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Flapless Implant Surgery for Replacement of Posterior Teeth

Authored by J. Steven Cloyd, DDS

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Flapless Implant Surgery for Replacement of Posterior Teeth

LEARNING OBJECTIVES:

After reading this article, the individual will learn:

- The principles of treatment planning for flapless implant surgery for posterior implants.
- The surgical procedure for flapless implant surgery.

ABOUT THE AUTHORS

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INTRODUCTION

The surgical procedure for placement of implants to replace posterior teeth normally begins with an incision to uncover the osteotomy site. When Bränemark developed modern implant dentistry with root form implants, and the concept of osseointegration was introduced, dental implants became a predictable procedure. Implant therapy is considered routine for single tooth replacement and stabilization of mandibular full dentures. However, even after 30 years of modern implant therapy, flapless implant surgery is still being developed. The concept that implants should be covered by tissue to ensure primary stabilization and reduce infection was standard of care in the original Bränemark surgical protocol.[1] This original concept is being challenged as unnecessary with flapless surgery for implant placement.

Clinicians are now using flapless surgical procedures to place implants. Using this approach, Campelo and Camera[2] placed 770 implants in 359 patients over a 10-year period. They reported a success rate of only 74% in 1990 but a 100% success rate in 2000, which was attributed to the learning curve for the procedure. Each patient was examined after 3 months, 6 months, 1 year, and then once every year. Prostheses were removed, if possible, and implant mobility was assessed, periapical radiographs were obtained, and periodontal probing was performed. Implants were considered failed if they had mobility or pain, had to be removed, or if they showed more than 0.5 mm of bone loss per year and signs of active peri-implantitis. They called flapless implant surgery a "blind" surgical technique but said advantages include less time and minimal bleeding, with no suturing necessary. They also stated that patient selection and proper surgical technique were essential factors for success.

Landsburg and Bichacho[3] recommended use of a one-step punch technique for many clinical situations requiring implants.[3] These include a wide bony ridge, presence of a broad zone of keratinized tissue, the absence of vital structures, and surgery requiring difficult and complex flap manipulation. This technique was also used when primary anchorage and stabilization were predictably obtained and to maintain the integrity and topography of adjacent hard and soft tissues. For patients who cannot discontinue use of anticoagulants and patients with meticulous plaque control, one-punch surgery is useful.

Flanagan recognized the problems associated with implants placed with a flapless surgical approach in parabolic shaped ridges.[4] He noted that site selection, adequate attached gingiva, and available bone volume are important considerations. Use of a surgical stent is necessary. The advantages of flapless surgery include reduced trauma, reduced operative time, fewer complications, and faster soft tissue healing.

Sclar[5] noted that flapless implant surgery has gained popularity and was initially recommended for novice implant surgeons. However, he observed that successful use of the flapless approach actually requires advanced clinical experience and surgical judgment. The advantages of the flapless approach include improved patient comfort and recuperation, decreased surgical time, and normal oral hygiene procedures immediately after surgery. Disadvantages include the inability to visualize anatomic landmarks, and possibly thermal bone damage secondary to inadequate irrigation during osteotomy preparation. Other disadvantages include malposed angulation or depth of implant placement, and no access to contour the osseous ridge to facilitate restorative procedures.

In a 2-year study by Becker, et al,[6] 79 implants were placed in 57 patients from 24 to 86 years old using a minimally invasive one-stage flapless technique. The parameters evaluated were total surgical time, implant survival, bone quality and quantity, implant position by tooth type, depth from mucosal margin to bone crest, implant length, probing depth, inflammation, and crestal bone changes. Thirty-two implants were placed in the maxillae and 42 were placed in mandibles. The cumulative success rate was 98.7% (one implant was lost). For remaining implants, changes in crestal bone over time were clinically insignificant, as were mean changes for probing depth and inflammation.

The average time for implant placement was 28 $\pm$ 13.1 minutes (range of 10 to 60 minutes). Average depth from mucosal margin to bone was 3.3 mm. The results of this study demonstrate that by following specific diagnostic and treatment planning criteria, flapless surgery using a minimally invasive technique is successful and predictable. The benefits of this procedure are reduced surgical time, minimal changes in crestal bone height, probing depth, and inflammation, minimal hemmorhage, and less postoperative discomfort.

Jeong, et al[7] examined the effect of flapless implant surgery on crestal bone loss and osseointegration in a canine model. The teeth were extracted on 6 mongrel dogs and bilateral, flat alveolar ridges were created in the mandible. Two implants (length 10 mm, diameter 4.1 mm; [Osstem]) were placed side-by-side in each area. One implant was placed with flap reflection and the other implant placed using a flapless procedure. Care was taken to place both implants at the same height. Prefabricated abutments were attached to all implants, simulating a single-stage procedure. The article did not state the number of implants placed but that all surgical sites healed uneventfully. At 8 weeks, the dogs were sacrificed and bone blocks containing the implants were removed. A morphometric study using microcomputerized tomography (micro-CT; Skyscan 1076 [Skyscan]) was used to quantify bone around the implants. Osseointegration was calculated as the percent of implant surface in contact with bone. Additionally, bone height in the peri-implant bone was measured as the distance between the alveolar crest and the bottom surface of the implant. The flapless group had significantly better vertical alveolar ridge height and more bone/implant contact than the flap group. Average bone height in the flapless group was 10.1 ± 0.5 mm versus 9.0 ± 0.7 mm in the flap group ($P < 0.05$) Average osseointegration was significantly greater in the flapless group (70.4% ± 6.3%) than in the flap group (59.5% ± 6.3%) ($P < 0.05$). This was the first controlled study reporting the results of flapless implant surgery on osseointegration and height of newly formed bone around implants. The authors speculated that flapless implant surgery may be more effective than traditional surgery with flap reflection in improving implant anchorage.

Flapless implant surgical procedures have not been clearly described or standardized in the dental literature. The following case report illustrates the importance of proper patient selection and meticulous surgical technique when placing implants in the mandible using a flapless approach.

CASE REPORT

A 55-year-old white male presented for replacement of tooth No. 30. The patient's medical history was noncontributory. The tooth had been extracted 3 months previously with minimal trauma using periotomes to ensure that the residual ridge was preserved and augmentation prior to implant placement would not be needed (Figure 1). Tooth No. 31 had a porcelain and metal crown with recurrent caries and failing endodontic therapy, and therefore was not an ideal abutment for a 3-unit fixed partial denture (FPD). Tooth No. 29 was not restored. Given the options for an implant or FPD, the patient chose restoration with an implant. The ridge was of sufficient dimension to accommodate a 6 mm wide implant. Wide body implants can be used in molar areas, and provide increased surface area and can accommodate heavier occlusal loads compared to narrower implants.[8]

From a longcone periapical radiograph it was determined that there was approximately 14 mm in height from the crest of the ridge to the mandibular canal (Figure 2). Due to shape, height, and width of the residual ridge, and available keratinized tissue, a flapless surgical technique was considered rather than a conventional surgical procedure with a mucoperiosteal flap.

The patient was dispensed 2,000 mg of amoxicillin and 400 mg of ibuprofen to take PO one hour prior to the surgical procedure. His vital signs were taken and charted. The area of tooth No. 30 was anesthetized using 1.8 ml 4% Septocaine (Septodont) with 1:100,000 epinephrine, augmented with 1.0 m of 0.5% Marcaine with 1:200,000 epinephrine (Cook-Waite, Novocol Pharmaceutical of Canada). An inferior alveolar block is not routinely used when placing posterior mandibular implants. Infiltration with anesthetic provides adequate anesthesia for implant placement without anesthetizing the inferior alveolar nerve. If the patient feels discomfort during the procedure, a radiograph is made with an instrument within the osteotomy. If the instrument is closer than 3 mm to the mandibular canal (neurovascular bundle), the depth of the osteotomy is reduced. If the instrument is 3 mm or more from the bundle and the patient feels discomfort, additional anesthesia is provided but depth of the osteotomy is maintained.

The site for the implant to replace tooth No. 30 was begun with a No. 4 surgical bur in a high-speed handpiece introduced through the soft tissue approximately 2 mm into bone. The location of the site was slightly facial to the middle of the ridge and precisely between the adjacent teeth (Figure 3). This location made it probable that placement of a 6-mm implant would be ideal. Accordingly, opposing occlusal forces would be on the facial cusps of the final crown and down the long axis of the implant. Placement of the implant equidistant between adjacent teeth reduces the cantilever

Figure 1. Tooth No. 30 site has adequate width and zone of keratinized tissue for a flapless surgical procedure.

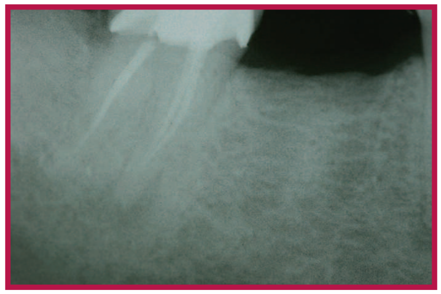

Figure 2. Radiograph of tooth No. 30 site measures approximately |14 mm of bone height from the crest of the ridge to the mandibular canal.

Figure 3. Initial entry is made through tissue and 2 mm into bone.

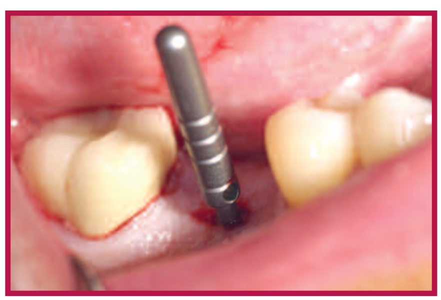

Figure 4. Parallel pin/depth gauge placed into initial osteotomy confirms proper angulation between adjacent teeth.

effect and likelihood of overcontouring the crown to establish a mesial and distal contact.

A 2-mm diameter implant pilot drill was placed into the site and was advanced to a depth of 13 mm (measuring from the tissue surface). A parallel pin/depth gauge was placed in the site to the depth of the osteotomy. The pin was checked in the oral cavity for angulation and parallelism (Figure 4). A radiograph was also taken to evaluate depth and angulation of the pin within the mandible (Figure 5). A 6-mm diameter rotary tissue punch (Salvin Dental Specialties) was placed in a slow-speed handpiece (Figure 6) and was positioned over the initial osteotomy to blanch the tissue and create an outline of the punch. The outline was evaluated to ensure that the initial osteotomy was properly centered. The punch was rotated through the tissue to the residual ridge. A tissue plug was removed, revealing the initial osteotomy made by the pilot drill in the center of the osseous ridge (Figure 7). Removal of tissue at this stage of the osteotomy allowed the topography of the ridge to be evaluated, and the thickness of soft tissue to bone was measured, making it easier to maintain correct depth with each implant bur.

However, depth of the osteotomy can be difficult to determine below the tissue level when using implant burs with measurement lines. The implant system used for this procedure (Screw-Line Implant [Camlog USA]) has removable depth stops on each implant bur, making it unnecessary to monitor measurement. Depth stops limit burs from going past the desired depth, allowing the surgeon to concentrate on angulation and position of the osteotomy.

The osteotomy was completed to the outline of the punched tissue and to a depth of 11 mm using sequentially larger diameter burs (Figures 8 and 9). A 6-mm x 11-mm

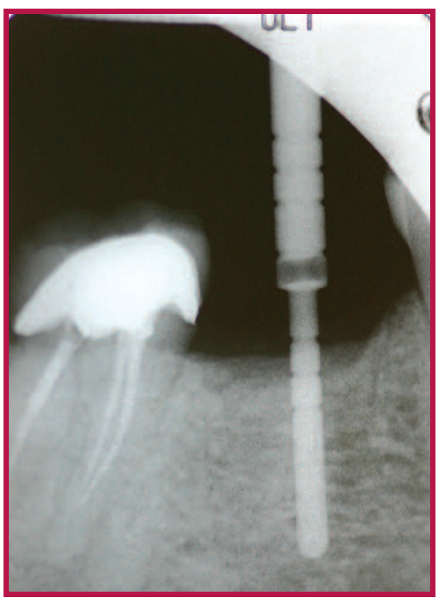

Figure 5. Radiograph of parallel/pin depth gauge into initial osteotomy confirms depth and angulation between adjacent teeth.

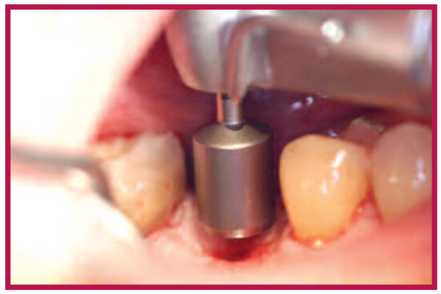

Figure 6. A 6-mm rotary tissue punch is placed on the tissue (see blanching), confirming proper location.

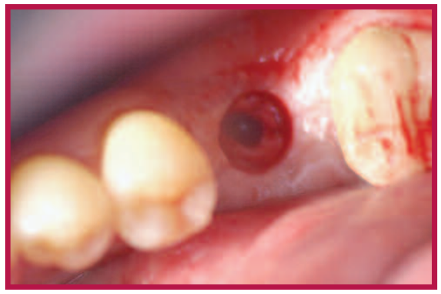

Figure 7. Tissue plug is removed revealing 2 mm diameter osteotomy in the middle of the site.

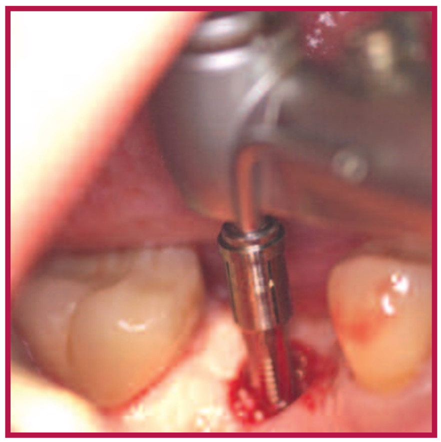

Figure 8. Implant burs with depth stops are used to deepen and widen osteotomy.

Figure 9. A 6-mm implant bur taken to the depth stop against the crest of the ridge.

threaded implant (Camlog USA) was placed in the osteotomy (Figure 10). Implant depth was initially evaluated by inspection of the fixture mount at tissue level (Figure 11). After removing the fixture mount, final depth was confirmed by examination of the implant platform below tissue level (Figure 12).

A 5-mm, wide-body healing abutment was attached and hand-tightened to the implant (Figure 13). Tissue height was lower on the facial than on the other 3 sides of the abutment due to parabolic topography of the ridge (Figure 14). A postoperative radiograph was made of the implant and healing abutment (Figure 15). The implant was evaluated clinically after one week (Figure 16). The patient took no analgesics and had no postsurgical discomfort or swelling.

At 3 months, a fixed level impression was made, an analogue was attached to the impression post, a cast was poured, and a prefabricated abutment was prepared. A porcelain and metal crown was fabricated on the abutment. The abutment was taken to the mouth, attached to the implant, and torqued to 30 Ncm according to manufacturer's instructions. A cotton plug was placed over the hex screw in the abutment, followed by temporary cement (Figure 17). This procedure ensured that the hex screw was protected should it be necessary to access the screw and remove the abutment. The crown was placed on the abutment and adjusted for fit, contact, and occlusion, and was cemented

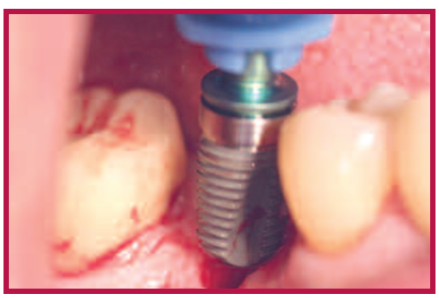

Figure 10. A 6-mm in diameter by 11-mm long threaded implant is ready for placement in the osteotomy.

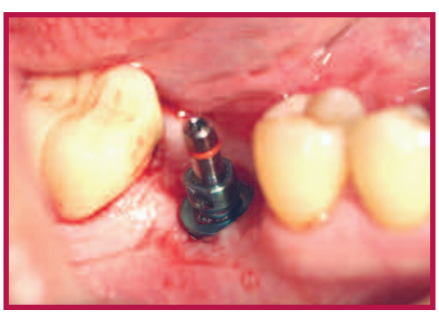

Figure 11. Position of the implant fixture mount confirms the depth of the implant. The implant is very stable.

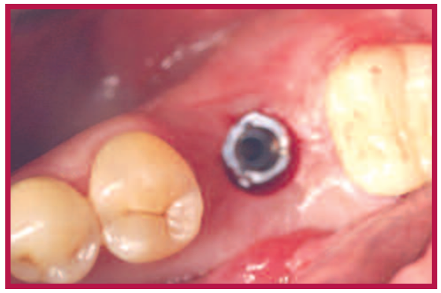

Figure 12. Implant platform is 2 mm below the surface of the tissue.

Figure 13. A 6-mm in diameter by 5-mm length tapered healing abutment is attached to the implant.

Figure 14. Facial view of healing abutment shows topography of the ridge is lower on the facial aspect of the ridge.

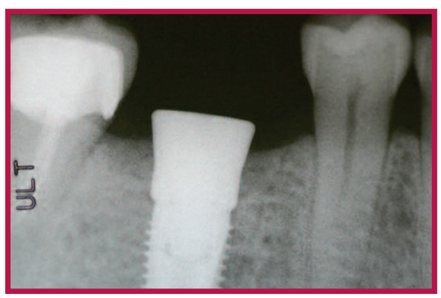

Figure 15. Postoperative periapical radiograph of the implant in place.

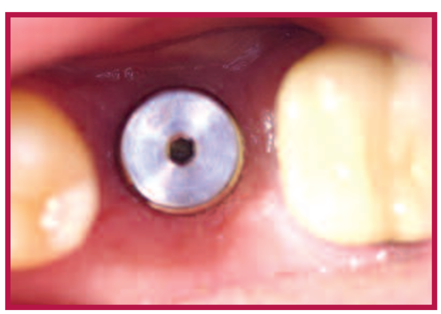

Figure 16. A one-week postoperative view of healing abutment shows proper tissue healing and excellent oral hygiene.

with crown and bridge cement (Figures 18 and 19). A postoperative radiograph was used to evaluate crestal bone height (Figure 20). Tooth No. 31 was later found to be nonrestorable and was extracted.

The patient was given oral hygiene instructions, including use of interproximal brushes to remove plaque between the crown and adjacent teeth. The implant-supported crown has been in function for one year without tissue inflammation or bone loss around the implant.

CONCLUSION

Flapless implant surgery using a tissue punch technique can be successfully employed when replacing posterior teeth. Careful diagnosis and treatment planning are essential. The protocol for this procedure includes proper evaluation of bone type, height and width of the residual ridge, and amount of available keratinized tissue. The surgical technique should include use of a surgical stent, appropriate use of rotary punches and implant burs, and creation of an osteotomy that promotes a stable implant.

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Figure 17. Abutment is attached to the implant. Cotton is placed over hex screw and temporary cement is placed over the cotton.

Figure 18. Occlusal view of implant supported porcelain fused to metal crown. Note reduced occlusal surface.

Figure 19. Facial view of properly contoured crown. Note absence of interdental papillae.

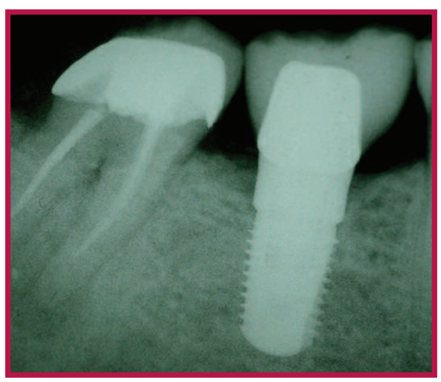

Figure 20. Periapical radiograph of implant with seated crown. Tooth No. 31 was extracted at a later date.

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POST EXAMINATION QUESTIONS

1. Flapless implant surgery can be employed in many situations. Which situation would NOT be recommended?
   a. wide bony ridge.
   b. thin zone of keratinized tissue.
   c. remote vital structures.
   d. predictable primary anchorage and stabilization.

2. Which of the following would NOT be an advantage of flapless implant surgery?
   a. patient comfort and recuperation.
   b. reduced surgical time.
   c. ability to visualize anatomic landmarks.
   d. ability to perform immediate oral hygiene procedures.

3. An animal study reported by Jeong, et al[7] revealed some startling results regarding flapless versus flap surgery. Which was NOT one of the results?
   a. average bone height was greater in flapless surgery.
   b. osseointegration was greater in flap surgery.
   c. average bone height was less in flap surgery.
   d. osseointegration was greater in flapless surgery.

4. When administering local anesthesia for placement of implants in mandibular molar areas, which of the following is NOT true?
   a. Anesthesia is provided with local infiltration.
   b. Anesthesia is provided with an inferior alveolar block.
   c. If a patient feels pain during an osteotomy, an instrument is placed to depth and a radiograph is made.
   d. If the depth of the instrument is closer than 3 mm from the mandibular canal, the depth of the osteotomy is decreased.

5. Which of the following is NOT true when locating the site of an osteotomy for implant placement in mandibular posterior teeth areas?
   a. Implant placement should be slightly facial of the middle of the ridge.
   b. Occlusal forces should be on the facial cusps.
   c. Occlusal forces should be down the long axis of the implant.
   d. It is unnecessary to place the implant equidistant between adjacent teeth.

6. Wide body implants are normally used in molar areas. Which of the following is a reason NOT to use a wide body implant in a molar area?
   a. increased surface area.
   b. residual ridge of 8 mm or more.
   c. ability of a wide-body implant to accommodate heavy occlusal loads.
   d. insufficient width between adjacent teeth.

7. A rotary tissue punch is very useful in flapless implant surgical procedures. Which would NOT be indicated during such surgery?
   a. Using a punch larger than the diameter of the implant.
   b. Using a punch on a slow-speed handpiece.
   c. Blanching the tissue prior to rotating the punch.
   d. Removal of a tissue plug down to the bony ridge.

8. Which answer would be NOT TRUE for use of depth stops?
   a. They make it unnecessary to look at measurement lines on implant burs.
   b. They limit the depth that implant burs can penetrate.
   c. They allow the surgeon to concentrate on angulation and position of the osteotomy.
   d. They punch through the tissue.

Flapless Implant Surgery for Replacement of Posterior Teeth

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