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Bridging the Gap: Immediate Implant Placement in Extraction Socket- A Clinical Case Series & Outcome Analysis

[1]Dr. Krupa Chokshi, Department of Oral and Maxillofacial Surgery, 3rd Year Resident, Mahatma Gandhi Dental College and Hospital, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur, India

[2]Dr.Vikas Kunwar Singh, Professor and Head, Department of Oral and Maxillofacial surgery, Mahatma Gandhi Dental College and Hospital, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur, India

[3]Dr. Ruchika Tiwari, Professor, Department of Oral and Maxillofacial Surgery, Mahatma Gandhi Dental College and Hospital, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur, India

[4]Dr. Bhavani Singh Rathore, Maxillofacial Surgeon, Tulsi Dharania Memorial Cancer Hospital, Bikaner, India

[5]Dr.Mahima Jain, Department of Oral and Maxillofacial Surgery, 3rd Year Resident, Mahatma Gandhi Dental College and Hospital, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur, India

Corresponding Author: Dr. Krupa Chokshi, Department of Oral and Maxillofacial Surgery, 3rd Year Resident, Mahatma Gandhi Dental College and Hospital, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur, India

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Abstract

The purpose of this study was to evaluate the stability of dental implants placed immediately into fresh extraction sockets over a period of six months. Ten patients with a single tooth indicated for extraction were treated by removing the indicated tooth, followed by the immediate placement of dental implants into fresh extraction sockets. The clinical parameters recorded were Radiofrequency Analysis (RFA) and the presence or absence of pain and discomfort. The radiographic parameters included IOPA radiographs and orthopantomogram (OPG). All 10 patients, with a mean age of 30.4 years, were regularly followed up during the entire six-month period. Radiographic analysis of IOPA showed a statistically significant crestal bone level distally around the implant. There was no radiographic appearance of periapical radiolucency. The implants remained clinically stable during the follow-up period, which was statistically significant. The Implant Stability Quotient (ISQ) values for all implants were also statistically significant.

Keywords: Immediate implant, extraction socket, implant stability, ISQ, crestal bone level, periapical radiolucency

Introduction

The goal of modern dentistry is to provide a healthy and beautiful smile supported by a functional and comfortable occlusion while preventing tooth loss. However, in certain cases, extraction is the only viable treatment option. In the anterior region, tooth loss is particularly distressing for patients as it affects aesthetics, speech, and function [1]. Several options are available for replacing a single missing tooth. One option is a removable partial denture; however, most patients are dissatisfied due to the bulk of metal and acrylic and the unsightly clasps required for prosthesis stabilization [2].

Today, the two most common treatment options for single tooth replacement are fixed partial dentures and implant-supported prostheses. Due to the advantages provided by implant-supported prostheses—such as improved aesthetics, better hygiene accessibility, osseous preservation, and reduced future maintenance—all at a comparable cost, single-tooth implant replacement is becoming the more viable option for many patients [3,4].

The replacement of a tooth using an implant stem from advancements in concepts, technology, and clinical applications following years of research on the concept of osseointegration[5].

The method of osseointegration, developed by many researchers, is well documented[6]. New protocols have been developed in which implants are placed at the same time as the extraction of a tooth or soon after, before significant bone resorption occurs. The modified protocol, in which implants are placed at the time of tooth extraction, is known as immediate implantation[7].

Since the first report of the placement of a dental implant into a fresh extraction socket, research and clinical studies in humans have been encouraging. Evaluations of unloaded titanium implants in extraction sockets have shown high levels of bone integration at the implant interface[8]. The immediate placement of implants into extraction sockets appears to be a safe and predictable method[9].

After natural tooth extraction, the greatest reduction in alveolar or crestal bone occurs within the first six months to two years[10]. The healing process following tooth extraction leads to a reduction in the external contours of the ridge, accompanied by the filling of the socket with newly formed bone[11]. If extraction sockets are left untreated, changes in their internal and external dimensions and the residual alveolar ridge can lead to bone deficiencies, which may contraindicate the placement of dental implants[12].

Immediate implant placement into a fresh extraction socket allows implants to be placed during the same visit in which the tooth is extracted. This approach reduces treatment time and cost, preserves gingival aesthetics by preventing alveolar ridge atrophy, and increases patient comfort[13]. The primary advantage of immediate implant placement is the reduction in healing time. Since the implant is placed at the time of extraction, bone-to-implant healing begins immediately alongside the natural extraction site healing. (Fig 1 – b) Another advantage is that normal bone healing, which typically occurs within the extraction site, takes effect around the implant[14].

Due to the high success rates of dental implants, many implant systems have been introduced to the market [15].

The purpose of this study is to determine the stability of dental implants placed immediately into fresh extraction sockets using ISQ and to radiographically evaluate the bone height mesially and distally to the dental implants over a six-month period post-implant insertion.

Aim

The aim of the study was to evaluate the stability using ISQ and radiologically evaluating the bone height mesially and distally in an immediately placed implant into extraction socket

Objectives

1. To evaluate the stability of the implant using ISQ.
2. To evaluate the crestal bone level at mesial site around the peri-implant surface radiographically
3. To evaluate the crestal bone level at distal site around the peri-implant surface radiographically
4. Evaluate clinically the presence or absence of pain and discomfort according to (Visual Analogue Scale)
5. Presence or absence of periapical radiolucency on intra oral periapical radiographs pre and post operatively

Material and Method

Patient Selection

The patients for this study were selected from the Out Patient Department of Oral & Maxillofacial Surgery, Mahatma Gandhi dental College and Hospital, Jaipur. Patients who were found to have maxillary and mandibular teeth indicated for extraction were selected.

Criteria for selection of patients:

Inclusion Criteria

1. Patients (male or female) within the age group of 20 -55 years.
2. Presence of a single failing tooth with intact adjacent dentition
3. Sufficient bone availability apical to the extraction site for stabilization.
4. Patients with good oral hygiene.
5. Adequate bone volume to accommodate an implant of appropriate dimension.
6. Multiple or total extraction cases requiring fixed prosthesis with loss of distal abutment

Exclusion Criteria

1. Presence of active infection around the failing tooth
2. A medical history that would complicate the outcome of the study. such as alcohol or drug dependency, history of smoking, poor health or any other medical, physical or psychological reason that might affect the surgical procedure or the subsequent prosthodontic treatment and required follow- up.
3. Dental history of bruxism, para-functional habits and / or lack of stable posterior occlusion
4. Perforation and / or loss of labial bony plate following tooth removal.
5. Insufficient bone quantity as determined by pre-extraction radiographs and clinical inspection before implant placement (E.g.: Local cysts, soft tissue ulceration, insufficient healing of previous extraction site).
6. Insufficient vertical inter-arch space to accommodate the prosthodontic components available, together with a proposed pontic and occasional gingival analog designs.
7. Patients with TMJ disorders.

Pre- treatment records

1. Detailed medical and dental history
2. Clinical parameters
3. Per apical and panoramic radiographs/CBCT
4. Clinical photographs.
5. Identification of anatomic landmarks in relation to implant site was done.

Clinical Parameters

After implant placement all implants were recorded and evaluated with the following clinical parameters at baseline, and at the time interval of 3 months, 6 months

1. PAIN (According to Visual Analogue Scale)

Degree of pain by 4-point VAS scale baseline, 3months and 6months post-operative day. Patients were asked to indicate the pain along the line that represents perception of their pain. The VAS score out of 10 was determined by measuring the distance from the left end of the line to the point that the patient indicates. Pain was recorded according to visual analogue scale.

NONE 0

1-3 MILD

4-6 MODERATE

7-10 SEVERE

2. Stability was tested manually and graded according to Resonance Frequency Analysis RFA procedure (Fig 2 - a)
3. Radiographic parameters

a) IOPA radiographs were taken at the time of implant placement, and at the time interval of 3 months, 6 months to interpret the peri-apical radiolucency at the apex of the implant.

b) To access the crestal bone level changes around the implant surface on Intra oral peri-apical radiograph at the time interval of 3 months and 6 months

Investigations

Complete hemogram, which included Hb%, RBS, HBSAG bleeding time and clotting time were done to evaluate the fitness of the patient for stage I surgery or implant placement. Rapid ELISA HIV testing was done to rule out the presence of HIV infection

Pre-medication

Patients were given one capsule of Amoxicillin + Clavulanic 625 mg 12 hours before and one capsule of Amoxicillin + Clavulanic 625 mg 1hr before the procedure.

Surgical procedure

A total of 10 patient's male or female with a mean age of 30.4 years, each having at least one tooth indicated for extraction (either maxillary and mandibular teeth) were selected and implants were placed into extraction sockets using implant system (Fig 2 – b, 3). After implant placement all implants were recorded and evaluated with the following clinical parameters at baseline, 3 months, 6 months Periapical radiolucency and pain and discomfort and implant stability according to implant stability quotient were assessed. (Fig 5)

Radiographic parameters: IOPA radiographs were taken using the long cone paralleling technique and assessed at the time of implant placement, at 3 months, 6 months. [Fig 4 (d), (e), (f)]

All clinical and radiographic parameters were subjected to statistical analysis. All the implants were stable at the end of 6-month period. Radiographic evaluation of crestal bone of the implant with intraoral peri-apical radiograph at distal sites revealed significant decrease in bone height indicating bone remodeling around the implant.

Results

The purpose of this study is to determine the stability of dental implants placed immediately into extraction sockets. Radiographically evaluating the crestal bone level mesial and distal to the dental implants placed. The stability of dental implants was evaluated upto 6 months. A total of 10 patients, each having at least one tooth indicated for extraction (either maxillary or mandibular teeth) were selected and immediate implants were placed into fresh extraction sockets during this study. After implant placement all implants were evaluated with the following clinical parameters at baseline, 3 months, 6 months.

1. Changes in Crestal bone level
2. Stability according to implant stability quotient
3. Peri-apical radiolucency with IOPA
4. Pain & Discomfort by Visual Analogue Scale

The interpretation of our study revealed that no statistically significant difference was present between the gender. There was no statistically significant difference in mesial height of crestal bone level in implant site after 6 months. Statistically significant difference was present in decrease in the height of crestal bone level distal to implant site after 6 months Statistically significant difference was found at baseline and 3 months of ISQ values which is suggestive of increased stability of implant at the end of 3rd month. No peri-apical radiolucency was seen at the end of 3rd month and 6th month post implant placement baseline and after 6 months. There was a significant decrease in the pain levels after 6 months.

Discussion

Dental implant therapy is a pioneering treatment modality for the replacement of missing teeth. It has gained popularity and acceptance among both patients and dentists. Patients receiving implant-supported prosthetic rehabilitation report higher satisfaction in terms of comfort, stability, and aesthetics when compared to conventional prostheses.

Aman Sachdeva et al. studied implant stability and crestal bone levels and concluded that there was no significant crestal bone loss at the end of 12 months, and implant stability was achieved (16). In contrast, our study showed significant crestal bone loss on the distal side, although implant stability after six months was consistent with their findings.

Durga Prasad et al. evaluated implant stability and bone loss after immediate implant placement and found that the implants remained stable after six months, with no signs of periapical radiolucency, pain, or discomfort—similar to our findings. However, they observed significant mesial and distal bone loss, whereas our study showed significant loss only on the distal side[17].

P. Singh et al. conducted a study on implant stability and bone loss after six months and reported similar outcomes to our study, showing both implant stability and crestal bone loss[18]. Sahitya Sanivarapu et al. carried out a nine-month study and concluded that the implants were stable, with no pain or periapical radiolucency—suggesting good osseointegration—which aligns with our findings. However, while they observed bone loss on both mesial and distal sides, our results showed more significant loss on the distal aspect[19].

In this study, the lower border of the crest module of the implant was used as a fixed reference point, and bone height on the mesial and distal sides was assessed. After statistical analysis, the p-values for mesial and distal bone loss were 0.095 and 0.041, respectively. These results indicate that bone loss on both sides was statistically significant, particularly on the distal side. This finding is consistent with the study conducted by Pecora G et al., who highlighted the importance of radiographic evaluation in assessing peri-implant bone health and stability[20].

Intraoral periapical radiographs were taken at baseline, 3 months, and 6 months using the long cone paralleling technique. These radiographs were subjected to digital analysis. After identifying the region of interest (ROI), the bone height was measured from a fixed reference point on the implant.

Anshul Chugh et al. studied crestal bone loss after implant placement and concluded that bone loss does occur when immediate implant placement is done, which corresponds with the findings of our study (21). Preetha Balaji et al. conducted a study on implant stability and crestal bone loss in immediate implants and concluded that significant stability was achieved. Their findings of reduced crestal bone levels mesially and distally support

our results, particularly the significant distal bone loss observed [22].

Helpful Hints

Legend Figures

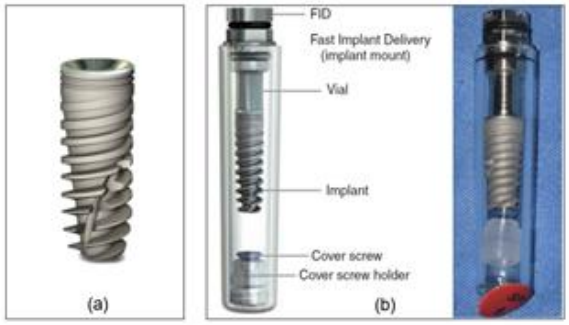

Fig 1: (a) Implant fixture (b) implant and its components which the implant packet usually contains.

Figure 1:

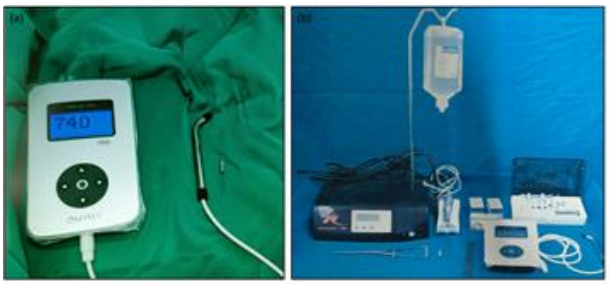

Fig 2: (a) Osstell ISQ for resonance frequency analysis (b) Dental surgical and implant system

Figure 2:

Fig 3- Dental implant system

Figure 3:

Figure 4: Immediate implant placement

Figure 5: 3 months follow up RFA

Conclusion

The following conclusions in our study which was done to evaluate stability of dental implants placed immediately into fresh extraction sockets

1. Radiographic evaluation of intraoral peri-apical radiograph of the implant at distal sites revealed significant decrease in crestal bone level indicating bone remodelling around the implant.
2. Patients initially though complained of pain and discomfort, at the end of the study none of the patients complained of pain and discomfort In all

patient implant stability quotient was statistically significant.

3. None of the patient in our study had peri-apical radiolucency as shown in intra oral peri-apical radiograph. Our study clearly demonstrated in a group of patients the Our stability of immediate implants in extraction socket is 100% during follow-up period of 6 months.

Possible explanations may be proper case selection, diagnosis, aseptic method of surgery, maintenance of labial cortical plate and good oral hygiene maintenance during follow-up period. In order to increase our understanding, studies need to be conducted with longer duration and more samples.

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