-surgery. A 0.2% Chlorhexidine gluconate mouthwash was prescribed twice daily for the next fifteen days.

Figure 3: Immediate placement of tapered screw-type implant into fresh extraction socket

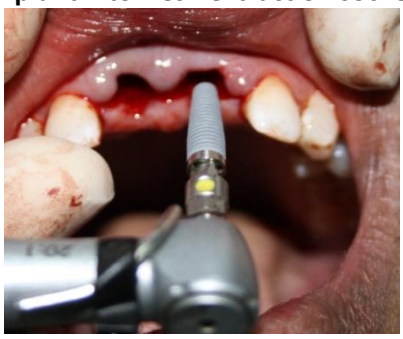
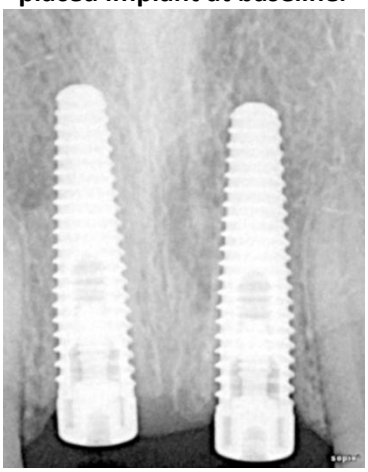
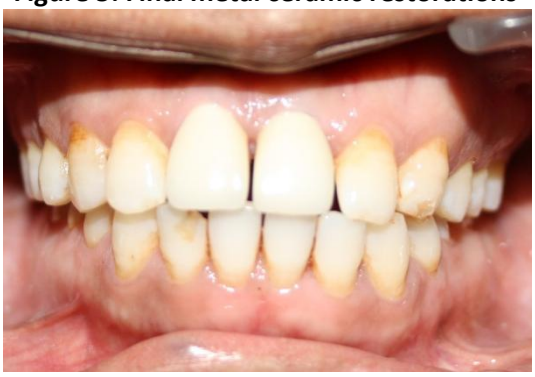


Figure 4: Post-operative radiograph of immediately placed implant at baseline.



Prosthetic protocol: Two weeks after the surgery, an acrylic-basedprovisional removable dental prosthesis (RDP) with wroughtwireclasps was made to replace the extracted teeth. Thesecond-stage surgical procedure was performed 3 monthsafter the first-stage operation. Transfer copings were inserted into the internal hex ofthe implant with a seating instrument and securedwith abutment screws. Impressions were taken witha silicon material using an individual impression tray.Metal abutments were screwed ontoosseointegrated implants, and temporary crowns werepositioned. Six months later, final metal ceramic restorationswere cemented on the abutments. (Fig. 5)

Figure 5: Final metal ceramic restorations



Follow up for implant survival: Follow up examinations were carried out at baseline, 12months and 24months after implant placement for pain, occlusion, prosthesis mobility and implant survival success. The success criteria were for implant survival as proposed by Buser[22]et al. and Cochran[23] et al. were followed, and they were: (1) implant stability at each control; (2) absence of pain or any subjective sensation; (3)absence of recurrent peri-implant infection; and (4) absence of continuous radiolucency around the implant.

Follow up for clinical parameters: The clinical parameters observed and recorded at baseline, 12months and 24months after implant placement were: (1)The probing depth(PD), (2) Modified plaque index(mPI), (3)Modified bleeding index(mBI) which was measured on the mesial, distal, buccal and palatal surfaces of the implants using a periodontal probe[24], (4) The distance between the platform of the implant and the marginal gingival level (MGL) which was measured at 4 sites per implant at the same surfaces as for the mPI, (5) The width of the keratinized mucosa (KM) which was recorded at the mid-buccal position.

Follow up for radiographic parameters: Intraoral digital radiographswere made at baseline and 12 and 24 months after implant placement. Periapical radiographs were taken perpendicular to the long axis of the implant with a long-cone parallel technique using an occlusal template to measure the marginal bone level. The changes in marginal bone height were measured over time. Vertical measurements were taken from the mesial and distal shoulder of the implant to the first bone-to-implant contact level in an axis parallel to the implant. To adjust each radiograph for distortion, the distance between the tips of three threads of the implant wasadditionally assessed and the vertical measurements were multiplied by the ratio between the manufacturer-specified thread pitch

and the observed distance. Furthermore, the periapical area of the implant was observed thoroughly for possible residual or newly formed periapical radiolucencies.

Statistical analysis: Clinical and radiographic parameters werereported for each group by both a measureof centrality (mean) and a measure of variability (standarddeviation: SD) at baseline, 12 and at 24 months. To compare differences between CG and TGdata at every time point, a Student two-tailed t testwas adopted for each clinical/ radiographic parameter that was tested.Data were processed using the Statistical Package for the Social Sciences and$P < 0.05$ was considered the threshold forstatistical significance.

Results: Implant Survival: Other than minor gingival inflammation in the first few days after surgery, no pain, mobility, flap dehiscences, suppuration, or radiolucency around the implant was reported during follow up. The survival rate for all implants in both the CG (n=10), as well as the TG (n=10) was 100% at all the time points evaluated.

Clinical parameters: Data obtained for clinical parameters are reported in Table 1. At the 24 months follow up, mean PD was 2.22+0.37 mm for CG and 2.11+0.32 mm for TG,mean mPI was 0.81±0.52 for CG and 0.79±0.81 for TG, mean mBI was 1.02±0.73 for CG and 0.71±0.24 for TG, mean MGL was 1.13±0.60 mm for CG and 1.02±0.14 mm for TG,and mean KM was 3.58±0.34 mm for CG and 3.56±0.21 mmfor TG. Between the CG and TG, no significant differences in the mean (±SD) values of PD, mPI, mBI, MGL, and KM were observed at any point from baseline to 24 months follow up.

With respect to the changes in clinical parameters from baseline upto the end of 24 months, the change in change in mean PD was 0.33±0.56 mm for CG and 0.17±0.86 mm for TG, the change in mean mPI was 0.19±0.57 for CG and 0.26±0.83 for TG, change in meanmBI was 0.43±1.06 for CG and 0.08±0.56 for TG, change in mean MGL was 0.24±0.75 mm for CG and 0.11±0.52 mm for TG, change in mean KM was 0.13±0.36 mm for CG and 0.25+0.67 mm for TG, change in mean KM was 0.13±0.36 mm for CG and 0.25+0.67 mm for TG. There was no significant difference between the control and test groups, with respect to the changes in any of the clinical parameters after 12 or 24 months follow up.

Table 1: Clinical parameters measured at baseline, 12 months and 24 months follow up

	Clinical parameters measured at baseline, 12 months and 24 months follow up						**Comparison between CG and TG by means of Student two-tailed t-test**		
Parameter	**Control Group (CG)n=10**			**Test Group (TG)n=10**			**P Value**		
	Baseline	**12 Months**	**24 Months**	**Baseline**	**12 Months**	**24 Months**	**Base Line**	**12 Months**	**24 Months**
PD	1.89+0.43	2.14+0.44	2.22+0.37	1.94+0.8	1.99+0.28	2.11+0.32	0.8637	0.3751	0.4861
PD: Difference with baseline		-0.25+0.61	-0.33+0.56		-0.05+0.84	-0.17+0.86		0.5500	0.6280
mPI	0.62+0.24	0.67+0.71	0.81+0.52	0.53+0.19	0.64+0.15	0.79+0.81	0.3648	0.8974	0.9483
mPI: Difference with baseline		-0.05+0.75	-0.19+0.57		-0.15+0.24	-0.26+0.83		0.6927	0.8285
mBI	0.59+0.78	0.79+0.84	1.02+0.73	0.63+0.51	0.65+0.21	0.71+0.24	0.8935	0.6153	0.2183
mBI: Difference with baseline		-0.20+1.14	-0.43+1.06		-0.02+0.55	-0.08+0.56		0.6583	0.3681
MGL (mm)	0.89+0.45	1.11+0.12	1.13+0.60	0.91+0.51	0.96+0.31	1.02+0.14	0.9269	0.1707	0.5793
MGL: Difference with baseline		-0.22+0.46	-0.24+0.75		-0.05+0.59	-0.11+0.52		0.4816	0.6578
KM (mm)	3.45+0.14	3.56+0.69	3.58+0.34	3.31+0.64	3.41+0.81	3.56+0.21	0.5078	0.6611	0.876
KM:Difference with baseline		-0.11+0.70	-0.13+0.36		-0.10+1.03	-0.25+0.67		0.9800	0.6239

Abbreviations:probing depth-PD, modified plaque index-mPI, modified bleeding index-mBI, marginal gingival level-MGL, width of the keratinized mucosa-KM

Table 2: Radiographic parameters measured at baseline, 12 months and 24 months follow up

	Radiographic parameters: marginal bone level measured at baseline, 12 months and 24 months follow up						Comparison between CG and TG by means of Student two-tailed t-test		
Parameter	**Control Group (CG) n=10**			**Test Group (TG)n=10**			**P Value**		
	Baseline	**12 Months**	**24 Months**	**Baseline**	**12 Months**	**24 Months**	**Baseline**	**12 Months**	**24 Months**
Mesial bone level (mm)	0.94+0.64	0.76+0.32	0.71+0.49	0.97+0.49	0.69+0.45	0.66+0.81	0.9076	0.6932	0.8692
Distal bone level (mm)	0.98+0.42	0.67+0.73	0.70+0.62	0.89+0.87	0.64+0.74	0.69+0.34	0.7717	0.9283	0.9648
Mean bone level	0.96+0.53	0.72+0.53	0.71+0.56	0.93+0.68	0.67+0.60	0.68+0.58	0.9136	0.8456	0.9076
Mean bone level: Difference with baseline		0.24+0.75	0.25+0.77		0.26+0.91	0.25+0.89		0.9578	1.0000

Radiographic parameters: Data obtained for radiographic parameters are reported in Table 2. At the 24 months follow up, the mean Bone level was 0.71±0.56 mm for the CG and 0.68±0.58 mm for the TG. Between the CG and TG, no significant difference in the mesial, distal or mean bone levels was observed at any point from baseline to 24 months follow up.With respect to the changes in mesial, distal or mean bone levels from baseline upto the end of 24 months, the level dropped by 0.25±0.77 mm for the control group and 0.25±0.89 mm for the TG. None of the changes in bone level after 12 or 24 months follow up were statistically different between control and test groups.

Discussion: In the present study, the results indicate that immediate implant placement into sockets with periapical pathologies, when compared to placement into non infected sockets, did not lead to any differences in clinical or radiographic parameters after

24 months. The implant survival rate at the end of 24 months was 100% in both groups. This implies that there is no biologic damage in the healing process associated with immediate implant placement in extraction sockets with chronic periapical lesions. The concept of immediate placement of implants after extraction of teeth with periapical infection is scarce in literature and still under debate[20,25,26,27]. Human clinical trials have implied that a history of periodontal or endodontic infection may be a potential and predictive indicator for implant infection and failure[28,29]. This has led many clinicians to consider infection as a contraindication to implant placement[28]. However, this study carried out in an Indian population, shows comparable success rates to other similar studies where implants were placed in the presence of chronic periapical lesions[17,26, 30, 31,32]. Most of these studies suggest that immediate implants maybe successful in infected sockets under a controlled procedure[17,28,29]. Findings in this study too, suggest that successful immediate implantation in debrided infected sockets mainly depends on the combination of complete removal of all contaminated tissues, controlled regeneration of the alveolar defect, antibiotic coverage, and chlorhexidine rinses[17,26]. According to Crespi et al[26],the high success rates of immediate implants placed in sockets with chronic diseases may be explained through the endoperiodontal origin of the infection, which is associated with anaerobic bacteria commonly restricted in the infected root canal (Fusobacterium, Prevotella, Porphyromonas, Actinomyces, Streptococcus, Peptostreptococcus)[26,33,34]. The subsequent variations in the anaerobic environment that occurred after the extraction and curettage of the socket would have led to the eradication of the associated endoperiodontalmicrobiota[26]. Moreover, the prescription of pre- and postoperative antibiotics may have established a favorable basis for bone healing and osseointegration[25,28,35].Further clinical and histological studies may allow a better understanding of the healing pattern in case of immediate implants placed in debrided infected sites. In this study, in addition to clinical and radiographic follow up, the

esthetic follow-up was lacking because implant survival was the sole variable to be investigated. Consistent esthetic results must be demonstrated before implant placement in infected sites as a suitable indication for implant therapy. Studies need to be conducted with a longer follow up period and a larger sample size. More studies are warranted to identify what are the best clinical protocols to efficiently handle infected post-extraction sockets with a minimally invasive approach.

Conclusion: Immediate implant placement into fresh post extraction sockets with chronic periapical lesions give comparable results with those placed in non–infected sockets, as far as the clinical and radiographic parameters are concerned. This is possible if appropriate clinical measures like antibiotic prophylaxis, meticulous cleaning and decontamination of the surgical sites are performed before the surgical procedure.

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