

Socket Shield Technique - A New Approach of Immediate Implant Articles Review

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Abstract

Dental implant restoration is challenging procedure when it involve the esthetics zone, and since implant dentistry is prosthodontically driven procedure, care were practice in restoration of missing teeth in esthetics area which will fulfill the objective.

Extraction of teeth leave buccal plate bone unsupported and decrease the blood supply and since this plate is very thin resorption will be expected. Different attempt was done in order to prevent this sequence and create natural emergence profile around dental implant prosthesis. Socket preservation procedures were introduced, however in case of ridge deficiencies, hard and soft tissue augmentation procedures are indicated.

Socket shield technique meets the demands of minimal invasion, tissue preservation, and no need of bone substitute materials. And can be applied not only for maintaining buccal contour of an edentulous ridge but also for keeping the inter-implant soft and hard tissue

In this review paper we present different articles and case report using socket shield technique as treatment protocols and try to explore different protocol are practice in order to achieve high treatment out come with optimal success.

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Introduction

Tooth loss due to extraction or trauma result in absence of periodontal ligament which is associated with variable but inevitable time dependent bone resorption. reported data has shown dramatically resorption of buccal cortical plate compared by lingual one[1]. Alternation of ridge contour result in compromise ideal positioning of implant for optimal support and stability of surrounding soft and hard tissue which will compromise esthetic outcome of the treatments [2].

Preservation of thin buccal cortical plate in freshly extraction socket has got many debate in literature and different methods were introduce including immediate implants after extraction protocol [3,4] which preserve the tissue contour, dimension and reduce number of surgical procedure which will decrease treatment time [5]. other methods include bone substitutes material has been used, and/or barrier membranes. The amount of ridge maintains by these procedure is still questionable [6,7]. However, a complete preservation and/or entire regeneration of the extraction socket have not been documented yet [8].

Araújo and Lindhe demonstrate the physiology processes following tooth extraction, presence of osteoclasts inside socket will result in resorption of bundle bone. Anatomically buccal bone plate are thin and has more bundle bone than lingual wall resorption of hard tissue will be pronounced buccal wall than lingual [9].

Different hypothesis on root retention have been tested clinically in order to avoid tissue alternation and minimize the influence of teeth removal in resorption process;

Salama et al [10] demonstrate Root Submerge Technique (RST) which preserve the natural priondantium, and prevent bone resorption. Von Arx et al [11] published a method to preserve the alveolar ridge by leaving the de-crowned root fragments. Davarpanah and Szmukler [12] published a case series of five patients showing that immediately placed implants where direct implant contact with ankylosed tooth fragments was ensured, were preserved without any signs of abnormal changes over a follow-up period

of two years. Hürzeler et al [8] also demonstrated that leaving coronal buccal root portion intact help to ensure the physiological preservation of labial and buccal bone structures if the implant is placed in contact to this natural tooth fragment.

However certain risks are associated with these approaches, such as formation of pre-implant periodontal membrane [13], preimplant infection. These occur in the presence of pre-existing or developing periodontal or endodontic infections or inflammations of the retained tooth fragment.

Material and Methods

Narrative review on published articles written in English language only reporting data related to socket shield technique. Comprehensive electronic search was performed using PubMed, Google scholar, furthermore a manual search was conducted in related journals. The search terms including extraction socket preservation, socket shield, tooth retention, and tooth fragment.

The search include original articles , case report, and animal studies are including in this review, the articles have been selected after critical assessment of research. A total of 15 articles were reviewed carefully and thoroughly in order to extract the information regarding different technique of preservation of bone with an attempt to offer suggestion that clinicians could be use as guideline in the clinical practice in attempt to preserve the post extraction tissue especially in esthetically challenging cases.

Discussion

Loss tooth initiate the remodeling process which it's a natural reaction of healing process, involving various degrees of alveolar bone resorption both vertical and horizontal, and more pronounced on the buccal than on the lingual aspect of the extraction socket . the bundle bone is primarily vascularized by the periodontal membrane of the tooth. Insufficient nutrition to alveolar bone leading to total or partial resorption [14,15]. Bone resorption of up to an average width of 50% [16] or 3.8 mm [17] has been reported. Losses in height of 2 mm to 4 mm (3) or 1.24 mm on average [17] have also been measured. However, this resorption process is highly variable and not fully predictable [18] A substantial 0.5% to 1% of the alveolar ridge volume is

lost as the result of it [19].

Retaining a root for alveolar ridge preservation and prevent tissue alterations after tooth extraction has been tested in several clinical studies. Hypothesis tested by Filippi et al [20] by retained root either of vital or pulpless teeth avoid tissue alternation and consequence of tooth extraction, he report that decoronation of an ankylosed tooth preserved the alveolar bone before implant placement.

Malmgren et al, Malmgren et al, Andersson et al. [21,22,23]. Presents a studies that demonstrated that the preservation of decoronated roots in the alveolar process not only helps maintaining existing bone volume but also enables vertical bone growth, which can be observed coronally to the decoronated root.

A study that confirmed regeneration of alveolar bone around endodontically treated teeth done by Bjorn [24]. O'Neal et al. [25] reported a new cementum and connective tissue form over the coronal surface of submerged roots separating the dentine from new bone.

Root Submergence Technique (RST) reported by Salama et al [10] which maintains the natural attachment apparatus of the tooth in the pontic site, which in turn allows for complete preservation of the alveolar bone frame and assists in the creation of an aesthetic result in adjacent multiple-tooth-replacement cases.

Five- case report study done by Davarpanah & Szmukler-Moncler [12] reported implant placement in contact with ankylosed root fragments show no any in specific pathological sign after a period of 12–42 months of loading.

No study yet has evaluated partial root retention around dental implants. the aim of the article review is the evaluate the effect of partial root retention around dental implant, and present different treatment modalities have been reported.

In 2010, Hürzeler et al [8]. introduced a new method, the socket shield technique, in which a partial root fragment was retained around an immediately placed implant with the aim of avoiding tissue alterations after tooth extraction, his study was conducted in beagle dog, in which the third and fourth mandibular premolars were hemisected using a fissure

bur. A coarse-grained diamond bur was used to decoronate the distal aspect of the pre-molar. The buccal fragment of the root was retained approximately 1mm coronal to the buccal bone plate. The residual tooth fragments were completely removed on the lingual, distal, and mesial region of the extraction socket. The dental implant administered on the internal aspect of the fragment. and was situated at the height of the buccal root segment. Implants were placed intentionally in direct contact with the buccal root fragment. Healing abutments were connected. Histological evaluation after 4 month showed no resorption of the root fragment and new cementum formed on the implant surface. their clinical case demonstrated excellent buccal tissue preservation and clinically successful osseointegration of the implant.

The study concluded that retaining the buccal aspect of the root in conjunction with immediate implant placement is a viable technique to achieve osseointegration without any inflammatory or resorptive response.

A case report presented by Al-Dary [26], using technique was described by Hürzeler et al. in which the root was hemisected using a fissure bur in a mesio-distal direction, then removal of the lingual fragment (atraumatic) of the root was achieved, then the buccal fragment was reduced using surgical bur leaving a thin layer of the root aspect intact to the buccal plate of the bone. In this study the author used one piece implant, since study conducted by Hermann et al. showed that significantly increased amounts of crestal bone loss around two-piece vs. one-piece implants, which result in a significant more apical position of the gingival margin, also, the degree of inflammation in peri-implant tissues is less around one-piece implants compared to two-piece implants.

In his study he concluded after 5 month waiting time retaining the buccal aspect of the root in conjunction with immediate implant placement is a viable technique to achieve three dimensional positioning of the implant which requires optimal support and stability of surrounding hard and soft tissues.

Another case report conducted by same author he used a bone trephine was used to take out the remaining root, leaving an organized rounded section of

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the palatal/lingual extraction site with a semi lunar internal shape of the buccal aspect of the root that will receive an implant. He concluded that preparing the shield with a trephine may be of a great advantage than using fissure bur [27].

A new case report [28], the author conducting immediate implant placement simultaneous to the socket shield (SS) technique. and in this study the author demonstrate a 1 year follow up successful preservation of post-extraction tissues coinciding with successful restorative implant treatment. He concluded that The socket-shield technique offer a promising solution to the difficulties encountered when managing the post extraction tissue and addition to clinical implant dentistry.

A case report conducted by Chen & Pan [29] using socket shield technique protocols, in which failing upper right second premolar which would be replaced by an implant-supported single crown. Leaving a partial root fragment at buccal side in combination with immediate implant placement lingual to the retained fragment was performed. Clinical examination after 4 month of installation showed healthy peri-implant soft tissue and the ridge was well preserved. A maximum amount of horizontal resorption at the buccal side was 0.72mm. Applying socket shield technique and immediate implant placement may be a feasible treatment option in case with high esthetic concern.

A comparison study was performed by Abadzhiev M, Nenkov P, Velcheva P [1]. This study design including Twenty-six implants in twenty-five patients, with a need of tooth replacement in frontal aesthetic region, visible during smile. Sixteen implants placed by conventional immediate implantation and guided bone regeneration. Ten implants placed using Socket-shield technique. All the implants were follow up of 2 years and evaluated by X-ray follow up on each 6 months ,Soft tissue volume, Aesthetic evaluation according to the doctor and according to the patient.

The Result Gather from this Study as Following

Radiological examination immediately after implantation and on every 6 months during the next 2 years shows considerable bone loss in conventional implantation. Up to 12% in the first two years, which is equal up to 5mm. Contrary in socket-shield technique

during 2 years follow up bone loss is 2% which is equal to 0.8mm.

Soft tissue volume is assessed by the quantity of attached gingiva. Almost same results are observed in this criteria as in the bone loss. 18% compared with 2% in favor of the socket-shield technique. High bone resorption leads to lack of soft tissue support and is a precondition for mucogingival surgery for increasing the volume of attached soft tissue. The result from the clinical assessment of aesthetics showed the predominant natural appearance of socket-shield treated teeth.

A Pilot Study [30] to assess histologically, clinically, and volumetrically the effect of separating the remaining buccal root segment in two pieces before immediate implant placement was performed. Since there are concerns that socket shield technique can only be used when buccal tooth structure is intact but in many cases a tooth that has to be replaced is vertically fractured. Three beagle dogs were selected in the study. The third and fourth premolars on both sides of the upper jaw were hemisected and the clinical crown of the distal root was removed. Then, the implant site preparation was performed into the distal root so that a buccal segment of healthy tooth structure remained. This segment was then separated in a vertical direction into two pieces and implants placed lingual to it. 4 month later the specimens were investigated for histological diagnosis and was concluded

1. healing of all experimental sites proceeded without adverse events and without signs of inflammation.
2. Presence of a tooth fragment apically in contact with the threads of the implant. which was still attached to the buccal bone plate by periodontal ligament.
3. On the buccal alveolar crest, no osteoclastic remodeling was found.
4. Junctional epithelium ending at the cemento-enamel junction detected using a higher magnification.

In a clinical case, the same technique was applied and impressions taken for volumetric evaluation by digital superimposition. selected surface measured about 28.68 mm². 5 month later, a mean loss of 0.66 mm in labial direction was detected. sine bone loss was not homogenous a maximum value of 1.16 mm and a minimum of 0.01 mm could be identified. more loss in the middle of the area, decreasing toward the mesial

and distal.

Finally the author conclude that applied modification of this protocol have no interfere with implant osseointegration and also apply the benefit of preserving the buccal plate. It may offer a feasible treatment option for vertically fractured teeth.

Kan and Rungcharassaeng [31] used proximal socket shield procedure (PSS) in conjunction with immediate implant placement and provisionalization on a failing tooth adjacent to an implant restoration. His protocol was to leave a portion of the root fragment adjacent to existing implant restoration, the idea was to preserve the proximal bone, the presence of a coronal portion of the root fragment with supracrestal cementum (2 mm above the proximal bone), where dentogingival fibers are attached, also contributes to the preservation of the level of the inter implant papilla.

Proximal socket shield technique (PSS) is sensitive procedure, success depends on proper case selection, the tooth an periodontal apparatus of the failing tooth must be healthy with no evidence of pathology (eg, internal/external root resorption, perforation, infection, or fracture) to avoid future complication.

They conclude that well-preserved inter-implant papilla and satisfactory esthetic results after 1-year follow up were shown in their case report. However, more studies are needed to prove the feasibility.

One study in which twenty-two fixtures were placed. and all implants were immediately loaded with a cement-retained acrylic interim restoration using "Root membrane technique". The protocol of this technique involve reduction of crown tooth structure to the level of one millimeter above the osseous crest. then the implant site were prepared by drilling through the long axis of roots. This technique implements with gradual endoroot extraction (dentotomy- osteotomy) of the palatal aspect of the root following the drilling sequence suggested by the implant manufacturer. The 'Root membrane technique' (immediate implants placement and loading in the aesthetic zone of the maxilla), has been proven to be a successful alternative method for the aesthetic preservation of the tissues in this demanding area. [32]

Conclusion

Long term success of implant in aesthetics zone

requires prudent participation of clinicians to contribute to the knowledge base before the procedure can be routinely prescribed.

Socket shield technique is cost-effective but still technique-sensitive, success require a precise case selection to achieve successful results. Moreover, appropriate surgical treatment, restorative procedures, and clinical experience are essential when performing immediate installment of implants [33]

This treatment modalities have advantage of, ultimate esthetic outcome imitating the natural emergence profile, preserving the soft and hard tissue volume, lack of bone loss, additional material cost, No co-morbidity, Single surgery, Applicable in sites with endodontic apical pathology. The disadvantage include not yet reliable or predictable, no long-term data available,

Long term clinical studies and observation are needed in order to achieve high esthetics result and long lasting implants outcomes using the protocol described by socket shield technique. Science and technologies guides us to desired results by using the most valuable prove in medicine.[34,35]

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