

# A Modified Surgical/Prosthetic Approach For Optimal Single Implant Supported Crown Part I - The Socket Seal Surgery

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Optimal implant placement can be achieved only if the ridge maintains its dimensions and the quality of bone. To prevent the resorption of the ridge and to enhance the quality of regenerated bone, two main approaches have been suggested. Part I of this article presents a modified regenerative technique - the "socket seal surgery" (SSS). Part II will present a modified prosthetic technique - the "cervical contouring concept" (CCC) - and it will be published in the May, 1994, issue of PP&A. The learning objective of this article is to supplement reader knowledge of methods and techniques for prevention of ridge resorption and enhancement of bone regeneration.

**T**he removal of a tooth in the anterior region of the mouth is unavoidably accompanied by marked resorption of the alveolar ridge.<sup>1</sup> This may present further functional, phonetic, and aesthetic problems that traditionally have been solved by a prosthesis, supported by the adjacent teeth. The preparation of these abutment teeth requires reduction of healthy tooth structure and often necessitates their devitalization.

These detrimental effects can be prevented by replacing the lost tooth with a single-implant-supported restoration. However, optimal implant placement can be achieved only if the ridge maintains its dimensions and the quality of bone. To prevent the unfavorable resorption of the ridge following tooth

extraction and to enhance the quality of regenerated bone, two main approaches to postextraction implant placement have been suggested:

1. The "immediate implant placement" in which the implant is placed simultaneously with the use of guided bone regeneration (GBR) procedure to create a suitable bone housing around the implant.<sup>2-9</sup>

**...superior quality of newly regenerated bone is achieved if the membrane site remains submerged during the healing period.**

2. The "staged implant placement" in which a GBR procedure is used to create a suitable bony site for future implant placement.<sup>10-11</sup>

In both approaches, a commercial synthetic membrane barrier is placed over the extraction site, thus allowing only bone-forming cells to repopulate the socket without interference of undesirable epithelial or connective tissue cells. It is generally agreed that superior quality of newly regenerated bone is achieved if the membrane site remains submerged during the entire healing period.<sup>2-11</sup> Primary flap closure over the membrane necessitates coronal positioning of the buccal flap and its optimal co-adaptation to

its counterpart with appropriate mattress sutures. This manipulation of the flaps may result in some undesirable changes, such as loss of keratinized gingiva and decrease of interdental papillary height, which may further present major functional, phonetic, and aesthetic problems, especially in the anterior region of the mouth.

The first part of this article presents a modified regenerative technique - the "socket seal surgery" (SSS) - that was specially developed for preparation of a suitable site for implant placement in the maxillary anterior region with minimal compromise of the aesthetic outcome.

The second part presents a modified prosthetic technique - the "cervical contouring concept" (CCC) - that accounts for optimal restoration of such cases.

## CLINICAL PROCEDURE - SURGICAL TECHNIQUE

### Preparation of the Socket

- Remove the tooth from the socket as gently as possible in order to avoid damage to the socket walls (Figure 1). (Perform flap elevation to facilitate tooth extraction only when necessary, ie, in case the tooth suffers a deep vertical fracture or extensive coronal damage.)
- Curet the bony socket walls thoroughly to remove all granulation tissue and remnants of periodontal ligament (Figure 2).
- De-epithelialize the gingival socket walls in their inner aspect to reach the vascularized connective tissue. This is achieved by water-cooled high-speed coarse diamond bur (Figure 2).

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- Decorticate the socket walls to increase participation of bone-forming cells originating from the endosteum (Figure 3).

### *Bone Grafting*

- Prepare a mixture of decalcified freeze-dried cortical bone particles (University of Miami Tissue Bank, Miami, Florida, USA) and 50 mg/ml solution of tetracycline/saline in a dappen dish. Graft the mixture gently into the socket until it reaches the margins of the bony socket walls (Figure 3).

### *Gingival Grafting*

- The preferred donor site is the masticatory mucosa palatal of the second premolar. Mark the outline of the

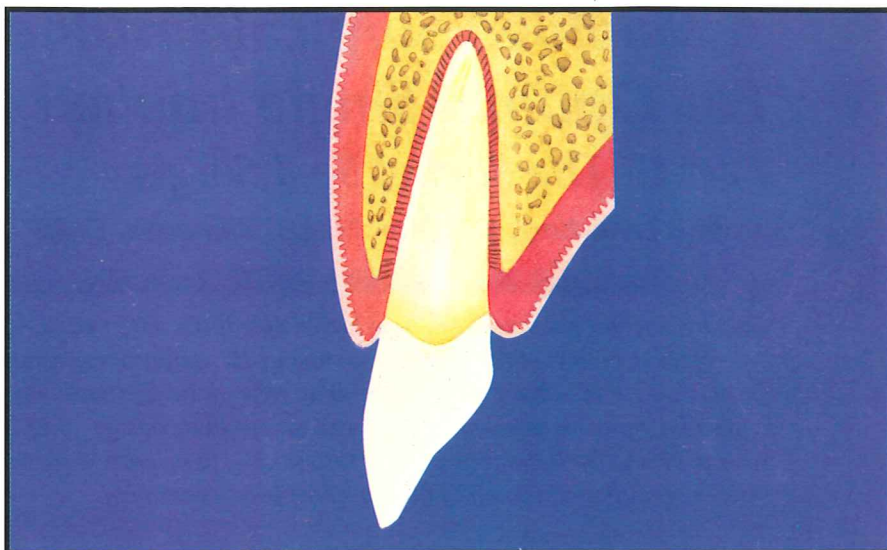
... modified regenerative technique-the "socket seal surgery"... developed to prepare a suitable site for implant placement...

graft with a #15 blade; its shape should be slightly longer than the orifice outline of the extraction socket. Make the vertical incision 2 mm in depth to create "butt joint" margins at the circumference of the graft.

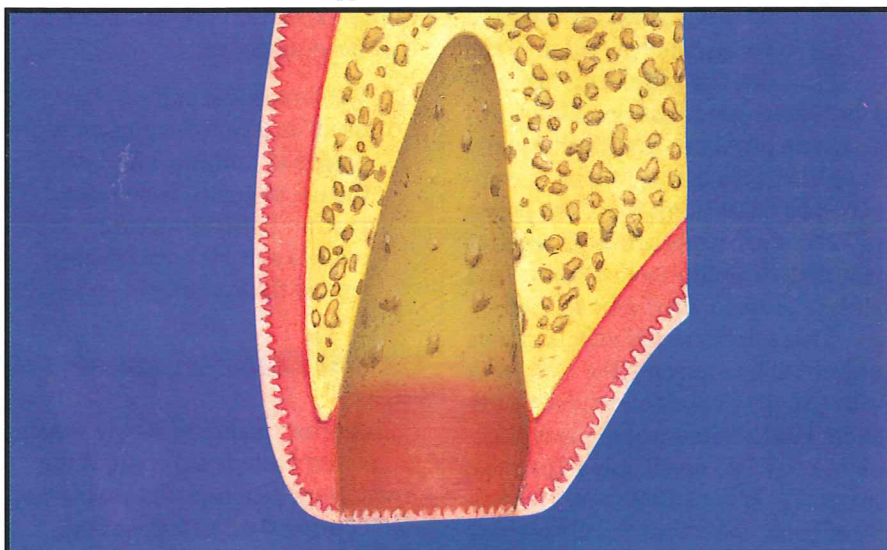
- Pass a suture through the graft surface to pull out the graft gradually, thus facilitating deeper incision slightly centrally into the submucosa until the graft is freed and removed.
- Suture the donor site with a mattress suture to stop bleeding and facilitate clotting.
- Place the graft on top of the bone graft (Figure 3) and hold it in place by sutures. Remove the sutures after 7 to 10 days.
- Allow wound to heal for 6 months, at which time an implant may be surgically placed.

### *CASE REPORT*

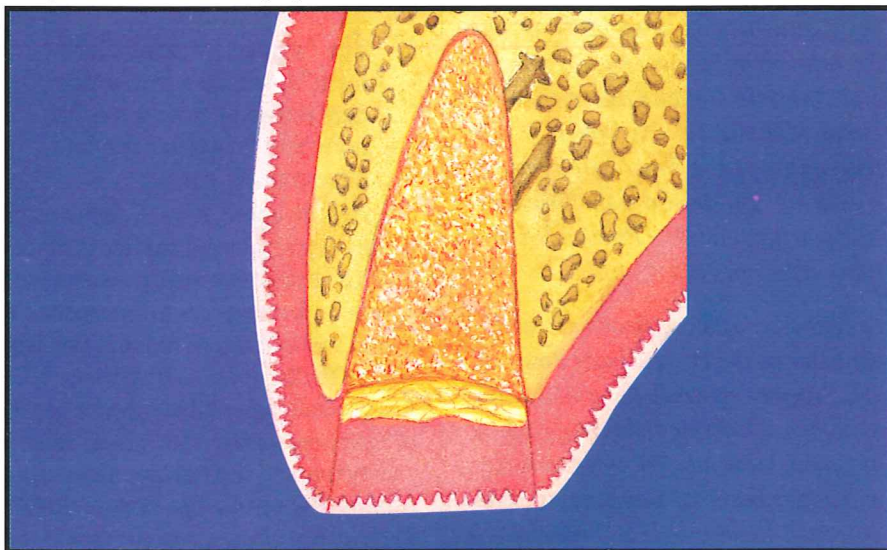
A 20-year-old male presented with pain, associated with tooth #8, and minute fractures at the incisal edges of the



**Figure 1.** A schematic representation of normal relationships between a healthy maxillary anterior tooth and its attachment apparatus.

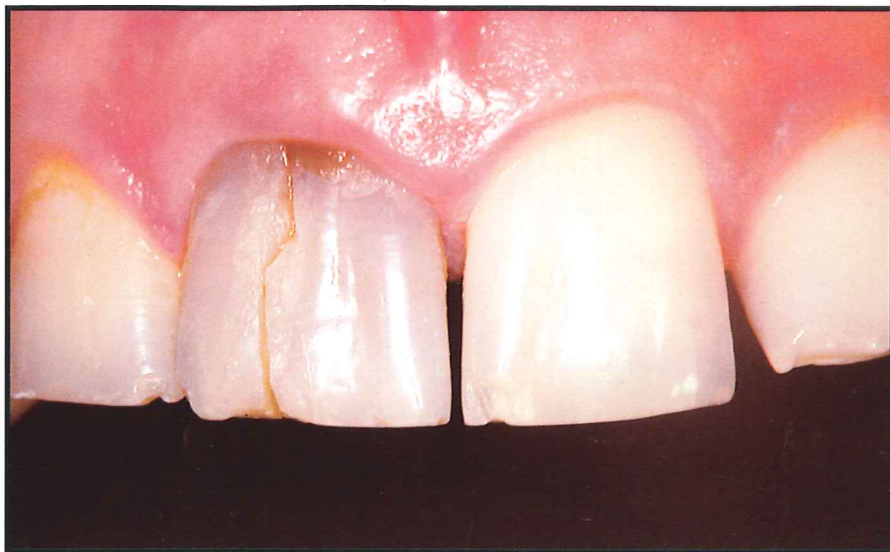


**Figure 2.** A schematic demonstration of complete curettage of the bony socket walls and de-epithelialization of the gingival socket walls.

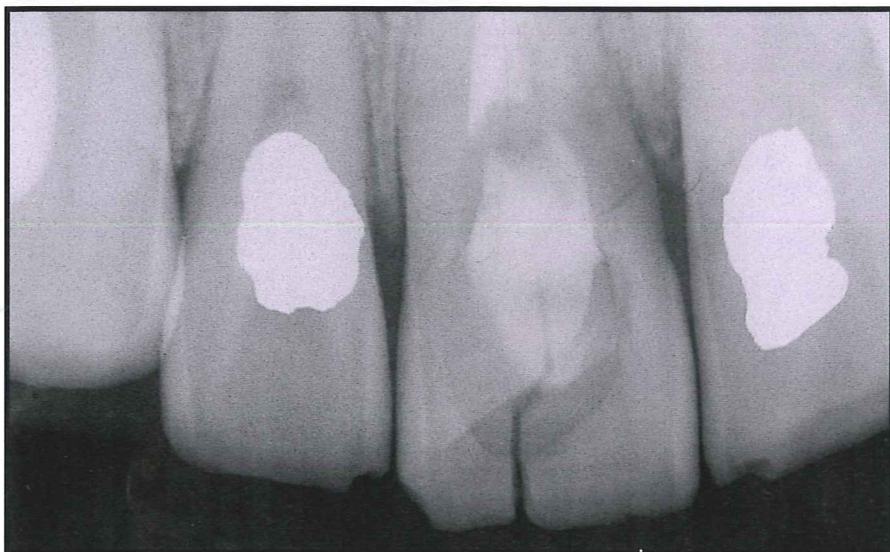


**Figure 3.** A schematic demonstration of decortication of the bony walls, bone graft, and gingival graft. Gingival graft "pushes" against the gingival walls.

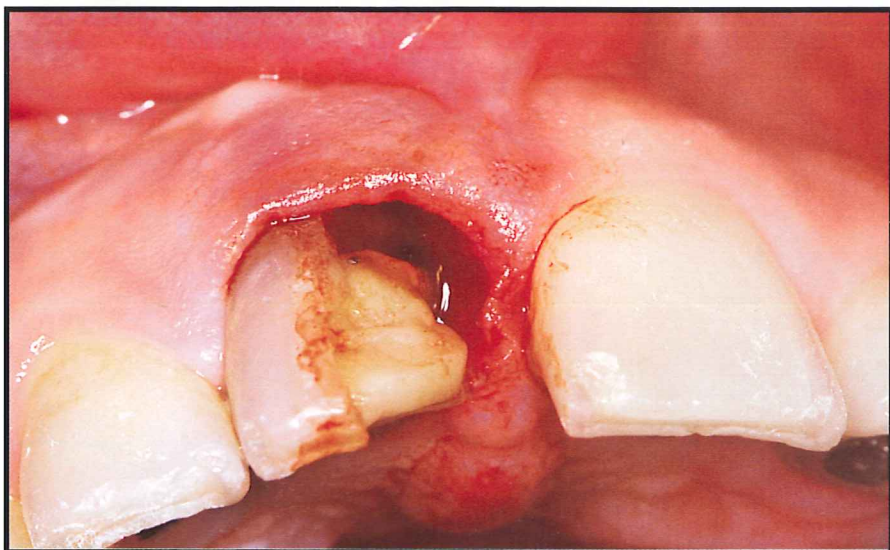




**Figure 4.** Preoperative view of maxillary right central incisor (tooth #8). Note darkened appearance with vertical fracture line and gingival inflammation.



**Figure 5.** Preoperative radiographic tooth #8. Note vertical fracture line extending to the osseous crest.



**Figure 6.** View of tooth #8 after removal of fractured piece. Note deep crown and root damage. Some buccal plate resorption was also noted.

other maxillary incisors, resulting from traumatic injury. Clinical examination revealed a dark discoloration of the tooth with a buccal vertical fracture, accompanied by a 5 mm deep pocket (Figure 4). Radiographically, the fracture reached the alveolar crest without any apparent periodontal damage (Figure 5).

Removal of the fracture revealed deep tooth damage with a narrow v-shaped loss of the buccal plate that significantly compromised the prognosis of the tooth (Figure 6). The patient was informed that the tooth had to be removed, and a detailed description of the surgical and prosthetic treatment alternatives was presented. The patient chose to replace the tooth with a single-implant-

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supported crown, while maintaining the diastema between the central incisors. The SSS procedure (socket seal surgery), as described in the foregoing, was the surgical treatment selected. The major surgical steps performed are illustrated (Figures 7-18); Branemark implant (Nobelpharma, Gothenburg, Sweden) was used.

## DISCUSSION

The socket seal surgery is a modified approach to preprosthetic surgical preparation of the alveolar ridge. It is a regenerative procedure performed immediately postextraction and is used mainly in the maxillary anterior region. The SSS differs from the conventional guided bone regeneration procedures primarily through the two following aspects:

1. Usually, the SSS does not include flap manipulation and suturing to minimize postoperative soft tissue dimensional reduction.
2. A thick free gingival autograft, containing the submucosa, is used



as a "natural" rather than a synthetic membrane barrier.

By not elevating and coronally positioning the buccal flap, it is possible to preserve the keratinized tissue that has a functional and aesthetic role when present at the buccal aspect of the ridge. Also, no deprivation of the bony ridge from its soft tissue lining during the surgery can significantly limit its tendency to resorb. Grafting of decalcified freeze-dried bone into the socket is carried out for three main reasons:

- It has osteoinductive properties that may enhance bone regeneration.<sup>12</sup>
- In cases of limited pre- or postoperative resorption of the buccal plate, it may, hypothetically, func-

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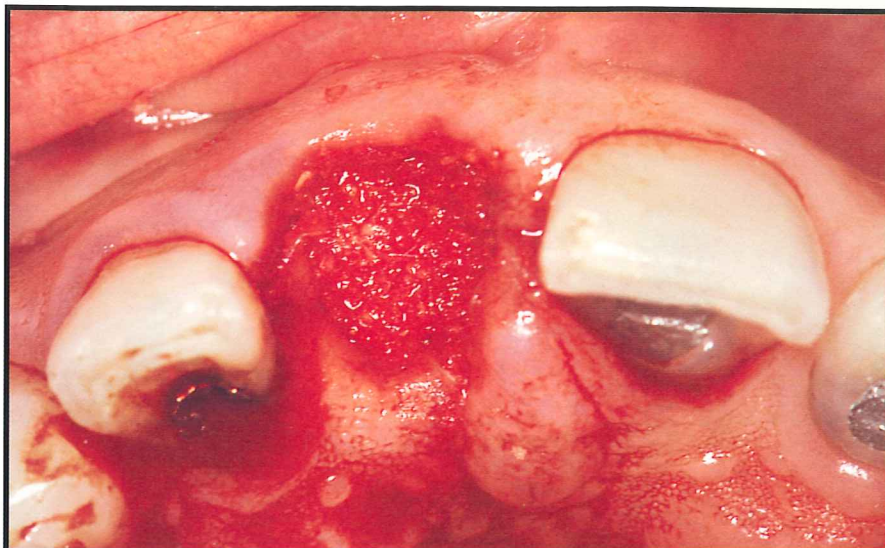
**The SSS procedure is relatively simple, easy to perform, and is currently widely used by the authors with clinically satisfactory results.**

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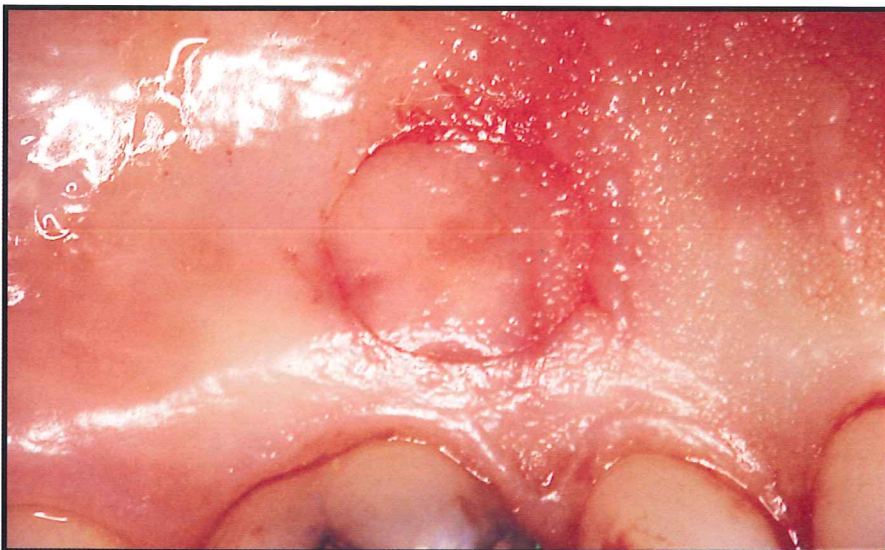
tion as a "solid bony front" against further labio-palatal resorption, since it tends to resorb in a very slow manner.

- It acts as a base for the gingival autograft and does not allow it to "sink" into the socket during the placement, suturing, and healing processes.

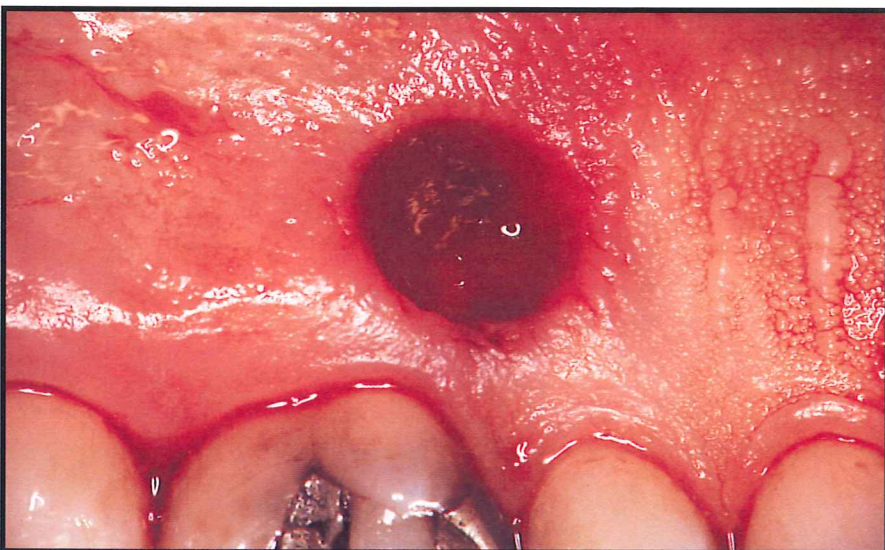
The incorporation of tetracycline powder in the bone graft is carried out primarily because of its anticollagenolytic and antiinfective properties.<sup>13-14</sup> In order for the gingival autograft to survive, it has to be tightly adapted to the socket gingival walls from which it receives the main vascular supply. It may be assumed that graft nourishment may be enhanced by plasma elements originating from the organizing clot beneath the graft. It has been recognized that the fatty tissue contained in the graft is composed of loosely arranged connective tissue into which plasma from the recipient site may readily diffuse.<sup>15-16</sup> It is suggested that the gingival autograft in the SSS procedure may act in four ways:



**Figure 7.** View of the bone graft in the prepared socket of tooth #8.

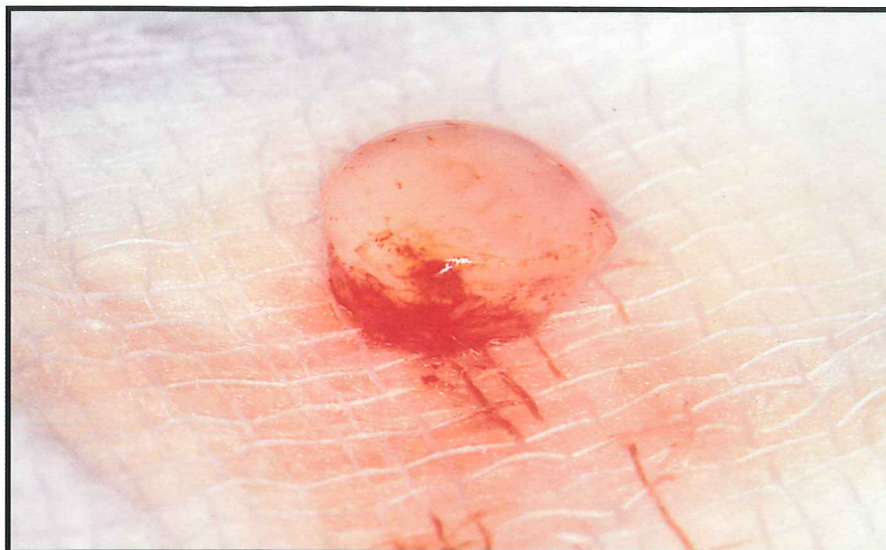


**Figure 8.** Donor site outline of the gingival autograft.

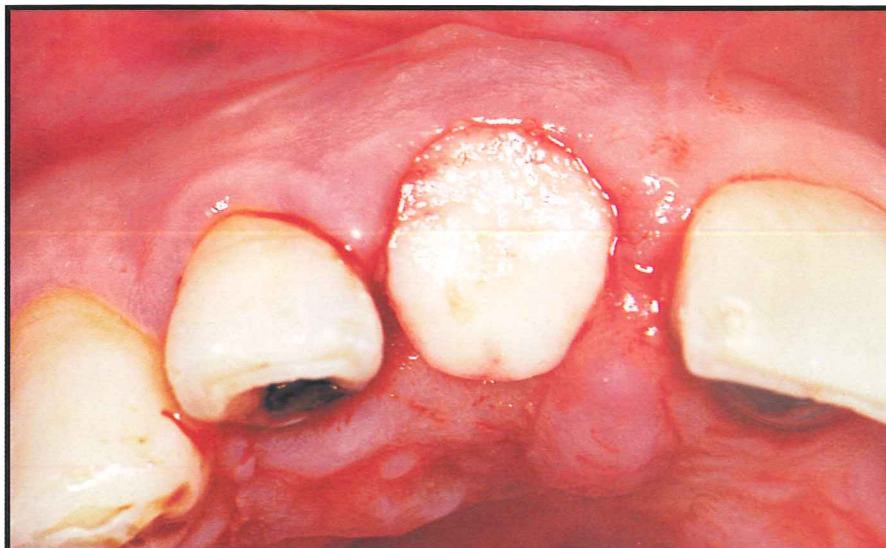


**Figure 9.** View of the donor site immediately postremoval of the gingival autograft.

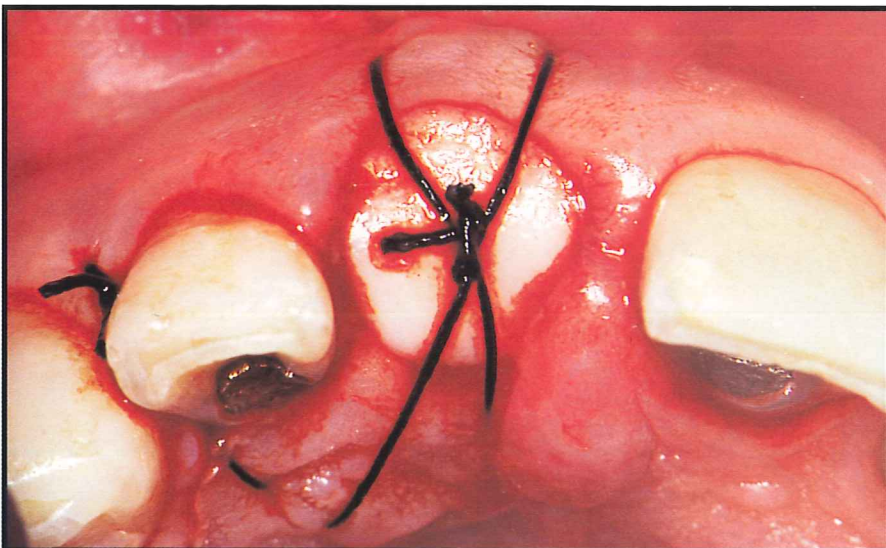




**Figure 10.** Free gingival autograft containing palatal submucosa is usually 3 to 5 mm thick.



**Figure 11.** Free gingival autograft, placed on top of the bone graft, slightly "pushes" against the socket gingival walls.



**Figure 12.** The graft is held in place by an 8-figure suture that does not pierce the graft itself. Note additional suture between teeth #6 and #7 for palatal "mini flap" adaptation.

1. It completely seals the socket orifice, thus preventing physical interferences and bacterial or chemical contamination of the wound underneath.
2. The unification of the lamina propria of the graft with the connective tissue in the socket gingival walls prevents undesirable penetration of epithelial cells to the wound.
3. The submucosa at the base of the graft may act as a barrier that allows only bone forming cells to repopulate the socket while preventing undesirable connective tissue cells to participate. It has been suggested that in root coverage,

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using soft tissue autograft, the fatty submucosa contained in the graft may act as a barrier against connective tissue cells originating from the lamina propria of the graft, thereby allowing only the desirable PDL cells to repopulate the root surface.<sup>17</sup> It has further been claimed that the submucosa seems to enhance the success rate of free gingival autografts or onlay grafts used to repair other types of mucogingival defects.<sup>16-18</sup>

4. It preserves the soft tissue width and height of the ridge, thus allowing optimal preparation of the peri-abutment gingival topography for obtaining functional and aesthetic restoration (as will be described in Part II).

The SSS procedure may preserve both the hard and soft tissue dimensions of the ridge enabling optimal future implant placement in the maxillary anterior region that further accounts for a functional and aesthetic implant-supported crown. It should be emphasized



that the SSS should preferably be carried out in situations where, upon tooth removal, the remaining bony socket walls are found relatively intact. When the bony walls are damaged, the gingival graft is unable to prevent undesirable participation of connective tissue cells originating from the oral mucosa in the wound. In such instances, it may be advantageous to use the conventional guided bone regeneration procedures together with the use of free gingival graft placed on top of the exposed part of the membrane to completely seal the wound.<sup>19</sup>

The SSS procedure is relatively simple and easy to perform and is currently widely used by the authors with clinically satisfactory results. However,

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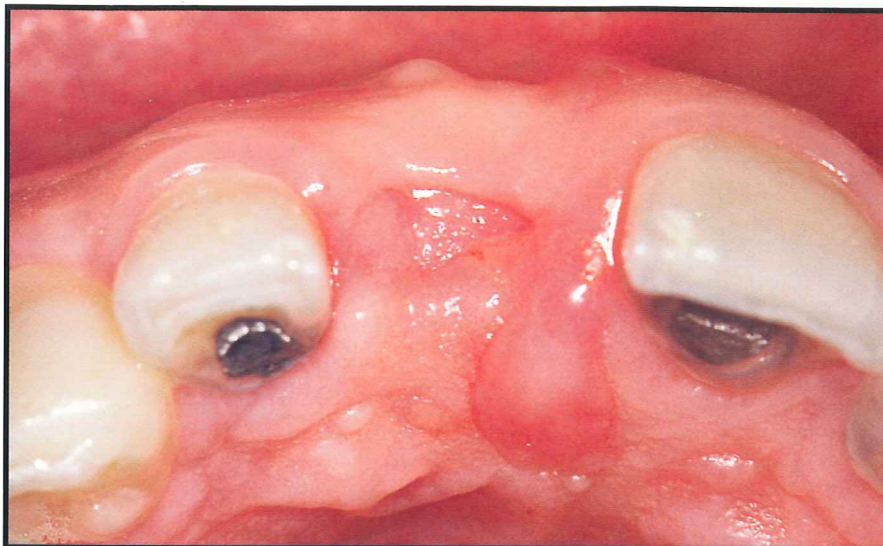
investigative studies are still needed to determine the quality of the bone achieved by this modified regeneration technique and its success rate.

### CONCLUSION

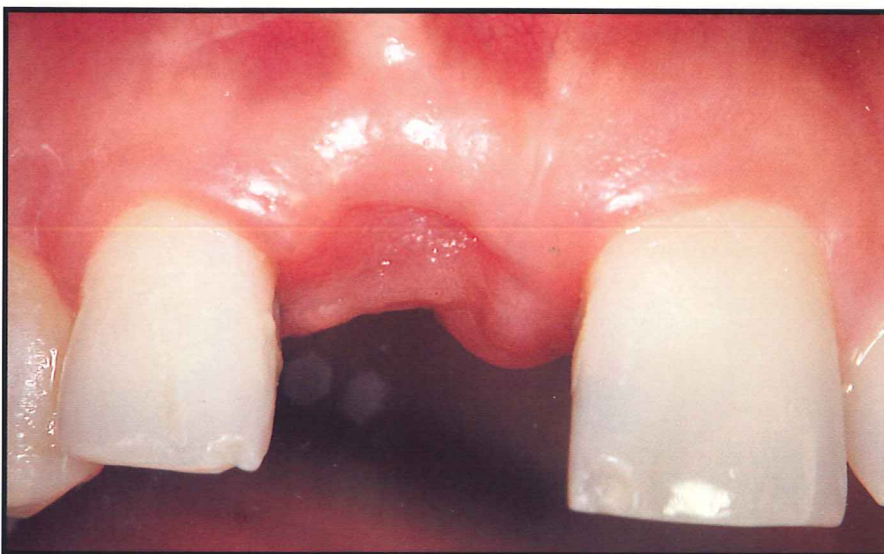
Anterior tooth removal is unavoidably accompanied by marked resorption of the ridge. This situation may create functional, phonetic, and aesthetic problems that present major operative challenges for both the implantologist and the prosthodontist.

The SSS procedure is a modified regenerative technique for ridge preservation and enhancement of bone quality immediately following tooth removal. It combines bone and gingival grafting that may guide the desirable bone forming cells to participate in the healing socket while creating ideal soft tissue topography prior to implant placement.

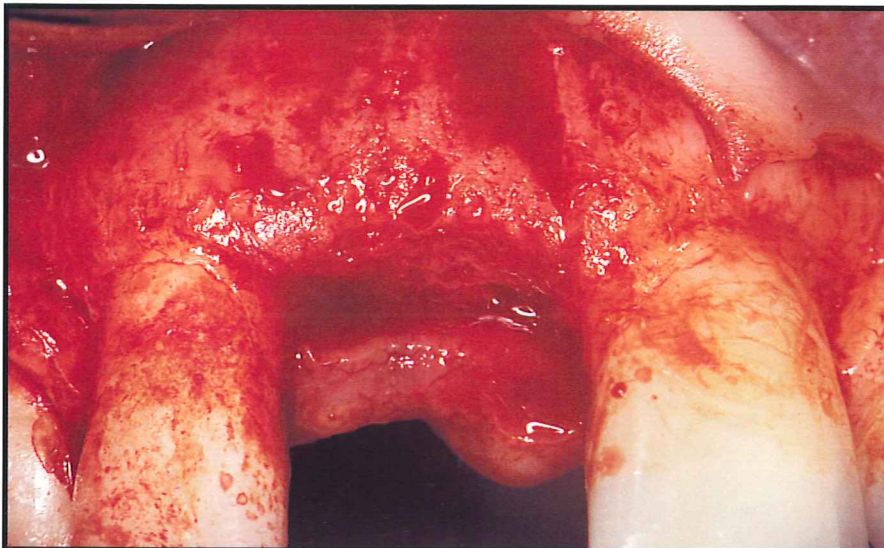
This procedure, followed by a modified prosthetic technique — the cervical contouring concept (CCC), as will be described in Part II — enables optimal tooth replacement by single implant supported crown.



**Figure 13.** Occlusal view of healing at 6 months. Note preserved ridge width.

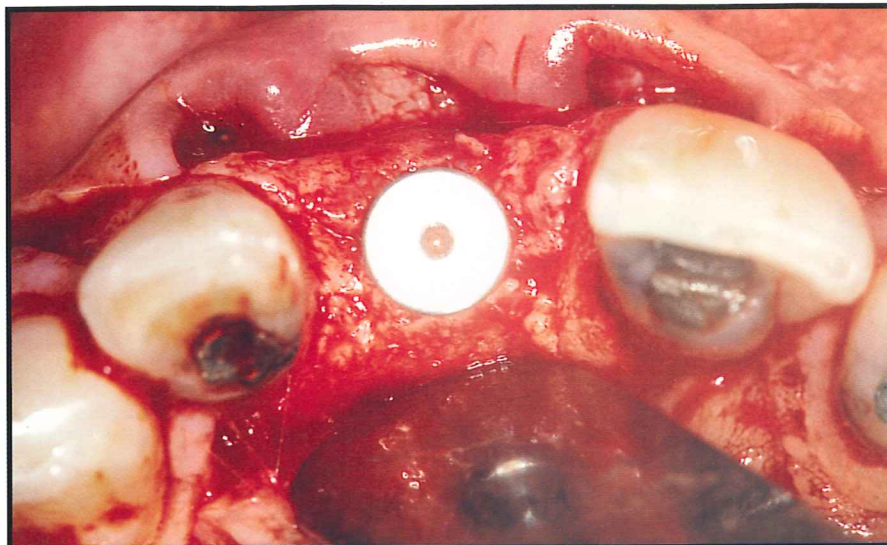


**Figure 14.** Buccal view of healing at 6 months. Note preserved width of keratinized gingiva and height of interdental papillae.

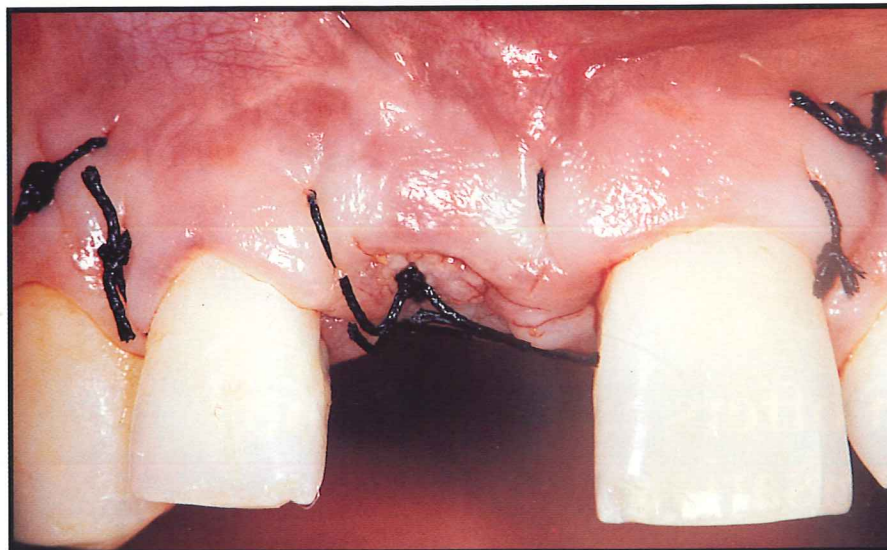


**Figure 15.** Implant surgery at 6 months. Note preserved coronal osseous level of the ridge.

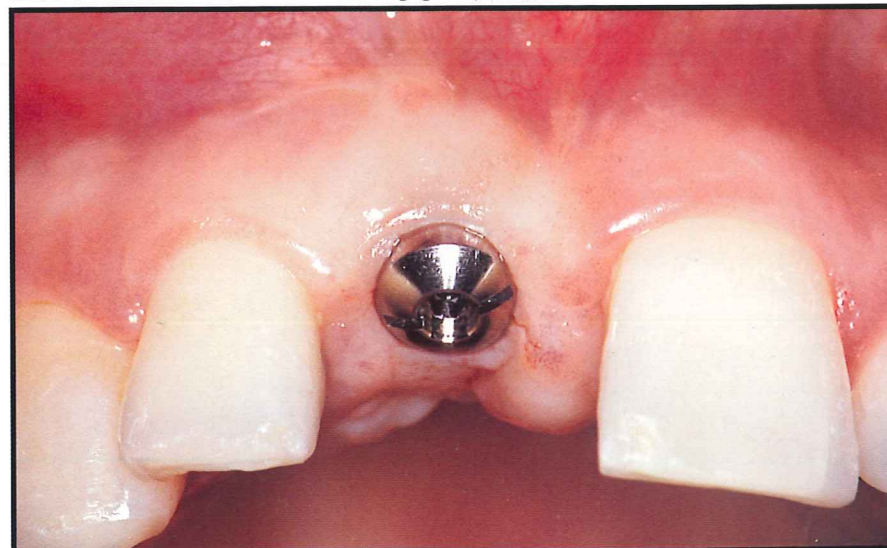




**Figure 16.** Occlusal view of implant surgery at 6 months. Note preserved bucco-palatal width of the alveolar ridge enabling optimal implant placement.



**Figure 17.** Implant surgery at 6 months immediately postimplant placement. Note vertical mattress sutures to maintain interdental papillary height.



**Figure 18.** One week after surgical exposure of the implant. Note the healthy keratinized gingiva surrounding the healing abutment.

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