



Root Submergence Technique, A Case Series with Follow-Up up to Seven Years

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Abstract

In the era of aesthetic dentistry, the goal is not only to provide a function to our patients but also to preserve the hard and soft tissue anatomy, to have a pleasing prosthesis. Obtaining natural aesthetics is simpler in single implant cases, however, in multiple implant prosthesis achieving natural dentition becomes a challenge. The root submergence technique (RST) is one such procedure that provides maximum preservation of the surrounding alveolar bone and soft tissue. This case series discusses the effect of a root submergence technique on preserving the periodontal tissue at the pontic site of fixed dental prostheses in the maxillary arch. The results of this clinical case series indicate that a root submergence technique can be successfully applied in the pontic site development with fixed dental prostheses, especially in the maxillary anterior aesthetic zone.

Keywords: Root Submergence; Alveolar Ridge; Fixed Dental Implant Prostheses

Introduction

The creation of an ideal aesthetic result is one of the prime objectives of implant-prosthetic therapy. In today's era of implant dentistry, the soft tissue profile is considered of utmost importance. Soft tissues as we know follow the hard tissue profile. Therefore, to achieve a harmonious soft tissue profile, the underlying alveolar bone must be present to support it.

However, as we know, the extraction of a tooth leads to dimensional changes in the alveolar ridge. The loss is about 1.5-2 mm vertically and up to 3.8 mm horizontally, even where the socket walls have been intact [1,2]. This occurs within the first few months after tooth loss and continues and without treatment. Almost 60% of total ridge volume can be lost in the first 3 years. Thin gingival biotype, prominent roots, or buccally positioned tooth further increases the degree of resorption post extraction [3,4]. This leads to loss of papilla and atrophy of residual ridge lead-

ing to an unesthetic outcome with an implant restoration, or even with a traditional tooth-supported fixed bridge, or so in cases of multiple implant prosthesis. The body of current evidence is that the treatment of numerous teeth is more successful when adjacent implants are avoided; instead, segregation of implants is done by the inclusion of a pontic [5]. This unfavorable change in alveolar anatomy can be prevented by doing a ridge preservation procedure at the time of tooth extraction, however, this would likely require multiple grafting procedures, which not only increases the treatment time but also adds to extra expense and inconvenience for the patient. Thus, to prevent alveolar bone resorption after extraction of teeth, the root submergence technique was introduced, wherein the crown is resected and covered with a buccal or buccolingual flap. The first published case report on root submergence was published by Bjorn in 1961 [6]. At that time, it was introduced to prevent alveolar bone resorption under complete dentures. The term RST was proposed by Howell in 1970 [7].

This method entails grinding the failing tooth to the level or below the level of the alveolar crest and then leaving it in the socket for 3-4 weeks so that surrounding tissue can proliferate over the remaining root.

A submerged root maintains the periodontal attachment complex, preventing the resorption of the alveolar bone on the buccal and lingual walls, as well as on the interproximal area [8,9]. Clinical and histological studies have reported, that non-infected vital or endodontically treated roots completely submerged within the alveolus were able to effectively preserve the residual ridge [10-12]. The root submergence technique has also been applied in implant-supported prostheses and successful aesthetic outcomes, have been reported [5]. This case series aimed to evaluate the clinical success of the root submergence technique in the maxillary arch as a part of fixed implant prosthesis in terms of preservation of soft and hard tissue framework.

Materials and Method

32 patients (26 males and 6 females, 22 years to 74 years old) were included in this case series. After initial clinical and radiographic examination (Figure 1) treatment was planned and presented to the patient and consent was obtained. Any teeth with periapical infection, vertically fractured teeth or ones with internal and external resorption, or teeth with mobility were excluded and extracted instead. In this case series both vital and non-vital teeth were selected for RST. Among the 32 cases, 10 teeth were previously root canal treated teeth, but now due to extensive coronal fracture of the crown could not be restored, 8 were found nonvital and root canal procedure was performed before the initiation of surgical protocol, 12 were vital teeth.



Figure 1: Pre-operative -Clinical view of the arch following the failure of the fixed bridge in the right quadrant demonstrating the residual root.

In all cases, first patient preparation was done with extraoral asepsis with 2% povidone-iodine, followed by intraoral preprocedural 0.2% chlorhexidine rinses. Local anaesthesia was administered. Bioner Top DM implants (Bioner, Barcelona, Spain) (Figure 2) were selected for their unique design. The implants offer an expanding cone-shaped core and an increasing diameter from the apical to the coronal area, thus favouring insertion in areas with low bone volume, like the maxilla. Also, the double acid etching and a dual pitch thread decrease the time for loading. The osteotomy site was prepared according to the manufacturer's instruction and the implants were inserted in the desired sites and submerged. The failing tooth pontic was retained at this stage to be used as a support for the interim Maryland prosthesis (Figure 3). At the second stage of surgery, a crevicular incision was given at the ridge with Bard Parker blade no. 15. Labial and lingual mucoperiosteal flaps were mobilized. For RST the tooth was first decoronated till the gingival level, with a tapered diamond, while protecting the gingiva with a gingival barrier. Then with the help of a wheel bur, the root is trimmed 2 mm sub crestal to facilitate soft tissue closure (Figure 4). Care should be taken to protect the gingiva at all times and there should be an absence of sharp edges at the coronal root periphery, else it would lead to perforation of soft tissue later.

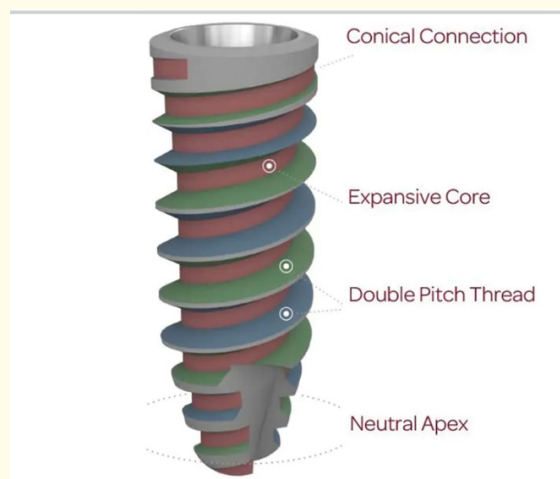


Figure 2: BionerTop DM Implants characteristics.

Healing abutments were placed for all the cases, soft tissue closure is then achieved employing by buccal advancement of the flap and sutured (Figure 5). After a healing period of 10 days in



Figure 3: Postoperative Panoramic radiograph with an interim prosthesis - maryland bridge.



Figure 5: Healing abutment placed on implants and buccal advancement of flap done with suturing to cover the submerged root.



Figure 4: Surgical step: Decoronation of root with a wheel bur for submergence.



Figure 6: Post- Operative healing after one week.

all cases (Figure 6), impressions were taken and a fixed prosthesis was planned, with the roots submerged pontic. (Figure 7,8) at the end of which a panoramic radiograph and an IOPA x-ray were taken to assess the fate of the RST upon clinical examination (Figure 9 and 10).

Results

Postoperative healing was uneventful in all cases. None of the patients reported any pain or swelling. All the implants were Os-seo integrated. The patient was satisfied with the outcome. The submerged roots helped in attaining an excellent soft tissue profile around the pontic site under the definitive metal-ceramic restoration, supported by implants on either side. Both vital and non-vital RST cases were equally successful at the end of 7 years.



Figure 7: Prosthetic abutments in placed for cement-retained PFM prosthesis.



Figure 8: Finished cement retained PFM prosthesis intraorally.



Figure 9: Post-Op Panoramic Radiographic after completion of the prosthesis with submerged root pontic and fixed implant prosthesis.



Figure 10: 7-year Post-Operative Panoramic radiograph.

Discussion

Retaining the gingival contour is one of the most significant factors in achieving optimum aesthetics in implant dentistry; more so, when treating multiple sites, wherein the proximity of the implants could lead to an accentuated bone resorption [13]. Atrophy of the residual ridge following extraction of a hopeless tooth compromises treatment outcomes, especially in areas of high aesthetic demands. Though techniques like socket preservation have been advocated in the past, there is an inherent issue of graft-related complications. Furthermore, the procedure does not preserve the alveolar; it only minimizes the amount of resorption of the alveolar bone [14,15]. Clinicians ought to hence continuously consider other alternatives accessible and can shape and delicate tissue profile for the conclusive implant-supported restoration.

Partial extraction treatment can be selected as a potential treatment methodology for the conservation of the bone when other modalities are limited due to systemic diseases and financial limitations. The root submergence procedure can be carried out on both vital and non-vital roots. However, in non-vital root submergence, the tooth is first endodontically treated.

As long as the hopeless tooth has limited periapical pathology, its root remnant can be submerged to preserve the surrounding periodontal tissue. Submerged roots between dental implants have also been found to preserve the gingival architecture and prevent interproximal bone resorption since the presence of root holds the bone and the soft tissue component in place Salama et al, have reported that in comparison to two adjacent natural teeth, the interdental papillae between an implant have the second highest ranking. Malmgren, *et al.* 1970, reported the technique with successful bone regeneration between dental implants [13].

This clinical case series describes the application of a root submergence technique to develop the pontic site of a fixed dental implant prosthesis. Roots were submerged under a fixed dental implant prosthesis that maintained the surrounding periodontium without periapical pathology for seven years (Figure 6). O'Neal, in their histologic and radiographic study on RST, reported positive results and concluded that the root submergence technique should be considered as an alternative to the extraction of key teeth to preserve alveolar bone [9]. In the present case series, all grafted roots were completely covered by soft tissue, after treatment and

showed no change at the 7-year follow-up evaluation.

The disadvantage of the technique is the complications that occur during the root submergence. These are the exposure of the coronal part of the root through the tissue, which makes it vulnerable to periodontal disease, prone to caries, or even a periapical infection if they are left untreated. In rare cases, migration of roots can also occur [17]. In a study by Von Wowern and Winther, wherein they reported a 53% failure rate of four-year follow-up of 20 non-vital submerged roots among 15 participants caused due to exposure of the root surface [18]. These complications, however, can be prevented, with a thorough examination, case selection, and correct procedural steps, such as keeping the root completely submerged, and all sharp edges to be removed.

Conclusion

In the present series of cases, favorable vertical anatomy of the alveolar bone around the submerged root was obtained, for ideal soft tissue support. Thus, the use of RST is likely to support the ridge tissues between multiple implants and can be a better option for maintaining the alveolar ridge framework. This makes it an economical option and a less time-consuming option to obtain excellent aesthetic ridge dimensions and the height of the papilla completely. The current case series supports the success of the technique. In any case, clinical cases ought to be examined in detail and legitimate case determination is the key to the long-term success of this treatment. However, in certain clinical situations, RST should be strictly avoided, these, Teeth with large periapical infections, vertically fractured teeth, tooth mobility, teeth with internal or external resorption.

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