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RESEARCH ARTICLE

IMMEDIATE PLACEMENT OF IMPLANTS IN INFECTED EXTRACTION SOCKETS

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ABSTRACT

The aim of this study is to evaluate the efficacy of immediate implants in periapical infected extraction sockets. A prospective study was conducted on 24 patients and 30 implants were immediately placed into the extraction sockets after debridement and filling the defect with bone graft. All the implants were placed in maxillary single rooted teeth and mostly centrals (right and left) except one (1st premolar region). The parameters such as periapical radiolucency, marginal bone, peri-implant radiolucency, implant stability, gingival papilla score and buccal gingival height were analyzed over a follow up period of 3 months. All the 30 implants were osseointegrated successfully with good gingival aesthetics and improvement in marginal bone and a considerable decrease in the periapical radiolucency and peri-implant radiolucency after a period of 3 months. It can be concluded that immediate placement of implants in periapical infected sockets is a safe, effective and successful treatment option, provided certain procedures such as meticulous debridement of the socket proper placement of the implant and antibiotic administration are followed.

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INTRODUCTION

Immediate implant placement after extraction is a well-accepted protocol as there is short total treatment time, preservation of aesthetics, maintenance of the socket walls, reduced surgical time and better actual implant placement (Lindeboom *et al.,* 2006). According to conventional protocol, implant placement should be delayed up to 1 year after tooth extraction to allow for complete alveolar bone healing. But the disadvantage of complete socket healing is that it causes residual ridge resorption and later an added surgical stage is required after the extraction considerably reducing the bone volume which also compromises the favourable positioning of the implant. The conventional protocol is challenged by immediate implants which reduce the time period and number of surgical interventions, increases the chances of survival and also improved aesthetic maintenance of hard and soft tissue at extraction site and higher patient satisfaction (Batra *et al.,* 2011). Teeth associated with peri apical infections were a natural contra indication for immediate placement of end osseous implants as told by (Barzilay, 1993). It is more demanding while replacing maxillary anterior teeth because of quality and quantity of residual post extraction bone is lower and the aesthetic demands of the patient are high (Villa and Rangert, 2007). Novaes and Novaes reported that success can be achieved in immediate implant placement for replacement of teeth with periapical lesions if certain peri operative and post-operative measures are followed. Such measures include antibiotic administration, meticulous cleaning and alveolar debridement[5]. Several authors like Dell Fabbro *et al,* Crespi *et al,* and Lindeboom et al concluded that immediate implant placement in presence of chronic peri apical lesions could be considered a safe, effective and predictable treatment option. This study was undertaken to determine the stability and efficacy of implants when placed immediately after extraction of periapical infected single rooted maxillary teeth.

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MATERIALS AND METHODS

Sample Size

In this prospective study, the sample includes 24 randomly selected patients who visited the Department of Oral and Maxillofacial Surgery, GITAM Dental College and Hospital with periapical infection associated with single rooted teeth. All the patients were given detailed explanation of the study protocol and were asked to sign surgical consent forms. The primary indication for placement of immediate implants was either a maxillary anterior or a single rooted premolar. The implant sites selected were either single tooth sites (single implant placement) with six cases having adjacent implants (replacement of both maxillary central incisors). A total of 30 immediate implants were placed in 24 patients following the same treatment protocol for all the patients.

Inclusion Criteria

- Patients above 20 years who are able to tolerate the surgical procedure.
- Patients who have shown their consent to participate in the study and return for the follow ups.
- Patients having maxillary teeth that are indicated for extraction because of the presence of a chronic periapical lesion (clinical and radiographic evaluation).
- Patients having no discrepancies in soft and hard tissue levels with the surrounding teeth before extraction.
- Having adequate bone apical to the tooth to be replaced with immediate implant to obtain good primary implant stability (radiographic evaluation).
- Presence of sufficient mesio-distal space for the immediate implant placement.

Exclusion Criteria

- Patients having systemic diseases and under medication.
- Patients having deleterious habits like chewing tobacco, smoking and alcohol consumption.
- Patients not willing to participate in the study and unmotivated patients.
- Patients with poor oral hygiene
- History of any previous irradiation
- Metabolic or systemic disorders that might affect bone healing and delay osseointegration and preventing the primary stability of the implant.

Procedure

All the procedures were done under local anaesthesia (2% lignocaine hydro chloride with 1: 80,000 adrenaline). The extraction of the tooth was done atraumatically with the help of a periotome and forceps followed by the thorough curettage and debridement of the socket using Lucas curette. Osteotomy sites are then prepared with the bicorticed drill bits of appropriate lengths under proper saline irrigation to prevent thermal necrosis of the bone. Bone graft is used to fill the periapical defect and then the implant is placed and tightened in the clockwise direction with the hatchet/torque wrench. After the desired primary stability is achieved, cover screw is placed.

Statistical Analysis

All the statistical data was collected and tabulated using ANOVA test and the Friedman test. ANOVA, a parametric test was performed in all the variables and $p < 0.01$ was accepted as statistically significant.

Parameters

1) Marginal bone measurement

a) Mesial Marginal Bone (MMB)

The study shows that the mesial marginal bone (MMB) is maximum on the day of placement of the implant. MMB values have significantly decreased over a period of 3 months (p value < 0.01). This implies that the height of the mesial marginal bone has gradually increased from the day of placement to the end of 3 months.

b) Distal Marginal Bone (DMB)

The study shows that the distal marginal bone (DMB) is maximum pre op (ie; before extraction of the tooth). The DMB value gradually decreases over the period of 3 months follow up. This indicates the gradual increase in the height of the distal marginal bone over the 3 month period. There is highly significant difference in the values of DMB as compared to the pre op, day of placement, after 1 month, after 2 months and after 3 months because the p value is <0.01.

2) Peri-implant Radiolucency

a) Mesial Peri-implant Radiolucency (MPR)

The study shows that the mesial peri-implant radiolucency (MPR) significantly decreases from the day of placement over a period of 3 months with the highest value on the day of placement and the least value after the 3rd month follow up. There is highly significant decrease seen in the MPR from the day of placement to the end of 3 months as the p value is <0.01.

b) Distal Peri-implant Radiolucency (DPR)

The study shows that the distal peri-implant radiolucency (DPR) significantly decreases from the day of placement over a period of 3 months with the highest value on the day of placement and the least value after the 3rd month follow up. There is highly significant decrease seen in the DPR from the day of placement over a period of 3 months as the p value is <0.01.

3) Periapical Radiolucency

The study shows that the mean values of the periapical radiolucency significantly decreases from the day of placement over a period of 3 months. There is decrease in the mean value from the pre op to the 3rd month follow up with the highest value at pre op and the least value after the 3rd month. Thus, it can be inferred that the periapical radiolucency significantly decreases from the day of placement over a period of 3 months as shown in figure 1.

4) Gingival Papilla Score

Out of the 30 implants included in the study, 40% scored 2 while 60% scored 3. This shows that the gingival architecture is well maintained at the end of 3 months. [0 = no papilla; 1 = less than one half of gingival embrasure; 2 = at least one half of the height; 3 = complete closure of the proximal space; 4 = overgrowth]

5) Buccal Gingival Height

21 implants out of 30 have a score of 1, 6 have a score of 2 and 3 implant region scored 3. This shows that buccal architecture is maintained at the end of 3rd month. [0 = no difference in gingival level; 1 = less than 1mm difference; 2 = less than 2mm difference; 3 = less than 3mm difference; 4 = differences in buccal gingival outline > 3mm]

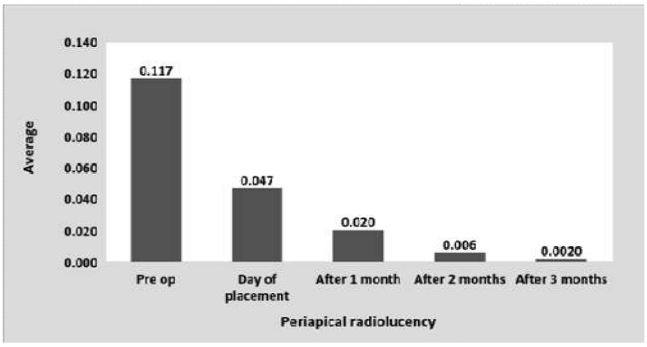

Figure 1. Decrease in periapical radiolucency over a period of 3 months

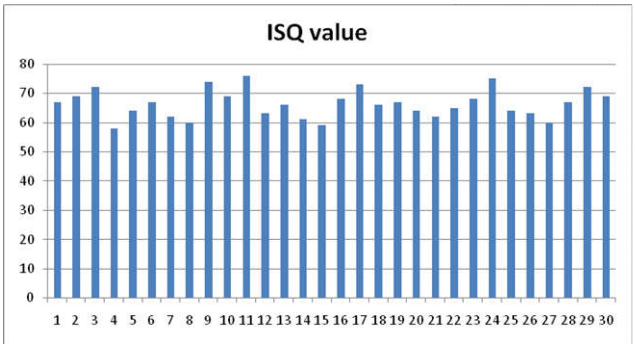

Figure 2. Implant Stability Quotient values for all 30 patients

Figure 3 Osstell apparatus for measuring implant stability

6) Implant Stability:

The primary implant stability was analyzed immediately on the day of placement of the implant and then the implant stability was measured at the end of the 3rd month follow up. ISQ values measured on a scale of 1-100; high stability if ISQ > 70, medium stability if ISQ between 60-69, low stability if ISQ < 60. Even though the p value was not significant (p-0.45), medium stability was found in most of the cases with a mean of 66.33 as shown in figure 2. ISQ, or Implant Stability Quotient, is a scale from 1 to 100 and is a measure of the stability of an implant. Implant Stability Quotient (ISQ) is an objective world standard for measuring stability of the implant. The clinical range of ISQ is normally 55-80. Higher values are generally observed in the mandible than in the maxilla. The ISQ scale has a non-linear correlation to micro mobility. With more than 750 scientific references, we now know that high stability means >70 ISQ, between 60-69 is medium stability and < 60 ISQ is considered as low stability.

Figure 4. After implant and cover screw placement in 14 region

Figure 5. After crown placement in 14 region

DISCUSSION

The history of the evolution of dental implants is a rich and fascinating travelogue through time. Since the beginning of mankind, humans have used dental implants in one form or another to replace missing teeth. From the past three to four decades, replacement of single rooted missing teeth has been accomplished effectively by the removable partial dentures and the fixed partial dentures. The RPDs have the disadvantages such as not aesthetically appealing, may cause oral infections, effects speech and mastication due to bulkiness, need to be removed every day, cause bone loss in the area and even mobility of the supported teeth. The disadvantages of FPDs are that they require trimming of the adjacent teeth which act as abutment teeth, periodontal disease of the adjacent abutment teeth causes failure of FPD, secondary decay of abutment teeth cause failure and not possible when the abutment teeth are angled in different directions. These disadvantages of the RPDs and FPDs have led to the beginning of the implants for the replacement of the missing teeth. The goal of modern dentistry is to restore the patient to normal contour, function, comfort, aesthetics, speech and health whether by removing caries from a tooth or replacing the tooth. What makes implant dentistry unique is the ability to achieve this goal regardless of the atrophy, disease or injury of the stomatognathic system. The implants can be placed in healthy bone of the missing teeth area, they can be placed adjacent to periodontally weak teeth, they are not bulky and are aesthetic. The advantages of single tooth implants over FPD are high success rate, decreased risk of caries of adjacent teeth, decreased risk of endodontic problems on adjacent teeth, improved aesthetics of adjacent teeth, decreased cold or contact sensitivity of adjacent teeth and decreased abutment tooth loss. The concept of immediate implants is even gaining popularity particularly in the maxillary anterior region as there is immediate replacement and with good results. As compared with delayed implant placement, the advantage of immediate implant is that it reduces the time period and number of surgical interventions,

high chances of implant survival rate and also improved aesthetic maintenance of hard and soft tissue at extraction site and higher patient satisfaction. Immediate implant placement after extraction is a well-accepted protocol as they have an advantage of short total treatment time, preservation of aesthetics, maintenance of the socket walls, reduced surgical time and better actual implant placement (Lindeboom *et al.,* 2006). This prospective randomized study is conducted on a sample of 24 patients to study the efficacy of the 30 immediately placed implants in periapical infected sockets (Saketh *et al.,* 2016). The parameters analyzed were the implant stability (Prakash *et al.,* 2016), marginal bone condition on the mesial and distal sides, periapical radiolucency and peri-implant radiolucency on the mesial and distal sides, gingival papilla score and buccal gingival height over a follow up period of 3 months.

Many studies on immediate placement of dental implant in fresh extracted socket had been conducted with success of above 90% in all the studies and is now become a well-established protocol (Batra *et al.,* 2011). Immediate implant placement in post extraction sites, without waiting for the site to heal is a treatment modality that has received much attention (Villa and Rangert, 2007). Immediate implant placement may reduce alveolar ridge resorption after tooth extraction by maintaining a percentage of the residual bone volume, thereby reducing the number of surgical appointments and treatment time. Placing the implants in a favourable position for an optimal restoration is also possible (Bruno *et al.,* 2014). Till date, only few studies (Salazar *et al.,* 2014) have reported on the clinical outcomes of immediate implants inserted in post extraction sockets. The technique of immediate implant placement was first described by Lazzara[8] in 1989. This one step surgical procedure reduces treatment time, improves aesthetic outcomes, increases comfort during healing and has proven to be a predictable strategy with a high success rate in the absence of periapical lesions. In contrast with the traditional protocol, the immediate placement of an implant after tooth extraction also maintains the horizontal and vertical dimensions of the osseous tissues and keeps the implants at the same angulation as the pre-existing natural teeth (Salazar *et al.,* 2014).

The findings of Schropp et al and Botticelli *et al.,* 2014 demonstrated that most of bone remodeling occurs 3 to 6 months after tooth extraction. The immediate implant technique also has similar survival rates when compared with implantation into a healed socket. Following immediate tooth extraction, there is a progressive alveolar ridge resorption, thereby causing bucco-lingual and apico-coronal alveolar bone reduction which compromises the favourable positioning of the implants especially in the aesthetic zone. Despite using many ridge preservation techniques such as bone grafts, membrane barriers, etc., the dimensions of the alveolar ridge were not favourable for delayed implant placement which otherwise favoured immediate implantation. The various benefits of immediate implantation in the aesthetic zone are significant reduction in treatment time, decreased loss of alveolar bone and immediate replacement of the missing tooth. Hence, immediate implants have been chosen for this study. Some authors consider placement of implants in chronic apical lesions a contraindication (Lindeboom *et al.,* 2006). According to the conventional protocol, implant placement should be delayed up to 1 year after tooth extraction to allow for complete alveolar bone healing. Periodontally (Kumari *et al.,* 2016) and endodontically compromised teeth that are indicated for extraction are involved with infectious condition which conventionally contraindicates the immediate replacement with end osseous dental implants. Many authors have suggested that this procedure should be avoided in the presence of periapical and periodontal pathosis (Batra *et al.,* 2011). Barzilay reported that the teeth with periapical pathosis or active periodontal disease are not suitable for immediate implant. Becker and Becker agree with this report (Batra *et al.,* 2011). Novaes and Novaes (Fugazzoto *et al.,* 2012) reported that in immediate implant placement for replacement of teeth with periapical lesions; success can be achieved if certain pre-operative and post-operative measures are followed such as antibiotic administration, meticulous cleaning and alveolar debridement. Assuming specific diagnostic and therapeutic protocols are followed, and that primary implant stability can be attained in the desired prosthetic placement, implant placement should not be avoided on the basis of the presence of periapical pathology (Truninger *et al.,* 2010). Ericksson *et al.,* SDS suggested that proper antibiotic coverage with immediate implant surgery could minimize the implant failure rate. Various studies on immediate implant placement in fresh extraction sockets confirm that healing and osseointegration were simultaneous processes. They suggested that the conditions associated with the repair of extraction socket may be favourable for integration of dental implants (Batra *et al.,* 2012). Even though some local and systemic factors could contraindicate dental implant placement, recent investigations verify that the presence of a peri-radicular infection may not be an inconvenience for immediate implants if the surgical sites are appropriately cleaned and decontaminated (Salazar *et al.,* 2014). So this study is designed for immediate placement of implants in single rooted infected extraction sockets of the maxillary teeth. In this study, the success rate of immediate implants in periapical infected sockets was 100%, the mean stability was found to be 66.33, the mean marginal bone loss was found to be 1.10 on the mesial side and 0.80 on the distal side, gingival papilla presented a healthy score of 3 in most of the patients (60%), a significant decrease in the periapical defect after filling with bone graft over a period of 3 months Thus, indicating the usage of immediate implants in infected extraction sockets following proper precautions such as antibiotic administration, proper cleaning and alveolar debridement as described by Novaes *et al.,* 1995.

Conclusion

- At the end of 3 months, good stability was seen in all the cases.
- Soft tissue parameters such as gingival papilla and buccal gingival height markedly showed good aesthetic results in most of the cases.
- Radiographically, there was a reduction observed in various parameters such as peri-implant radiolucency, periapical radiolucency and marginal bone all of which indicate the successful osseointegration of the implant and the healing of the periapical defect.
- It can be concluded from this study that immediate placement of implants in periapical infected sockets can be considered a safe, effective and successful treatment option when appropriate peri-operative procedures are undertaken for the debridement of the periapical lesion. However, further studies with larger sample size should be undertaken.

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