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CASE REPORT

Prosthetically Driven Implant Placement with Immediate Function in the Esthetic Zone - A Case Report

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ABSTRACT

A waiting period of two weeks after osteotomy increases the surrounding tissue activity to its maximum level as collagen formation and neo-angiogenesis represents a relaxed and acceptable implant bed configuration. In this case delayed implant placement protocol and conventional implant placement was followed with immediate function of esthetics, phonetics and comfort with implant restoration in the esthetic zone with minimal invasive approach. Early osteotomy with delayed implant placement showed lesser bone resorption and higher success rates than conventional implant placement.

Keywords: Conventional implant placement, Early osteotomy with delayed implant placement, Provisionalization, Immediate loading, Esthetics

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INTRODUCTION

The last decade has seen a profound shift in implant dentistry from function to esthetics, with esthetics enhancing the patient's need and desires. The focus evolved from a "*surgically driven approach*" to a "*prosthetically driven approach*" with the goal of optimizing and maintaining esthetics (1). The delicate balance between the function and esthetics must be maintained as they both complement the treatment outcome.

Switching from the lengthy healing original protocols to immediate loading has demanded a veritable intellectual revolution, a cognitive rupture, a paradigm shift. Immediate-loading of oral implants is an innovative and attractive treatment method available in implant dentistry today. It is recommended that special surgical techniques be used to increase bone density in the implant bed before implant insertion to improve primary stability - a gold standard to reduce micromovements and to establish long term success for immediate loading (2).

A newer concept of early osteotomy with implant placement delayed for approximately two weeks has revealed to augment the surrounding tissue activity to its maximum level in view of the fact that collagen formation and neoangiogenesis represents a relaxed and acceptable implant bed configuration. Thus, offering a relaxed healing implant bed all set to receive a fixture is undoubtedly preferable than inserting a fixture in a traumatized and heated site. For that reason, a healthier method that enhances the alveolar binding capability before implantation is always preferred (3).

TREATMENT PLAN

Patient with missing maxillary central incisors reported to the clinic. She was motivated and committed for implant placement in the esthetic region. Patient had adequate amount of bone volume and quality with sufficiently sculpted and stable soft tissue architecture (4, 5).

A standardized implant integration protocol included the principles of subject selection, site evaluation and grouping,

proper planning, pre-operative preparation, optimal implant placement and implant specified provisional and definitive restoration.

PRETREATMENT RECORD

The basic principle of health care to sign the consent form was accomplished by giving sufficient information about the proposed treatment protocol and the possible alternatives.

The patient was comprehensively examined both intraorally as well as extraorally. Implant sites were evaluated for esthetic smile line, gingival architecture, adjacent tooth morphology and osseous architecture.

Hematological and biochemical investigations were done to evaluate the surgical fitness for implant placement.

Standardized Intra-Oral Periapical radiographs, Orthopantomographs and Computed Tomography scans were taken to check for the proximity to anatomic landmarks and evaluation of the mesiodistal and buccolingual bone width (6).

PRETREATMENT PLANNING

Study models and working cast models were prepared for occlusal evaluation and record purposes. An esthetic wax up of the proposed implant site was constructed on the working cast model (5).

RIDGE MAPPING (IMPRESSION TRACING METHOD)

Putty index was made of the edentulous region extending upto two teeth either side, labially till the vestibular fornix and onto the palatal side. Index was cut vertically from the centre of the highest point of the ridge. Then, outline was traced on to a paper (7).

BONE SOUNDING

Four to six lines were marked on the cut surface of the putty index perpendicular to the mucosa,approximately 7 mm apart on labial surface, crestal region and on the palatal surface. The endodontic reamer with rubber stopper was used to measure the thickness of soft tissue along the lines marked on index after the edentulous area was anesthetized. The measurements were recorded (7).

EVALUATION OF BUCCOLINGUAL WIDTH

The dots were then connected with a marker in order to obtain the osseous contour at the centre of edentulous region. Then, the tracing so obtained was superimposed with the transparent radiographic guide provided by the manufacturer to evaluate the dimensions and direction of implant placement (7).

PREPARATION OF SURGICAL AND RADIOGRAPHIC TEMPLATE (8)

With the help of Intraoral Periapical radiograph and tracing so obtained, the emergence profile and the shape of the restoration were reproduced on the surgical template prepared from transparent heat cure polymerizing resin. First, the surgical template served the purpose of radiographic template when a hole was made through the middle of the incisal edge where gutta percha cone was inserted to relate the ideal prosthetic axis on the intraoral periapical radiograph (Figure 1). Then, the hole was widened which helped in guiding the lance drill during osteotomy for marking the optimal implant location on the alveolar crest in order to verify the implant position during placement.

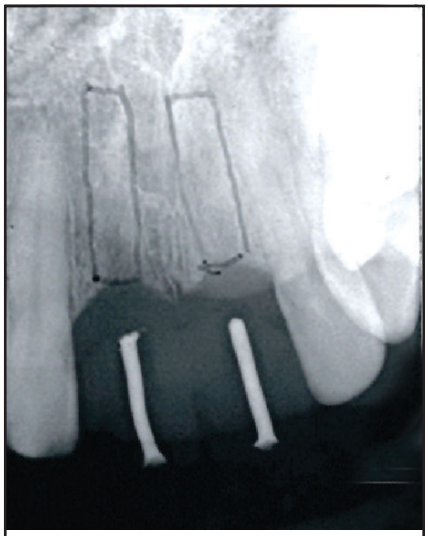

Figure 1: *IOPA radiograph with Gutta Percha in template*

PRESURGICAL PROTOCOL

Principles of presurgical preparation were strictly adhered to. Interdisciplinary treatment was initiated to treat active dental or periodontal infections. Oral prophylaxis was done before the scheduled implant placement. Patient was advised to use 0.12% chlorhexidine gluconate mouthwash, twice daily for a period of 15 days. She was given Amoxicillin 2g and Diclofenac Sodium 50 mg 1hour before the procedure. The antibiotic regimen was continued for the next 5 days. The surgical site was anaesthetized with local anaesthesia by giving indicated nerve block and/or infiltration.

SURGICAL PROCEDURE

For delayed implant placement

After achieving adequate local anesthesia, a minimally invasive paracrestal mucoperiosteal flap not involving buccal and palatal mucosa was placed on the planned test site for osteotomy with No.11 Bard Parker blade (Figure. 2).

Full thickness flaps were elevated using periosteal elevator to expose the alveolar crest. Then, preparation of osteotomy specific to implant dimensions as per manufacturer's instructions was performed (Figure 3).

Figure 2: *Incision at implant site*

Figure 3: *Osteotomy for left implant placement*

Figure 4: *Implant Placement*

The flap margins were then repositioned and sutured tension free with a 3'0 braided silk suture. After about 7-10 days, sutures were removed.

After about two weeks, osteotomy site was exposed with soft tissue punch. Then, slight curettage of the socket and irrigation with saline was accomplished.

The implant was removed under aseptic conditions from its sterile package, carried to the prepared implant site by holding the implant mount with a mount driver and was placed into the site and threaded to the desired depth with the help of torque controlled hand wrench (Figure 4).

The mount was then removed with the help of fixture mount removal tool. After a high degree of primary stability was achieved (indicated by insertion torque of 30 Ncm or more), abutment of required dimension into the fixture with the help of abutment driver.

For conventional implant placement

After achieving adequate anaesthesia, planned control site for osteotomy was marked with the help of a periodontal probe using presurgical prosthetic guide

Figure 5: *Pre surgical guide*

template (Figure 5). A manual soft tissue punch was rotated around the marking till alveolar crest was felt. Then, a periosteal elevator was used to expose the alveolar crest. Then, preparation of osteotomy specific to implant dimensions as per manufacturer's instructions followed by conventional implant placement immediately after osteotomy (Figure 6).

Post Operative Care and Post surgical instructions(9)

Patient was advised to continue with antibiotics and analgesics given before surgery for five days. She was instructed to follow an appropriate soft diet for one week. Brushing was advised as usual and instructed to rinse gently with a 0.12% chlorhexidine mouth rinse two times a day until the wound was healed. She was instructed to visit for regular follow up.

RESTORATIVE PROCEDURES

Abutment Placement (Test and Control Group)

After the implants were placed in their desired position, straight rigid abutments of recommended dimensions were screwed with the help of torque controlled hand wrench with an insertion torque of 20-25 Ncm (Figure 7).

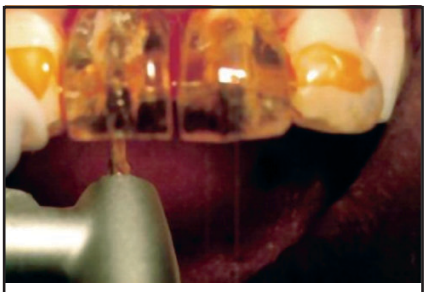

Figure 6: *Osteotomy for right implant placement*

Provisionalization

After placement of abutment, impression was made with rubber base impression material and sent to laboratory where esthetic and non-functional acrylic provisional restoration was fabricated. After about 24 hours, provisional restoration was cemented with temporary Zinc Oxide eugenol cement. (Figure 8) It was assured that the provisional restoration was kept out of contact in centric as well as eccentric occlusion.

Fabrication of Definitive Restoration

After about 6-8 weeks of implant placement, the process of fabrication of definitive restoration was taken up, after a clinical and radiographic evaluation of the implant (Figure 9).

Provisional crowns given over the abutment were removed for making of final impression. Plastic Impression cap was

Figure 7: *Abutments in place*

Figure 8: *Provisional restoration*

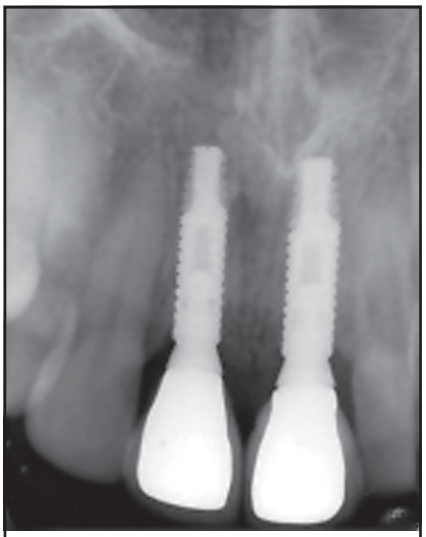

Figure 9: *Post-operative IOPA radiograph*

Figure 10: *Post operative view*

seated on to the abutment and a final impression was made using addition silicone impression material to obtain abutment level impression. Abutment lab analog was then seated into the impression cap which got transferred to the cast when impression was poured with type IV dental stone. Metal trial was done before the fabrication of porcelain fused to metal definitive restoration to evaluate occlusion in centric and eccentric contacts.

All the porcelain fused to metal definitive restorations were cemented using glass ionomer cement (Figure10).

Clinical Parameters Assessed

The following clinical parameters were recorded with the placement of definitive as baseline, 1st month, 3rd month, 6th month and 9th month, afterwards.

- Modified Plaque index (10)
- Simplified Gingival index (10)
- Bleeding index (10)
- Keratinized mucosa index (11)
- Probing depth (12)
- Implant Mobility (13)

For the implant site, all the indices were recorded by visual examination, of the four surfaces of the implant i.e. mesial, buccal, distal and lingual or palatal.

The score for the implant site was obtained by totaling the scores, of each surface of the implant, and dividing the obtained score by four.

Radiographic Parameters

Intra oral periapical radiographs were taken with long cone paralleling technique with exposure time of 0.8 seconds at baseline, 1st, 3rd, 6th and 9th month interval. All the obtained radiographs were digitalized using flatbed double width photoscanner at 200dpi, 8 bits, 256 grey scales and saved as bitmap image. For each digitized radiographic image, mesial and distal measurements were made from the inferior edge of the implant collar (first thread) as a reference point to the observed point of contact of the bone and implant with the help of image tool software, University of Texas Health Science Center in San Antonio (UTHSCSA) (Version 3). This helped in assessing the amount of bone loss occurred over the period of the study on the mesial and distal aspect of the implant.

DISCUSSION

With the ever increasing demand for esthetics, the interim period of edentulousness even after implant placement can cause psychological, social or functional problems especially if the edentulous area is in appearance region. Consequently, immediate loading of dental implants was introduced to achieve triumph over original Branemark protocol which not only includes non submerged one stage surgery, but actually loads the implant without compromising osseointegration (14). The rationale for choosing a delayed loading period was that premature loading resulted in fibrous tissue encapsulation rather than direct bone apposition based on a hypothesis that necrotic bone at the implant bed border is not capable of load bearing and should first be replaced by new bone (15). Therefore, immediate loading with newer implant placement protocol with an acceptable, relaxed implant bed configuration was considered a study worthy step.

So, the present case was designed to compare conventional and delayed implant placement protocols stipulating that implant placement delayed for two weeks after osteotomy can be a better possible alternative to enhance implant bone binding intended for achieving predictable osseointegration.

During the preparation of implant bed, excessive surgical trauma and thermal injury may lead to osteonecrosis and result in fibrous encapsulation around the implant. According to a study conducted by Albrektsson *et al* (16) on thermal injury to bone, temperature over 47°C for 1min causes 'heat necrosis' in the bone and without irrigation, drill temperatures above 100°C are reached within seconds during the osteotomy preparation. Therefore, adequate cooling with the internal and external saline irrigation was accomplished so as to minimize the thermal injury to the implant bed.

Understanding of the healing process of bone and thermal effect of cutting, Costich *et al* (17) evaluated acceleration in the initial healing process with the reduction of amount of heat. The effect was revealed by early formation of granulation tissue and early resorption of the margins of the bony defect. At 3 weeks, there was more rapid formation of new trabecular bone to repair the defects, and an earlier fusion of new and old bone.

According to a study, Perrone *et al* (17) reported that bone healing after osteotomy passes through three stages: inflammation (granulation tissue), fibrous tissue and maturation. In the present case, implant insertion was performed after two weeks after drilling in the one of the implant insertion. The insertion time is so selected because collagen formation and neoangiogenesis represents an acceptable implant bed configuration.

According to a histological literature on the concept of delayed implant placement by Ogiso M *et al* (3), delayed method of implantation appears to enhance trabecular bone formation with spongiosa rich in original trabeculae and numerous enlarged capillaries as revealed by histological observation around the implant. This was compared to the conventional implant placement where the histological examination demonstrated loose fibrous tissue with very few and thin capillaries. It was observed that delayed method of implantation could be an efficient method for promoting better and faster bone formation around the implant.

To minimize the possibility of postopera-

tive peri-implant tissue loss and to overcome the challenge of soft tissue management during or after surgery, the concept of flapless implant surgery has been introduced and clinically applied to both immediate and delayed loading cases as studied by Campelo LD and Camara JR (18) The authors stressed the advantages of their approach and considered flapless implant surgery as a predictable procedure, provided patients are selected appropriately and proper surgical technique is meticulously followed. The benefits of this procedure were concluded as shortened surgical time; minimal changes in crestal bone levels as blood supply is never disrupted, decreased probing depth, and reduced inflammation; perceived minimal bleeding; and lessened postoperative discomfort (19).

According to the report of Brunski *et al* (20), micromovement of more than 100 ìm are sufficient to jeopardize healing with direct bone implant contact. The primary stability can be achieved by required amount of torque during implant placement.

According to Heydenrijk K *et al* (21), by adjusting the cutting depth and width of the crestal drill, it is possible to derive an advantage from the condensing and friction effect of the implant, resulting in an increase in primary stability as was applied. With the trend of shortening treatment time and reducing patient discomfort, immediate loading has reemerged as an alternate approach. It has achieved similar success rates as those reported in the delayed 2-stage approach (22). Abutments of specified dimensions were seated and tightened to 25 to 30 Ncm with the help of abutment driver in conjunction with torque controlled hand wrench as performed in a study by Higginbottom F *et al* (23).

Peri-implant probing was evaluated at 3rd, 6th and 9th month in accordance with a study by Orton *et al* (24). It was observed that there was decrease in the probing depth of both the implants.

In both the implant insertions, the bone levels were calibrated from the first thread on the implant as reference point to the bone – implant contact. The highest marginal mean bone levels observed in first implant insertion was 0.45mm at baseline and in second implant insertion was 0.86mm at 3rd month interval.

CONCLUSION

Hence, it can be concluded that in our hands, early osteotomy with delayed implant placement showed lesser bone resorption and higher success rates than conventional implant placement which was clinically significant. Future studies are required that may find indications based on surgical, host, implant, and occlusal conditions for early osteotomy with delayed implant placement and also ascertain its advantages over the conventional approach. Additional data will provide clinicians and researchers improved foundations for decision making relative to selecting the most appropriate implant treatment protocol.

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