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Socket Shield Technique with Temporization: An Esthetic Solution for Complex Immediate Anterior Tooth Replacement

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ABSTRACT: This case report shows a 21-year-old male patient who needs immediate replacement of fractured root canal treated tooth in the maxillary left anterior region.Diagnostic radiographs showedthin buccal plate in relation to 21 and horizontal fracture of root progressing diagonally from crest of mesial aspect to 3mm below thecrest on the distal aspect, with a minor abscess on the mesial aspect of fracture.The treatment plan included removing the crown, sectioning the crown from the root, and then sectioning the root mesio-distally. As the root was separated into buccal and lingual portions, the lingual root portion was removed using periotome. Then buccal portion thinned to a 2mm thick shield extending bellow the fractured section up to lower 1/3ed of root height. After shield preparation, implant placed into the socket followed by abutment placement. Then temporary crown fabrication done on the abutment done using prefabricated thermoplastic resin splint. Following the treatment, the patient experienced confidence as the crown was esthetically acceptable. This case shows the importance of immediatereplacement of tooth in complicated and esthetically important anterior region in younger adults who gives more importance to their appearance, which improves their confidence to face the society.

KEYWORDS: Socket Shield Technique, Dental Implants, Ridge Preservation, Immediate Placement, Immediate Loading, Temporary Crown, Composite Crown

I. INTRODUCTION

Implantology is a distinctive branch of dentistry deals with rehabilitation of edentulous areas regardless of atrophy or injury to stomatognathic system[1].Dental implants have become a popular procedure for replacing missing teeth, particularly in the esthetic region, resulted in the demand for buccal hard and soft tissue preservation[2]. Post-extraction immediate implant placement in the esthetic zone has gained popularity as it boosts patient satisfaction to a greater extent.The prosthodontist must conduct a thorough treatment planning and prosthesis designingto get an esthetically and functionally successful restoration[3].

Alveolar bone, tooth, cementum and periodontal ligament constitute a functional unit. The loss of teeth causes an interruption in the functional unit, which inevitably results in alveolar ridge resorption. A 50% of the alveolar width is reabsorbed in the first 12 months after the extraction of a tooth, corresponding to an average of 5−7 mm.The morphology of the alveolar ridge after tooth extraction shows a discrepancy in bone height between the lingual and buccal plate[4].

Patients requesting immediate dental implants in the aesthetic zone have increased in recent years. Chappuis et al. (2015) state that the two primary prerequisites for placing an implant right away are a thick gingival biotype and a completely undamaged buccal bone wall with a thickness of more than 1 millimetre [4].

The introduction of procedures like immediate implant insertion, soft tissue augmentation procedures, palatal orientation of the implant in the socket, the use of platform switching, and several socket preservation techniques like "Immediate Dentoalveolar Restoration" or "Ice Cream" technique are the results of multiple studies carried out on various techniques to prevent bone loss after tooth extraction in the past few years. While all of these methods can help preserve bone, changes to the peri-implant tissues will always occur and cannot be completely prevented. The preservation of dental root to avoid alveolar resorption have been described by different authors as it provides good

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aesthetic results after preserving soft tissues. Based on this concept, Hurzeler et al. in 2010 introduced a new technique called "Socket Shield" (SS) withpartial root fragment has been preserved surrounding an immediately placed implant to avoid tissue changes following extraction of tooth[4]. This was done to maintain the bundle bone on the buccal sidein order to preserve the crestal bone at the original level. In recent years following the same biological basis another concept of "Partial Extraction Therapies" (PET) has been described, in that "Socket-shield" is the most commonly used one[4]. This proof of principle demonstrates that osseointegration can be achieved without inducing inflammation and resorption when a buccal root fragment is retained and an immediate implant is placed[2].

When a restoration is complete, it should physically resemble the lost tooth through preserving the same functionality and aesthetics and by guaranteeing a harmonious gingival architecture. The restoration of the single edentulous space is a viable and predictable alternative to the treatment plan when using dental implants. The soft-tissue level around anterior-maxillary single tooth implants can be affected by many factors including the interproximal papilla and interproximal bone crest level of the adjacent tooth[5].

Various authors provide varying recommendations for getting an extremely esthetic outcome for implants. These recommendations emphasize on the optimal three-dimensional (3D) implant placement and the most effective way to use the proposed restoration's cervical contour as a guide. Finding the occlusal plane or incisal edge is the first step in the treatment planning process. The proposed restoration's cervical contour is identified in the second stage, and the gap between the cervical contour and the level of the remaining bone is measured in the third. Therefore, the optimal crown length depends on the depth of the implant. To attain the proper biological width, the implant should be placed 3 mm from the proposed crown's cervical margin.In order to prevent resorption and preserve 1.8 to 2.0 mm of buccal bone, the implant should be positioned 2 mm in the lingual or palatal direction from the cervical contour. If the bone is 3 mm from the cervical contour, the implant can be positioned at the level of the bone. It is known as the "3 mm Apical and 2 mm Buccal rule—3A-2B rule" and can be used as a guidance for implant placement according to these two biological factors. A bone grafting technique is recommended if the bone deviates more than 3 mm from the cervical contour in the apical direction. The bone will need to be reduced to create space for biological width if the bone is less than 3mm. The implant can be positioned below the bone (without reducing the bone) in extraction socket locations when the crestal bone is less than 3 mm from the planned crown's margin.In all patients, the implant should be placed 3 mm from the cervical contour, and the procedure should maintain 2 mm of buccal bone[5].

Loss of tooth followed by collapse of alveolar ridge is a burden for implant dentistry. This case report shows an immediate replacement of maxillary central incisor tooth with implants using socket shield method to prevent collapse of buccal bone and immediately loaded with temporary crowns for esthetic purpose.

II. CASE REPORT

A 21-year-old malepatient reported at the Department of Prosthodontics with complains of discharge from root canal treated maxillary left central incisor tooth with pus discharge in the last 2 weeks. On clinical examination the tooth was root canal treated with porcelain fused metal ceramic crown cemented on to it 2 years back, shows a dark black margin between crown and the gingival margin. The tooth also had grade I mobility.

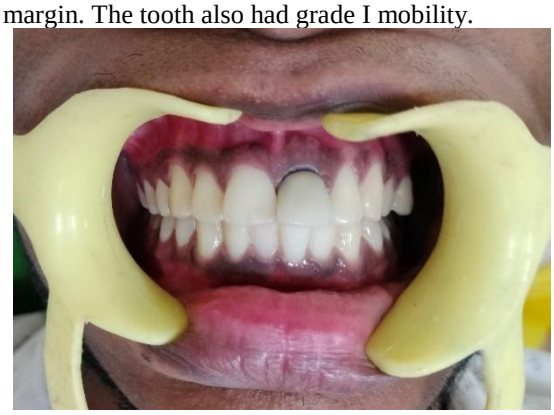

Figure 1: pre operative view of patient's dentition

Radiographic examination shows coronal radio-opacity which extending through the root canal which is 2-3mm short of the apex with horizontal fracture of root in the cervical 1/3rd. A radiolucency of 0.5 -1mm diameter present near the fracture line on the mesial aspect of root suggestive of mild abscess (figure 2).

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Figure 2: intraoral periapical radiograph showing fractured root canal treated 21.

A CBCT examination of tooth performed using a Newton Go Scanner with a voxel size of 0.15mm (figure 3). the results showed that in tooth region 21, the mesiodistal width at crest was 8.9mm, buccolingual width of 7.4mm at crest with a very minimum bone thickness at the labial aspect of root (figure 4 a &b). These images reconstructed using NNT software which shows the 3D view of the implant sight 21 (figure 5).

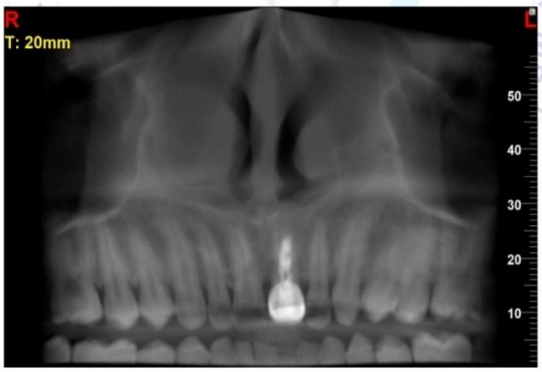

Figure 3: CBCT image of maxillary arch

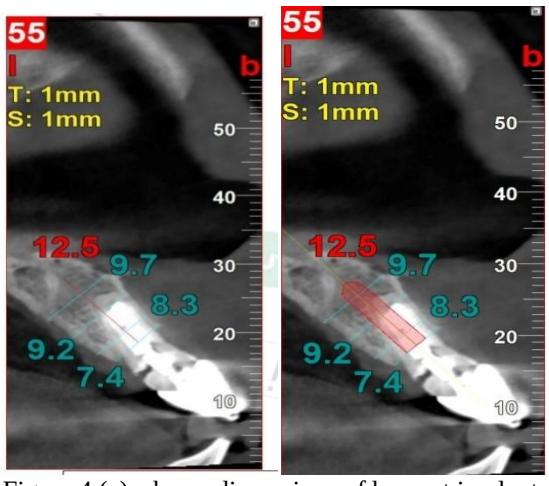

Figure 4 (a): shows dimensions of bone at implant planning sight 21. (b) shows planning images of implant.

Figure 5: 3D reconstructed images of planned implant at 21 regions.

Then diagnostic impression made and cast were made (figure 6).

Figure 6: maxillary and mandibular diagnostic casts.

III. TREATMENT

On this diagnostic cast a thermoplastic resin splint fabricated using thin thermoplastic sheet using vacumold portable dental vacuum forming machine. Then tooth 21 was removed from the cast and the stunt was adapted on to the cast (figure 7)

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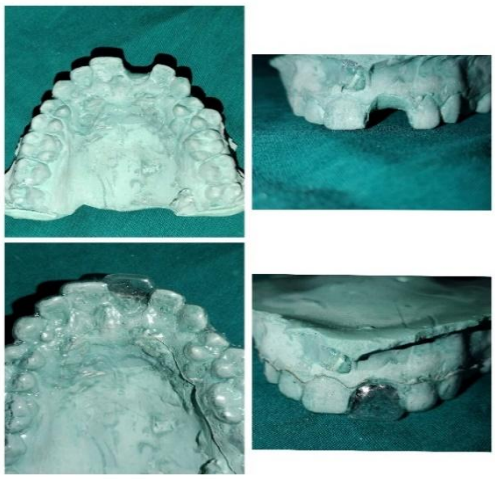

Figure 7: shows images of modified cast and splint adapted over the cast in which 21 tooth was removed.

A temporary acrylic crown was fabricated in the 21 region with the help of thermoplastic splint to assess the esthetics and fitting a crown prior to surgery (figure 8).

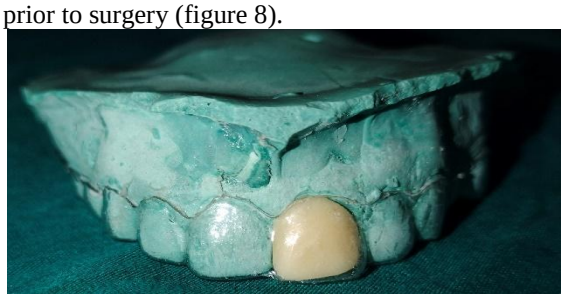

Figure 8

On the day of implant placement induction of antibiotic and local anesthesia was carried out. The removal by splitting the porcelain fused metal crown was done as first step along with removal of remaining coronal tooth structure from the root (figure 9 a& b).

Figure 9 a: images of maxillary arch prior to the procedure.

Figure 9 b: image after crown removal and removal of coronal portion of 21.

After removal coronal portion, the root canal was cleaned and gutta percha removed using gates glidden drills. Then tooth was splitted into 2 halves buccal and palatal portions, using a surgical bur in mesio-distal direction (figure 10). Then palatal root portion removed using periotome (figure 11).

Figure 10: radiographic image during splitting of root.

Figure 11: image showing buccal portion of tooth remained after removal of lingual portion

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Then buccal portion thinned to a 2mm thick shield extending bellow the fractured section up to lower 1/3ed of root height.

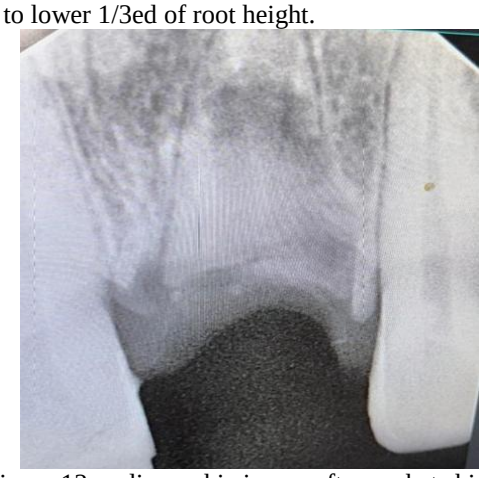

Figure 12: radiographic image after socket shield formation.

Then implant placement procedure was started usingpiolet drill of length 13mm, preparation done more palatally to achieve estimated length of planned implant (MIS IMPLANT SURGICAL KIT). After achieving the required length, sequential drilling was done using 3.25 and 3.75 diameter drills respectively. After finishing osteotomy implant of size 4.2 X 13mm (MIS LANCE) was placed into prepared osteotomy site (figure 13).

Figure 13: after implant placement.

Then a straight abutment was screwed on the implant and customized modification of abutment done after checking the occlusion (figure 14a&b).

Figure 14a: shows radiographic image of implant along with abutment and prepared buccal shield

Figure 14b: shows clinical images after abutment placed on to the implant.

Then thethermoplastic splint was adapted on to the maxillary ach that clearly shows required size of temporary crown (figure15). Then composite material was added into the splint and cured with light curing system. Thistemporary crown had the original dimensions of tooth previously occupied the same place. After checking the occlusal and proximal contacts temporary crown along with abutment removed from implant, correction done and finished.

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Figure 15: shows soft splint adapted on to the maxillary arch.

Then polished temporary crown along with abutment replaced on to the implant and screwed. Sthe screw hole was closed using composite material, then sutures place on mesial and distal aspect of crown of 21 (figure 16 a,b&c)

Figure 16: (a) shows labial view of temporary crown, (b) radiographic view of implant along with abutment and temporary crown, (c) palatal view of temporary crown.

A review done after 1 week, suture removal done and CBCT taken for assessment (figure 17)

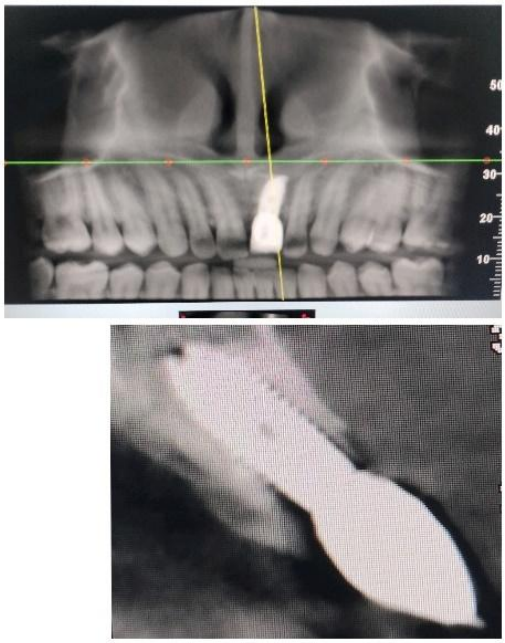

Figure 17: shows CBCT images after 1week of implant placement.

IV. DISCUSSION

Since the beginning, implant dentistry has advanced significantly through the improvements and alterations made to surgical methods, restorative procedures, and the implants themselves[6]. Dental implants are widely used and considered to be one of several treatment options used to replace missing teeth. The healed extraction sockets exhibit morphologic alterations that result in a decrease of the bucco-lingual ridge by roughly 5 to 7 mm. During the first four months of healing, the majority of these alterations occur. The horizontal shift is accompanied by an identical decrease in apico-coronal or vertical height of 2.0 to 4.5 mm[7]. Since the periodontal membrane predominantly vascularizes the tooth's bundle bone, when a tooth is extracted, the blood vessels in the periodontium are disconnected, which causes the facial bone plate to resorb. Implant dentistry is hampered by complex situations where the buccal cortical bone is thin and more prone to fracture. Therefore, maintaining the ridge after extraction is crucial since it could affect the implant's placement and effectiveness. However, ridge preservation possesses the biggest challenge, hence a new method in which there is deliberate retention of root to preserve bone was introduced. Socket-shield technique (SST) aims to avoid alterations of tissue following extraction, offers promising results, and reduces the need of bone grafting. As an alternative to surgical ridge augmentation is the SST which offers promising results[2,8].

In a report by Denissen et al. a delay of 3 months or more after tooth extraction in the anterior maxilla resulted in such an advanced stage of resorption, that only narrow diameter implants could be used[9.]

Kher etal. stated that Immediate implant placement with immediate fixed interim restoration in the esthetic zone results in excellent short-term treatment outcomes in terms of implant survival and minimal change of peri-implant soft- and hard-tissue dimensions[3].

There are five important factors to take into account while making decisions in order to place immediate implants with excellence and prevent errors that could result in awkward aesthetic scenarios.

The rule of 5 triangle includes:

(I) The presence of a buccal plate
(II) Primary stability
(III) Implant design
(IV) Filling of the gap between the buccal plate and the implant
(V) Tissue biotype

An atraumatic extraction should be done to prevent bone loss. When positioning the implant in an ideal 3D position, the void should always be grafted with biomaterial, that gap between the buccal plate and the implant is called as jumping space[12]. Graft is used to close the gap if the jumping space is greater than 2 mm[13].

According to Sethiya et al. principles of socket shield technique include thebuccal root section should be prepared in such a manner that its physiologic relation remains intact to the buccal plate, the attachment apparatus of periodontium should remain undamaged and vital to prevents post extraction socket remodelling and the sectioned tooth root should act as a socket shield and prevent bucco-facial tissue recession of an implant[2].

The contraindications of this technique were explained by Gluckman etal. in 2015 includes indicated tooth has buccal bone loss due to vertical fracture, fragment need to be retained has root caries, loss of buccal bone due to periodontitis, patients on drugs like bisphosphonates, anticoagulants and on radiation therapy, immunocompromised patients[10].

Vinh Giap Nguyen et al published a case series of socket shield technique used in conjunction with immediate implant placement in an anterior maxilla and review done for a period of 6 years. He concluded that this technique produces virtually no change in the hard and soft tissue, appears to provide excellent aesthetic outcomes and stable short-term results.

The restoration of a single upper central incisor represents one of the most difficult dental treatments.A low crown-to-root ratio, prior endodontic therapy with surgical or non-surgical interventions, insufficient periodontal support, the existence of the black triangle, and the adjacent teeth will further complicate the scenario.William T on his case report on immediate anterior implant with provisional crown fabricated with a bis-Acryl material which was seated over the lubricated abutment. The final temporary checked for proper occlusion and elimination from any working, balancing, or centric contact and also, he used this temporary crown to hold the graft material used in the case[13].

Kher etal done a case series onfixed screw-retained interim restorations with immediate implant placement in esthetic zone. Different techniques used to fabricate interim restorations onto immediate implants includes putty index/ thermoplastic splint withbisacryl resin, polycarbonate shell crown with bisacryl resin, laminate veneer conversion etc[3]. In this case patient was insisted to provide immediate crown over the implant due his difficulty in accepting unesthetic situation, we used thermoplastic splint as mold for fabrication crown with composite. As the splint was transparent it provided good visibility during interim restorationfabrication. No grafts were used as the jumping space is less than 2mm. The crown provided was accepted and appreciated by the patient. This situation revealed the importance of immediate loading of anterior implant provides the patient confidence and it bury the stress of unesthetic situation.

V. CONCLUSION

This case report exhibiting a successful management of immediate placement of maxillary anterior implant using socket shield technique along with immediate loading done using permanent abutment and temporary composite crown in a younger male patient. The patient was extremely worried about the appearance while planning the implant and he requested to provide a temporary replacement of tooth. The patient expressed satisfaction with the crown that was delivered following implant insertion and expressed happiness with his post-treatment appearance.

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