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*RESEARCH ARTICLE*

# THE PARTIAL EXTRACTION THERAPIES:ROOT MEDIATED RIDGE PRESERVATION IN RESTORATIVE AND IMPLANT DENTISTRY

**Dr. Bhushan Bangar, Dr.Jayshree Ghuge, Dr. Susheen Gajare, Dr. Shashi Patil and Dr. Shivani Raut**

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## Abstract

Crestal bone loss, a decrease in the edentulous ridge's width, and a decrease in the height of the interdental papillae are all possible outcomes of extraction. It is commonly known that alveolar bone volume decreases following tooth extraction. Following tooth extraction, the bundle bone-periodontal ligament complex [BB-PDL complex] is lost, which results in the loss of alveolar bone and ridge shape. Compared to the palatal and lingual cortical plates, the buccal cortical plate is thinner and has four times as much residual ridge resorption. Numerous methods for preserving ridges have been suggested in the literature. By preserving the buccal bone-periodontal complex's vascular supply, partial extraction procedures have been shown to stop buccal bone loss. Techniques such as root submergence, socket shield, proximal socket shield, and pontic shield are examples of partial extraction therapy. This method maintains the ridge contour and the loss of alveolar bone. To replicate the future pontic, the coronal root is hollowed out and the tooth is decoronated at the level of the bone crest using the root submergence procedure. When planning a pontic location underneath a traditional fixed partial denture, the root submergence approach is recommended. The tooth root is divided into the palatal and facial portions longitudinally in the socket shield procedure. The long-shank dental bur has a little concavity in the facial root. Pontic shielding entails the same preparation as extraction socket grafting using a slow-resorbing bone replacement. By preserving the periodontal ligament and the blood vessels that are connected to it, these procedures highlight the long-term effectiveness of implants and are anticipated to produce better aesthetic results. Thus, by stopping the buccal bone's natural bone resorption and the soft tissues that cover it from contracting. The review of several partial extraction therapy approaches is the main focus of this article.



## Introduction:-

For dental implants to have long-term clinical success, there must be enough bone volume and alveolar ridge height available. If teeth are not replaced right away after tooth loss, active resorption causes bone height and volume to rapidly decline. Approximately 1.5–2 mm of alveolar bone loss occurs vertically, and up to 3.8 mm occurs horizontally, within the first six months following tooth removal. Without therapy, bone loss will continue, and within the first three years, 60% of the entire ridge volume may be lost.1–2. The buccal aspect experiences the most

**Corresponding Author:- Dr. Bhushan Bangar**

bone loss, which is associated with a thinner bone wall made up of a lot of bundle bone that is mostly vascularised by the periodontal tooth membrane and is especially vulnerable to resorption and surgical trauma3. Loss of bone tissue in both the vertical and horizontal dimensions makes it extremely difficult to install dental implants successfully and has a negative impact on osseointegration, implant location, and aesthetic results. It is essential to retain and keep intact the bone architecture and the soft tissues that cover it in order to achieve a successful aesthetic result with a single implant-supported repair in the anterior area.

In an attempt to reduce the physiologic bone resorption that occurs in the anterior region after tooth extraction, a number of surgical treatments have been put forth and studied. Alveolar socket preservation, soft-tissue grafts, implant placement immediately following extraction, implant placement on the palatal/lingual wall, buccal wall contact preservation, flapless surgery to preserve vascularization, and guided bone regeneration (GBR) with membranes and/or grafting materials are a few of these methods3–4.

With advancements in dentistry, extraction of any teeth has become the last resort in any treatment plan. This brings us to a very popular concept known as 'Partial Extraction Therapy' (PET). These techniques were first described under a collective term and classified by Gluckman et al. in 2016. Partial extraction therapy is a method of ridge preservation by retaining tooth roots to prevent ridge collapse[4].The root submergence technique, socket shield technique, proximal socket shield technique, and pontic shield technique are among the various methods used in partial extraction therapy. The various partial extraction therapy approaches are explained in detail in this article4.

**Indications[3]**

1. An unrestorable tooth indicated for extraction.
2. Absence of periapical pathology.
3. Teeth with healthy amputated pulp or root canal treated teeth.

**Contraindications[3]**

1. Teeth with external root resorption.
2. Root caries
3. Existing endodontic-periodontal lesions due to unhealthy roots.

| PET | CLINICAL SITUATIONS INDICATED |
|---|---|
| 1. Root Submergence | 1.Unrestorable tooth crown or tooth indicated for extraction.<br>2.Absence of apical pathology<br>3.Healthy amputated pulp or endodontic therapy completed.<br>4. Intentions to preserve the alveolar ridge.<br>5. Planned pontic site beneath fixed prosthesis.<br>6. Cantilever pontic site as an alternative to two adjacent implants.<br>7. Actively growing young patient planned for implant treatment later<br>8. Ridge preservation in conjunction with other PET. |
| 2. Socket Shield | 1.Unrestorable tooth crown or tooth indicated for extraction.<br>2. Tooth root with or without apical pathology.<br>3. Intentions to preserve the alveolar ridge, specifically to prevent,bucco palatal collapse.<br>4. Immediate implant placement.<br>5. Ridge preservation in conjunction with other PET. |
| 3. Pontic Shield | 1.Unrestorable tooth crown or tooth indicated for extraction.<br>2.Absence of apical pathology.<br>3. Intentions to preserve the alveolar ridge.<br>4. Planned pontic site beneath fixed prosthesis.<br>5. Cantilever pontic site as an alternative to two adjacent implants.<br>6. Ridge preservation in conjunction with other PET. |
| 4.Proximal Socket-shield | 1.Unrestorable tooth crown or tooth indicated for extraction.<br>2.Absence of apical pathology.<br>3. intentions to preserve the alveolar ridge.<br>4. Planned immediate implant placement sites of two or more adjacent implants. |

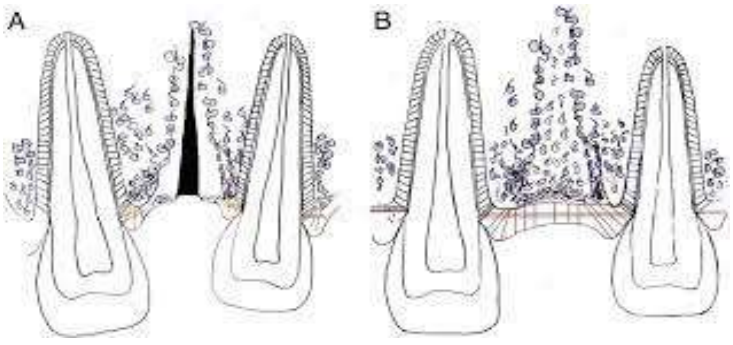
| | |
|---|---|
| | 5. Papillae preservation in conjunction with other PET. |

| INSTRUMENTS AND MATERIALS REQUIRED FOR PET |
|---|
| SOCKET SHIELD TECHNIQUE<br>1.Long shank root resection bur.<br>2. extra-large round diamond head bur (to reduce inner aspect of shield into concavity)<br>3.End cutting diamond head bur (to reduce coronal aspect of shield)<br>4. Gingival protector<br>5. Irrigated surgical motor.<br>6. Contra-angled surgical fast handpiece.<br>7.Microperiotomes<br>8.Microforceps |
| PONTIC SHIELDTECHNIQUE<br>1.Long shank root resection bur.<br>2. extra-large round diamond head bur (to reduce inner aspect of shield into concavity)<br>3.End cutting diamond head bur (to reduce coronal aspect of shield)<br>4. Gingival protector<br>5.irrigated surgical motor.<br>6. Contra-angled surgical fast handpiece.<br>7.microperiotomes<br>8.microforceps<br>9.Socket grafting instruments, plugger, particulate graft spoon and crucible.<br>10. SM69 blade.<br>11.6/0 nylon sutures |
| ROOT SUBMERGENCE TECHNIQUE<br>1. Irrigated surgical motor<br>2. Contra-angled surgical fast handpiece<br>3. extra-large round diamond head bur (to reduce inner aspect of shield into concavity)<br>4. SM69 blade.<br>5. 6/0 nylon sutures |

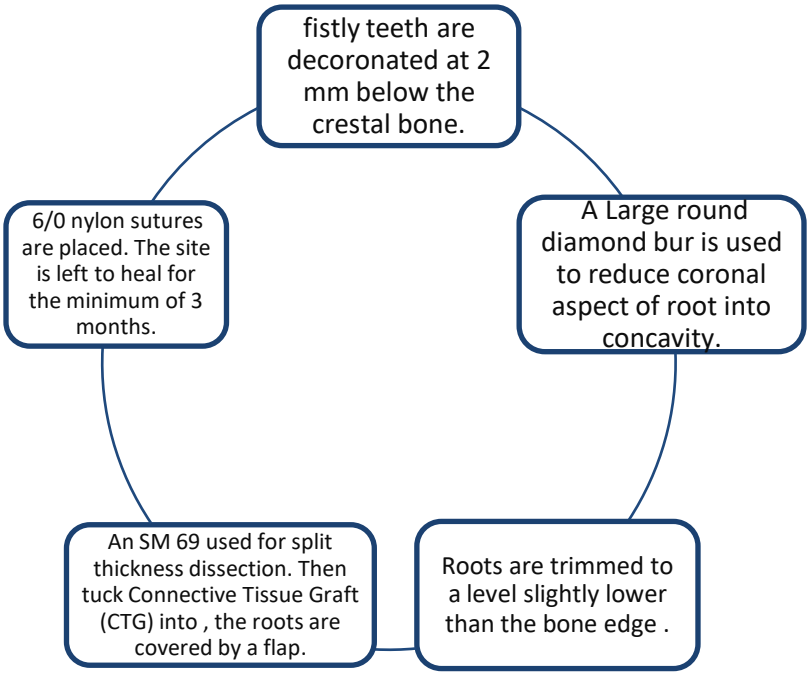
**1] Root Submergence Technique[5]**

Bjorn initially described this method in a 1961 study on dogs, and he expanded it to include humans in 1965. It is mostly recommended when the gingiva is not subjected to any noticeable occlusal forces. Both vital and non-vital teeth may undergo it. The use of non-vital root submergence to lower the probability of failure due to pulpal infection following submergence is supported by the literature. Natural teeth have the potential to keep the surrounding bone and soft tissue height because of their attachment apparatus, which also preserves and enhances the shape of the alveolar bone and the gingival and alveolar mucosa.

The RST not only eliminates the risk of caries and periodontitis, but more important, the retention of a natural tooth root allows for maximum preservation of the surrounding alveolar bone and soft tissues. The RST was introduced to preserve the alveolar ridge; later it was used to prevent downgrowth of epithelium during the regeneration of periodontal tissues[5].



**Technique**




**2]Socket-shield technique[6]**

When a tooth is extracted, a series of actions take place that cause the alveolar bone around the socket to resorb. Both vertical and horizontal bone loss are caused by the buccal bone loss that follows extraction. In these situations, achieving aesthetically attractive results necessitates intricate hard and soft tissue repair. Hurzeler was the first to describe this method in 20106. For the socket shield procedure, a tooth with apical disease that is recommended for extraction may be chosen.

A classification of SST technique is proposed depending on the position of the shield in the socket.

**Classification[6]**

This classification is required so as to help in understanding the preparation design and role of shield, in treatment planning various clinical scenarios discussed above.

**Type I: Buccal shield**

Buccal shields are defined as those that are located solely in the buccal region of the socket, which is between the tooth's proximal line angles. It is indicated when both the distal and mesial teeth are present in a single edentulous location.

**Type II: Full C buccal shield**

When the shield is located in both the buccal and interproximal regions on either side of the socket, the situation is categorised as Full C Buccal Shield.
It is advised to use this shield design in the following therapeutic situations:
• Two implants already in place on either side of the suggested location.
• One or both missing teeth that are not implanted
• Having a tooth missing on one side and an implant on the other.

**Type III: Half C buccal shield**

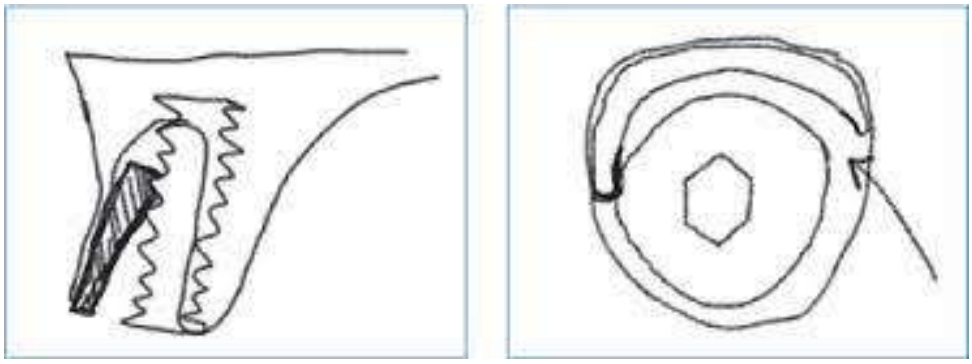
When the shield is located in both the buccal and one of the interproximal regions, the condition can be categorised as half C buccal shield. When one side has a tooth and the other side has an implant or a missing tooth, this design is advised.

**Type IV: Interproximal shield**
When the shield is located just in the mesial or distal portion of the socket, the condition might be categorised as interproximal. This design is recommended when an adjacent side has an implant or a missing tooth and buccal bone resorption necessitates a graft. In these situations, removing the entire tooth could result in the loss of the important interproximal bone.

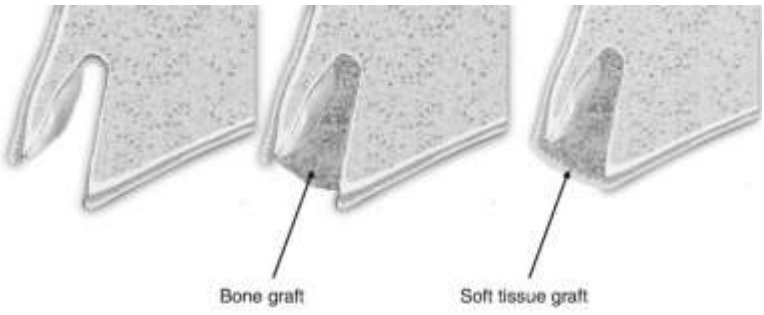
**Type V: Lingual-palatal shield**
When the shield rests on either the lingual or palatal side of the socket, the condition is categorised as lingual-palatal shield. Although there are limited indications for this kind of shield design, maxillary molars may be a good candidate.

**Type VI: Multiple buccal shields**
If a case has two or more buccal shields in the socket, it might be categorised as multiple buccal shields. When there is a vertical root fracture, it is recommended. Bone deposition between fractured roots has been demonstrated, which may help hold the two pieces together.

**Advantages of socket-shield technique[6]**
The goal of this minimally invasive surgical technique is to preserve a portion of the root in order to support the preservation of the hard and soft tissue shapes. It reduces the need for hard and soft tissue grafting operations, which shortens the course of treatment. By creating an interdental socket shield, the interdental papilla can be protected even when there are nearby implants. In terms of preserving pink and white aesthetics, this method is quite promising and offers a remedy for cases that are crucial to appearance, like maxillary anterior and high lip line. As long as the shield is intact, this method not only protects but also aids in maintaining the hard and soft tissues in the future.

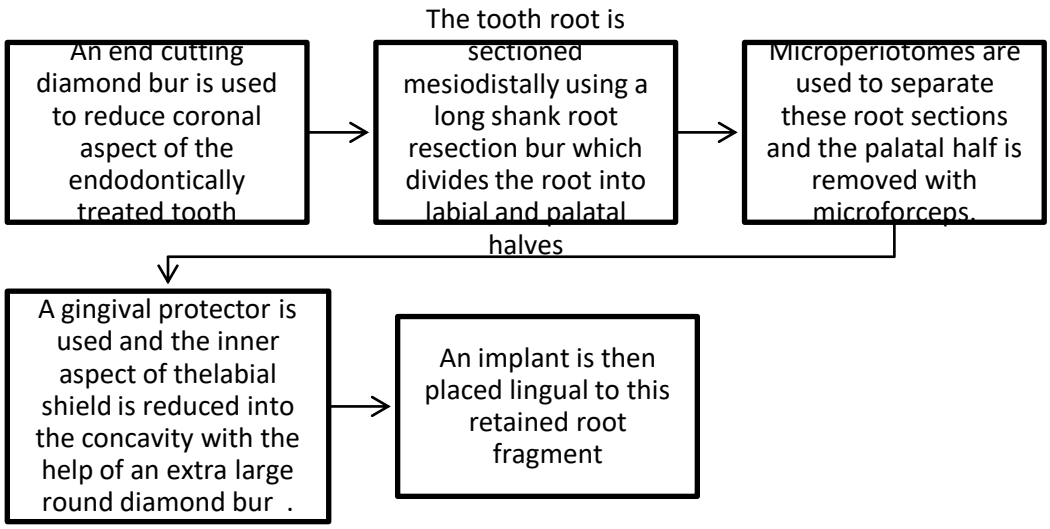


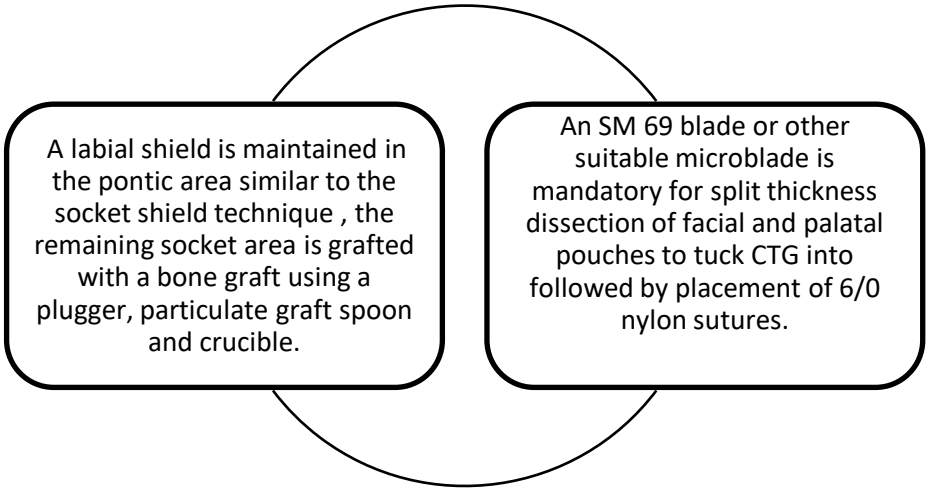
**3] Pontic shield technique[4,5]**
This is a modification of the socket shield technique. In cases of multiple implant placements, the pontic sites lose alveolar bone contour if the teeth are extracted in these sites.




Pontic Shield

**Technique**




**Proximal socket shield technique**[6]

It was first introduced by Kan and Rungcharassaeng in 2013. It is similar to the socket shield technique except that tooth is sectioned labiopalatally and a proximal half is preserved. This is followed by implant placement in the remaining socket area[10]. This technique is primarily useful in preserving the interdental papilla and preventing formation of black triangles between adjacent crowns.

## Discussion:-

The literature has reported post-extraction ridge collapse with varying degrees of alveolar resorption. The breakdown of the bundle bone-periodontal complex1 causes the tissue to resorb after the tooth extraction. Before receiving final restorative therapy, a healed ridge defect after tooth extraction may necessitate substantial surgical intervention3. On the buccal side of the extraction socket5, the alveolar ridge resorption is more noticeable than on the lingual side. Alveolar bone preservation for the support of complete or removable partial dentures may be facilitated quickly and affordably by non-infected vital roots fully submerged within the alveolus, according to the clinical and histologic evidence provided in the studies reviewed by Casey and Lauciello17. In order to maintain the

height of the alveolar ridge, there may be bony infill coronal to the root tip when the roots are submerged to the level of the alveolar bone crest. Using the procedure under overdentures may result in soft tissue perforation because pressure will be transmitted to the soft tissues covering the roots through the denture base. In fixed prosthodontics, retrievability is crucial for developing pontic sites using the root submergence approach.

In a 4-year clinical and radiological follow-up investigation of 20 nonvital submerged roots under the overdentures of 15 patients, von Wowern and Winther7 found that 11 failures occurred as a result of the root surface becoming exposed. The authors asserted that bone resorption surrounding the roots was the main cause of coverage failure and that preserved roots did not stop alveolar ridge resorption. This difficulty can be avoided by fully submerging the root and adjusting all sharp edges to prevent exposed sharp edges 7-8. Since the soft tissue covering the roots will be shielded from pressure when applied at a pontic location, this problem is not anticipated. This technique's side effects include soft tissue damage, periapical pathology, ankylosis, and root resorption.

Dentists have begun integrating and applying the PET technology into their patient treatments since Hurzeler4 first presented it in 2010. By proposing a standard treatment approach for the Socket Shield Technique, Gluckman and his colleagues have addressed the problem of having a standardised PET treatment. Since then, numerous people have attempted this process, with varying degrees of success. In a four-year follow-up research, Gluckman5 discovered that 96% of socket shield therapy (SST) locations experienced no problems, which is comparable to implants that were placed right away. After a one-year follow-up with 40 SST procedures done on 30 patients6, Han10 reported 100% success. Zhu completed nine patient follow-ups between 12 and 48 months with 100% success14.

Bramanti compared SST to conventional implant placement and followed up his cases for three years. Bramanti compared implant survival, marginal bone level and the pink aesthetic score between the two comparison groups and found the SST was superior in all three categories

Bramanti tracked his subjects for three years and contrasted SST with traditional implant insertion. Bramanti observed that the SST was better in all three areas when comparing the two comparison groups' marginal bone level, implant survival, and pink aesthetic score.

Internal exposure of the socket-shield as a result of insufficient space between the coronal edge of the shield and the subgingival contour of the crown was the most frequent problem observed in a study by Gluckman and associates5–6. When the temporary repair is removed, internal exposures are typically observed. At that point, the shield is lowered to bone level, a micro-flap is raised, and any sharp edges are smoothed15.

To aid soft tissue closure, a little connective tissue graft is suggested to be inserted into the sulcus. The external exposure is the second most frequent problem. This is more likely to occur at locations where facial bone is naturally lacking (lower anterior, cuspids, prior orthodontic treatment), and it is also probably caused by an overextension of the shield's coronal aspect or the sharp coronal aspect that pierces the soft tissue above. Internal exposure management and this management are comparable. The proximal socket shield technique and, in certain situations, the pontic shield technique might cause similar issues. However, partial extraction procedures help provide great aesthetic results and offer a durable alternative for ridge preservation17.

## Conclusion:-

Maintaining the bundle-bone periodontal ligament complex and the blood vessels connected to it by avoiding physiologic bone resorption of the buccal bone and contraction of the soft tissues covering it is expected to improve the aesthetic results and long-term success of immediate implants.

Several traditional ridge preservation methods are recommended in order to protect the bundle bone-periodontal ligament complex. Partial extraction therapy is a viable substitute for these traditional methods that preserves the height of the interdental papilla, the ridge contour, and the loss of alveolar bone.

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