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Socket shield technique versus conventional immediate implant placement in thin buccofacial bone to evaluate buccal bone resorption: A randomized controlled trial

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Abstract---Objectives: The alveolar ridge resorbs and collapses following tooth removal which continues to be a major concern for practitioners. Many researchers concluded that buccal aspect of the ridge is more prone to resorption, as it is primarily supplied by the periodontal tissues and ligaments of the tooth¹. Recently, several papers were published concerning the socket shield technique explaining how to maintain the ridge width and height. Socket shield technique aids at retaining the buccal fragment of root in place thus placing the implant behind the lingual aspect of that fragment so as aid in preventing the collapsing of the buccal bone. This would help in improving aesthetics especially during immediate implant placement in the anterior maxillary region (schroop et al, 2003).
Materials and Methods: The patient passed through phase I therapy (Supragingival scaling, subgingival debridement and oral hygiene instructions) before

any surgical procedures. - CBCT scan using On Demand 3D is performed to record preoperative ridge width and height measurements and specially crestal bone in aesthetic area; -The non-restorable tooth is separated using a partial extraction therapy bur, then the lingual portion is removed atraumatically thus retaining the buccal fragment of the tooth; - The osteotomy site is then done using appropriate drill sizes; - A paralling pin is applied to assure the implant future position behind the root fragment and a periapical x-ray is taken, - The implant is then inserted in place and another periapical is then taken shown in on surgery day and a cone beam is done after 12 month post-operative(hurzeler, 2010). Results: Buccal bone was measured by the use of CBCT, it was 0.98mm buccolingual. When measured after 6 months it was 0.96mm. When measured after 2 years follow up, it was the same 0.96mm which indicated that buccal bone was not resorbed between 6 months and 2 years follow-up post-operative. Conclusion: Socket shield technique provides a future solution to prevent collapse of thin buccal bone with immediate implantation (Baumer et al, 2015)

Keywords--Thin buccal bone, Socket shield technique, Immediate implant, Esthetics, Buccal root aspect

Introduction

The alveolar ridge resorbs and collapses following tooth removal which continues to be a major concern for practitioners. Many researchers concluded that buccal aspect of the ridge is more prone to resorption, as it is primarily supplied by the periodontal tissues and ligaments of the tooth. Therefore, extraction of the hopeless tooth, may be a reason for buccal cortical plate resorbing at a faster rate than the palatal plate leading to its total degradation. This may lead to dimensional changes in the human ridge and the aesthetic area is highly affected by this procedure (Hurzeler, 2010).

A prospective study having a 12 month follow up, after an immediate tooth extraction the mean width of the alveolar and crestal bone ridge was 12mm (range 8.6-16.5mm). the difference was reduced after a healing period of 12 months to be 0.2 mm which was a result of tissue healing and gain of 0.3mm buccal and a loss of 0.8mm intraorally. Almost all the gain was formulated from 3 to 12 month after extraction, where the entire loss of the height was found during the first 3 months. So as to conclude, a decrease of approximately 50% was found throughout the 3 month (Schroop et al, 2003).

Several techniques in the literature were proposed to solve the problem of thin buccal bone resorption with or without immediate implantation in the aesthetic area. Some of these techniques are the guided bone and soft tissue regeneration and bone augmentation but proved to be slight aggressive with high morbidity rate (Hurzeler,2010). Recently, several papers were published concerning the socket shield technique explaining how to maintain the ridge width and height. Socket shield technique that was first introduced in 2010 aids at retaining the

buccal fragment of root in place and intact thus placing the implant behind the lingual aspect of that fragment so that the periodontal ligaments and tissues preserve its vitality and aids in preventing the collapsing of the buccal bone. This would help in improving aesthetics especially during immediate implant placement in the anterior maxillary region (Wadhani et al, 2015).

Patient Information

Medical history: A 25-year-old man, non-smoker, in good general condition, no systemic illness, not on regular medication. Extra-oral findings: The patient's facial features were symmetrical with deep smile lines. On inspection and palpation, no abnormalities detected.

Local intra-oral findings 1st quadrant: Fixed reconstruction of teeth 11 with a crown (metal-fused-to-ceramic), amalgam restoration of teeth 36,46. X-ray: The dental radiography showed a translucency at the crown margin of tooth 11, the endodontic treatment needed to be repeated. Diagnosis: Secondary root caries on tooth 13 in the region of the distal crown edge and suspected root perforation as well as apical periodontitis.

Prognosis: Root 12 was considered irrational to treat.

Treatment plan: removal of the crown of 11 and retreatment of the endodontic treatment of 11 and socket shield technique is performed to the 12.

Patient's Timeline

Stage/Time	Procedure/s	Measuring device
T-ve Presurgical phase		
Screening	<ul style="list-style-type: none"> - Initial crestal bone width - Initial Radiographic measurement. - Study cast. 	<ul style="list-style-type: none"> -Regular periapical. -Alginate Impression
Initial phase therapy	<ul style="list-style-type: none"> - Full mouth scaling & Polishing. - Oral hygiene instructions. - Restoration of decayed teeth. - Extraction the hopeless teeth. - Preoperative radiographic record. 	<ul style="list-style-type: none"> - Cone Beam CT.
T0		
Presurgical	The patient signs the consent and the procedure is explained	
T1 Surgical phase		
Pre-operative	<ul style="list-style-type: none"> - Crestal bone width assessment. 	<ul style="list-style-type: none"> - CBCT - Periodontal Probe.
T2 Postoperative follow up phase		
Stage/Time	Procedure/s	Measuring device
F1 (1 st – 7 th day)	<ul style="list-style-type: none"> - Postoperative pain assessment. - Assessment of root exposure. 	<ul style="list-style-type: none"> - NRS - Periodontal probe (Ogata et al, 2013)
F2 (1 weeks)	<ul style="list-style-type: none"> - Assessment of exposure. - Collecting the questionnaire. 	<ul style="list-style-type: none"> - Periodontal probe (Ogata et al, 2013)
F3 (4 weeks)	<ul style="list-style-type: none"> - Assessment of wound healing. 	<ul style="list-style-type: none"> - visual
F4 (8 weeks)	<ul style="list-style-type: none"> - assessment of healing and prevention of root exposure 	<ul style="list-style-type: none"> - visual and periapical radiographs
F5 (16 weeks)	<ul style="list-style-type: none"> - prosthetic assessment 	
F6 (48 weeks)	<ul style="list-style-type: none"> - measuring implant stability and prosthetic loading 	<ul style="list-style-type: none"> - Osstel

Therapeutic Intervention

Preoperative measures: - The patient passed through phase I therapy (Supragingival scaling, subgingival debridement and oral hygiene instructions) before any surgical procedures shown in fig.

(1). – CBCT scan using On Demand 3D is performed to record preoperative ridge width and height measurements and specially crestal bone in aesthetic area shown in fig.

(2,3).Surgical procedure: - The non-restorable tooth is separated using a partial extraction therapy bur, then the lingual portion is removed atraumatically thus retaining the buccal fragment of the tooth fig.

(4,5,6,7) - The osteotomy site is then done using appropriate drill sizes - A paralling pin is applied to assure the implant future position behind the root fragment and a periapical x-ray is taken - The implant is then inserted in place and another periapical is then taken shown in fig.

(8,9,10) on surgery day and after 6 month post-operative



Fig1



Fig 2

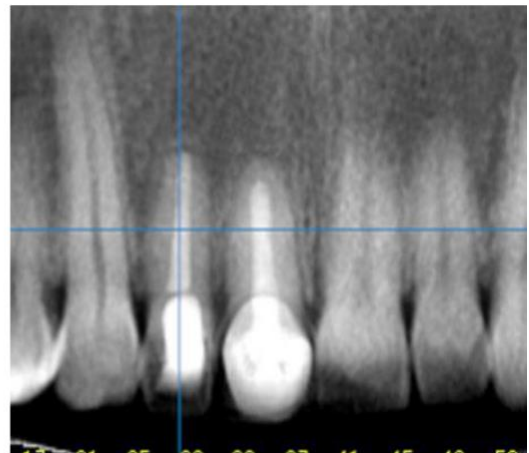


Fig 3



Fig 4

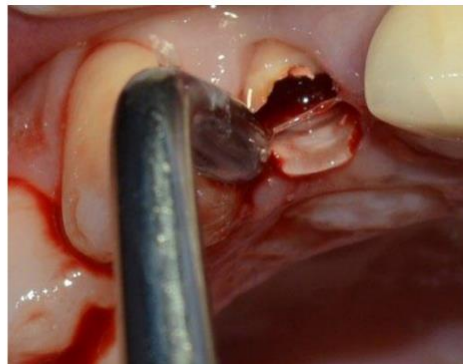


Fig 5



FIG 6



fig 7



Fig 8

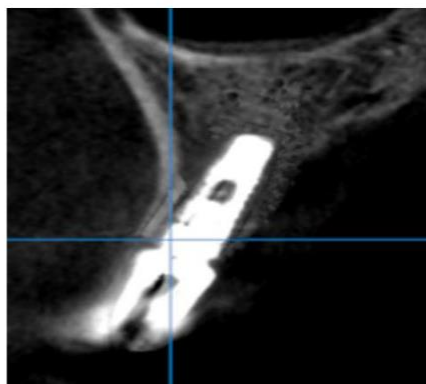


Fig 9

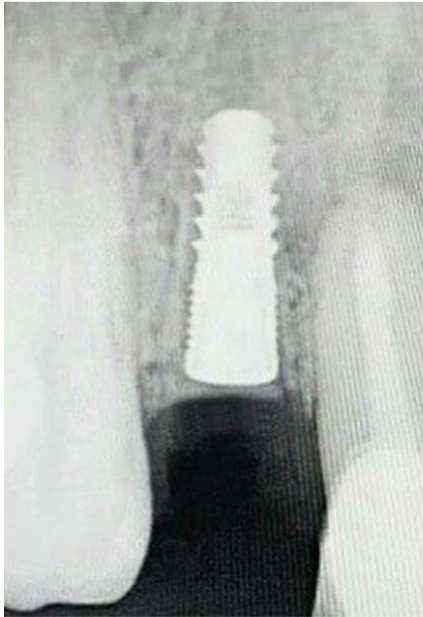


Fig 9



fig 10

Predictable complication/s	Suggested treatment
Exposure of root fragment	- Removal of the root fragment and the case is turned in to an conventional immediate case
Root fragment moved while implant insertion	- Root fragment is extracted and patient is left to heal for 6 month and a delayed implant is then inserted
Pain persisting more than one week	Pain killer (e.g., Brufen ¹ 400 mg: t.i.d for 5 days)
Infection	<p>1-Antibiotics (e.g., Augmentin² 625 mg: 1 tab t.i.d. for 7 days).</p> <ul style="list-style-type: none"> - If the patient is allergic to penicillin, prescribe: Azithromycin³ 250 mg: 2 tabs stat, then 1 tab q.i.d. for 4 days; or - Clindamycin⁴ 150 mg: 2 tabs stat, then 1 tab q.i.d. for 7 days <p>2- Rinsing with Povidone Iodine</p> <p>3- For severe infections with fluctuant swelling, incision and drainage with sterile saline irrigation might be indicated stronger analgesics, including narcotics in combination with non-narcotics.</p> <p>4- Follow up by phone after 2–3 days. If there is no improvement, consider prescribing an alternate antibiotic.</p> <p>5. In all cases, reevaluate the patient after 1 week.</p>

Follow-Up And Outcomes

The patient is assessed for pain after the intervention (T0) and postoperative by one week (T1) and after one month (T2) by the aid of a questionnaire. The patient is followed up for two years by the aid of CBCT, one immediately after the surgery to assess that the shield is in place and the implant is placed correctly behind the root fragment and take a measurement baseline of the buccal bone.

Another CBCT is done after 6 months after prosthetic loading again to assess the location and measure the buccal bone resorption. A final CBCT done after 2 years to assess and diagnose any changes in the buccal bone, fragment of root retained and the implant inserted. Buccal bone was measured by the use of CBCT, it was 0.98mm buccolingual. When measured after 6 months it was 0.96mm. When measured after 2 years follow up, it was the same 0.96mm which indicated that buccal bone was not resorbed between 6 months and 2 years' follow-up postoperative

Discussion

Results concluded from this case report was similar to the report by Hürzeler and coworkers, that retaining the buccal fragment of the root would achieve osteointegration without causing resorptive modalities on the thin buccal wall (Cherel and Etienne, 2014). The technique provides a solution when dealing with post extraction sites specially with immediate implantation in thin buccal bone. Many published papers in the literature support the idea but most of them reported slight shrinkage of the buccal fragment (Baumer et al, 2015).

Moreover, the technique like any other has complications which might lead to implant failure if not managed correctly like root exposure and infection specially that it is a technique sensitive (Miller, 1969). When reported first in 2010 that the concept of root retention which was done in 1959 thus indeed limits buccal tissue resorption. The technique of root submergence was first introduced to preserve buccal bone under removable prosthesis (Morrow et al, 1969). When comparing, ridge preservation techniques may decrease the amount of ridge resorption but won't reduce or prevent the loss of papilla and interdental bone (Malmgren et al, 1969) (Salama et al, 2007).

It has been cleared that leaving or retaining a part of the tooth with its PDL, its fibers and reticulate vascularity connected with the bundle bone, improves the remodeling of the extraction socket and the alveolar crest (Fillippi et al, 2001). The resorption of thin buccal bone after extraction could be the direct result of trauma to the bone-PDL-tooth complex (Gluckman and Toit, 2015). However, as stated before, the retention of tooth roots in the alveolar process can preserve the ridge tissues. Histologically this was proven by Hürzeler and coworkers (Baumer et al, 2015) (Chen and Pan, 2013). Their study proved that the retained fragment of the SS to the thin buccal plate via a physiologic PDL free of any inflammatory response (Chen and Pan, 2013).

Conclusion

Socket shield technique provides a future solution to prevent collapse of thin buccal bone with immediate implantation (Fillippi et al, 2001). This is accomplished by retaining the buccal fragment of the root thus preserving the periodontal ligaments and tissues and prevent its collapse (Gluckman and Toit, 2015). This would help in improving aesthetics especially during immediate implant placement in the anterior maxillary region (Chen and Pan, 2013).

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