Modified Root Submergence Technique for Pontic Site Development in Maxillary Anterior Region

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Extraction of tooth leads to alveolar ridge resorption, which is more pronounced in the 1st year after extraction. Ridge resorption results in loss of interdental papillae and creation of unesthetic black triangles. Root submergence technique (RST) is a procedure where the tooth is decoronated and submerged at or below the alveolar bone level. The goal of the technique is to maintain the attachment complex of the tooth, which will prevent the alveolar bone resorption at the site with maintained soft tissue profile resulting in better esthetic results. The present case describes a relatively bloodless and minimally invasive modified RST that can be implemented in routine clinical practice with the predictable esthetic outcome.

Key words: Esthetic dentistry, Interdental papilla, Pontic, Ridge resorption, Root submergence technique

INTRODUCTION

Tooth extraction is one of the most encountered dental procedures in the dental office even after the recent advancements in the field of dentistry. After the extraction of the tooth healing usually occurs uneventfully, but it is well-documented that loss of tooth causes resorption of the alveolar ridge, which is mainly seen during the 1st year after the extraction. Carlsson and Persson (1967) stated that 25% decrease in alveolar bone width with 4 mm decrease in vertical height during the 1st year after extraction for immediate dentures.¹

Residual ridge resorption starts with the loss of tooth and its periodontal membrane, which is responsible for the bone formation.² Periodontal membrane loss leads to decreasing metabolism in the alveolar ridge and to biochemical resorption of the bone caused by the dental plaque endotoxins, prostaglandins, and human stimulating factors of alveolar ridge resorption.² Araújo and Lindhe suggested that following tooth extraction, the blood vessels in periodontium to the thin bone walls are severed, thereby causing facial bone plate resorption.³

Loss of supporting bone causes the apical migration of soft tissues resulting in the creation of ugly black triangles which is not only is a matter of esthetic concern but also causes problems related to phonetics and lateral food impaction.⁴ Various procedures, such as socket preservation, tissue augmentation, or immediate implant placement, are applied to counteract for the bone resorption after extraction. However as said by Aristotle, “In all the things of nature there is something of the marvelous,” i.e. these procedures may cause decrease in the resorption but do not completely stop the alveolar ridge resorption. Thus, it can be assumed that retaining the periodontal apparatus of tooth may alter the occurrence of bone resorption.

Hence, to preserve the alveolar bone resorption by retaining the natural tooth, the concept of the root submergence technique (RST) emerged. It is a procedure where the tooth is surgically decoronated, and the root is submerged at the level or below the alveolar crest instead of extraction. In 1961, Bjorn was the first person to publish a report of root submergence.⁵ This technique was introduced in the late 1960s to prevent residual ridge resorption in complete denture patients.⁶

RST has been described for both vital and non-vital teeth. Guyer (1975) submerged vital root for the first time in
humans and reported vitality of the pulpal tissue through the apices and collateral occlusal circulation from the soft tissue.7 O’Neal et al. performed histological examination of 16 endodontically treated submerged roots and reported 62.5% of the root specimens had half of their cut surface covered by osteocementum.8

The advantage of RST is that it preserves the alveolar bone resorption thereby maintaining the soft tissue profile thus giving esthetically more favorable result. It is relatively simple and easy procedure with good proprioceptive, perceptive, and physiologic patient response. The present case reports the effective utilization of modified RST in fractured left upper lateral incisor for esthetic rehabilitation.

**CASE REPORT**

A 50-year-old male patient was referred to the Department of Periodontology and Implantology with the chief complaint of missing tooth in left upper front teeth region for the past 15 days for oral prophylaxis (Figure 1). Medical history was non-contributory. On examination, root stump was seen in relation to maxillary left lateral incisor, second molar and third molar (Figure 2). The patient gave history of the prosthesis in relation to maxillary left lateral incisor which he got fabricated from a local quack 8 months back. Careful examination revealed notch preparation in adjacent teeth which were used as undercuts to stabilize an acrylic tooth in the edentulous area using cold cure acrylic resin.

The patient was advised for extraction and immediate implant placement in relation to maxillary left lateral incisor and endodontic treatment of maxillary left central incisor and canine along with fabrication of crowns. However, the patient was reluctant to undergo any kind of surgical procedure. Based on the patient’s chief complaint and desire, a modified RST was planned in relation to maxillary left lateral incisor followed by a bridge over the endodontically treated central incisor and canine.

Initially, the maxillary left central incisor, lateral incisor root stump, and canine were endodontically treated. In the subsequent visit, the root stump was submerged subgingivally using a flame bur in air rotor handpiece under local anesthesia (lignocaine 2% with 1:80,000 adrenaline) so as to create a concavity in the root (Figure 3) such that the central portion of the submerged root was more apical compared to peripheral root margins (Figure 4). The central area of the submerged root was restored by a thin layer of restorative glass ionomer cement (GIC). The crown reduction of maxillary left central incisor and canine was done and an irreversible hydrocolloid (alginate) impression was recorded and cast was poured.

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**Figure 1:** Pre operative intraoral view

**Figure 2:** Pre operative OPG

**Figure 3:** Illustrative diagram depicting endodontically treated Root Stump being submerged

**Figure 4:** Illustrative diagram depicting submerged root with an occlusal concavity
The cast was sent to dental lab for fabrication of bridge where an ovate pontic was fabricated so as to fit into the concavity of submerged root. The bridge along with the pontic was cemented onto the prepared teeth and submerged root using resin-modified GIC. The crown in the region of submerged root exhibited good emergence profile with better esthetic outcome (Figure 5). The procedure was minimally invasive, and the patient was satisfied with the treatment.

**DISCUSSION**

There is synergy between the smile, the skin and the sense of confidence that having both brings; and to have beautiful smile maxillary anterior teeth play a very important role. In the recent years, the demand for esthetic dentistry has increased rapidly. Prosthetic rehabilitation should aim for perfect harmony between white and pink tissue esthetics. As soon as the tooth is extracted, residual ridge remodeling starts with the cascade of inflammatory reaction. Although bone deposition in socket will continue for several months, it will not reach the coronal bone level of neighboring teeth. Atwood and Coy (1971) stated that the rate of Residual ridge resorption averaged 0.1 mm/year for maxilla and 0.4 mm/year for the mandible. Schropp et al. (2003) reported that extraction of tooth triggers resorption of the surrounding tissue and the width of alveolar ridge decreases by up to 50% in 1 year. The buccal plate of the teeth in the maxillary anterior dentition is the most often very thin, leading to significant dimensional alterations during the immediate post-extraction period.

Thus, the loss of vertical dimension and interdental bone results in the loss of interdental papilla and creation of black triangles leading to unesthetic smile. Salama et al. (1998) studied the interproximal height of bone (IHB) as a factor in achieving optimal esthetic outcomes and classified the predicted height of Interdental Papillae based on the IHB measured from crest of bone to future contact point of the prosthesis (Table 1). Esthetic treatment is more difficult in maxillary anterior multiple-tooth defect sites because an ideal soft tissue frame with intact interdental papillae is difficult to create without an adjacent intact natural tooth attachment apparatus. Therefore, in such areas RST can effectively be used for preventing bone resorption at the pontic site. RST not only preserves the alveolar bone but also allows the creation of an ideal interdental papilla which is in more harmony in color form and contour with the adjacent tissues.

Rodd et al in 2002 justified the efforts to retain permanent anterior roots in a young population in light of the high clinical success rate of over 90% over a 2-year period. Salama et al. (2007) suggested a strategy to provide a more predictable protocol for esthetic implant treatment for multiple-tooth defects using the RST. Hürzeler et al. (2010) introduced a new method, based on the same concept, 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.

This case report describes the application of a modified RST for pontic site development for a fixed partial prosthesis. 1 year follow-up visit revealed that a submerged root below a fixed partial denture maintained the hard and soft tissues without any periapical pathology (Figure 6). Choi et al. (2015) reported a similar case series for pontic site development in maxillary anteriors utilizing RST for fixed

<table>
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<th>Class</th>
<th>IHB in mm</th>
<th>Prognosis</th>
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<tbody>
<tr>
<td>I</td>
<td>4-5 mm</td>
<td>Optimal</td>
</tr>
<tr>
<td>II</td>
<td>6-7 mm</td>
<td>Guarded</td>
</tr>
<tr>
<td>III</td>
<td>&gt;7 mm</td>
<td>Poor</td>
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IHB: Interproximal height of bone
partial dentures. As long as the hopeless tooth has no periapical pathology, its root remnant can be submerged to preserve the surrounding periodontal tissue. However, vital root submergence may develop pulpal infection resulting in failure or can lead to various complications such as root resorption, ankylosis, periapical pathology, and soft tissue perforations. Therefore, endodontic treatment of root being submerged is suggested.

CONCLUSION

The undisturbed root attached to the alveolar bone by the periodontal ligament is the “perfect” implant and is instrumental in preserving the alveolar bone integrity. Within limits, the modified RST could serve as a promising technique for alveolar ridge dimension maintenance at the pontic site of a fixed partial denture in the esthetic zone of maxillary anterior. Moreover, this technique is also suitable for meeting the esthetic demands of medically compromised patients where surgery is contraindicated. More longitudinal follow-up studies are required to evaluate the long-term outcomes of this technique. In the words of Muller de Van (1952) we would like to conclude on this note, “The preservation of that which remains is of utmost importance and not the meticulous replacement of that which has been lost.”

REFERENCES