The surgical aspects of the first and second stages of the osseointegration technique can be divided into: i) flap management, ii) implant placement and iii) ancillary (e.g. mucogingival) procedures. The implant placement and suturing techniques have been described elsewhere and thus will not be addressed here. This article will emphasize certain mucogingival and improved flap procedures in relation to the two surgical stages of the osseointegration technique.

FLAP DESIGN – Stage I Surgery:
The first surgical stage includes the initial placement of the implant(s). The flap design according to the “classical” Branemark technique, utilizes an initial curve-linear, mesial-distal incision placed in the buccal vestibule, such that it is located approximately 10 millimeters apical to the osseous crest. The advantages with this flap approach include: a) excellent access (e.g. sinus, mental foramen), b) complete post-surgical tissue coverage of the implant sites, and c) a suture line that is remote from the implant sites (thus reducing the chance of premature implant exposure as well as minimizing potential suture-related contamination). The disadvantages with this type of flap design may include: a) increased post-operative swelling, b) decreased post-operative vestibular depth, and c) difficult suture removal, especially if horizontal mattress sutures are utilized. (Figs 1, 2). Clinically these disadvantages may result in increased post-operative discomfort, difficulty in wearing a removable prosthesis and potential post-operative infection if all suture remnants have not been removed.

Other flap designs have been recently suggested in order to overcome some of the aforementioned disadvantages. One such design has been described and is called “THE OVERLAPPED FLAP.” This technique can be utilized only if the tissue is of adequate thickness (Fig. 3). Interested readers are referred to the article that describes and illustrates this technique in detail (in The International Journal of Periodontics and Restorative Dentistry, Vol. 10, #3, 1990, pg. 209).

In the maxilla, this author utilizes a palatally placed horizontal (i.e. mesiodistal) incision rather than a vestibular one. As with the vestibular approach, this design provides: a) excellent access, b) complete post-surgical tissue coverage, and c) a suture line that does not directly overlie the implant sites. The palatal approach however has the advantage of minimizing post-operative swelling and facilitating suture removal. The initial palatal incision should be located a minimum of 6 mm palatal to the soft tissue ridge crest and should extend mesially and distally several millimeters beyond the anticipated implant sites. A flap is then raised, starting with a bevelled palatal incision that angles toward the crest of the ridge. (The bevelled incision allows a greater connective tissue surface area for flap closure.) A full thickness flap is then carefully dissected over the ridge, which then continues up onto the buccal aspect (Figs. 4, 5). In most

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Fig. 1. Horizontal mattress sutures have just been removed (10 days post-operatively). In this case a flap design incorporating a horizontal curve-linear (i.e. mesiodistal) vestibular incision was utilized during the initial surgical implant placement.

Fig. 2. A suture remnant is visible at 24 days after the initial surgery (i.e. corresponding to 14 days after the suture removal appointment as shown in Fig. 1). Retained sutures can create a "point of entry" for bacteria to migrate into the implant site and potentially lead to infection.

Fig. 3. The initial incision may be placed just palatal to the crest, but only extends 1-2 mm into the connective tissue. A palatal split thickness dissection is curved 4-6 mm to the palatal aspect. A full thickness flap is raised from the palatal aspect towards the buccal. Upon closure, the exposed connective tissue will be "overlapped" by the palatal epithelium and connective tissue.

Fig. 4. The flap may be sutured to the vestibular mucosa throughout the surgical procedure to facilitate atraumatic flap reflection. Similarly in the mandible, the flap can be linguually retracted with the use of sutures.

Fig. 5. The initial incision is placed well palatal to the crest of the ridge and a bevelled incision is angled toward the osseous crest. A full thickness flap is then raised over the crest of the bone and extended up into the vestibule.

Fig. 6. The same case as in Fig. 4, but 11 days post-surgically, illustrates some sloughing of the palatal epithelium. This is expected when one utilizes the type of flap design as seen in Fig. 4. The connective tissue exposure is superficial and not significant, as routinely there is uneventful healing and no implant exposure.

partially edentulous cases, bilateral buccal releasing incisions are utilized to allow adequate flap reflection. It is sometimes worthwhile to suture the flap to the vestibular mucosa, to allow atraumatic reflection throughout the surgical procedure (Fig. 4). The palatal-lined incision will delay revascularization of the palatal tissue and thus at 7-10 days post-surgically, some epithelial denudation will be evident (Fig. 6). In the author's experience, however, the exposed palatal connective tissue does not perforate and thus there is no oral communication with the implant. The palatal regeneration of the epithelium proceeds uneventfully on a routine basis.

In the mandible the author most often utilizes a horizontal vestibular incision as described in the Branemark technique. Some clinicians, however, prefer to utilize a mid-crestal incision because of the ease of manipulation and closure. Most dentists with experience in the surgical phases of implantology; however, will agree that there is an increased incidence of early implant exposure with the crestal incision (Fig. 7). To this author's knowledge there have not been any scientifically valid published studies that correlate early implant exposure with higher rates of implant failure. It seems prudent however, that until this question is definitively answered, one should strive to maintain a "closed" healing environment for the implant during the prescribed healing period. In the event that the exposed implant does perforate through the soft tissue within the first two months, an attempt can be made to close the perforation. The technique involves creating a circumferential fresh wound margin, and then suturing the wound closed. In most cases, however, the procedure will not be successful (Fig. 8) and at times it is prudent to leave the implant. The
patient should be instructed on how to maintain the exposed area plaque-free. This underscores the importance of the initial flap design that will reduce the incidence of early implant exposure as much as possible.

Flap design – Stage II Surgery
The second surgical stage includes the exposure of the implant and attachment of an abutment or insert after the prescribed healing period (usually 3-9 months). The two most common techniques to expose healed implants utilize either a tissue punch or a flap approach. The tissue punch is a slightly less traumatic procedure, but should only be considered under the following conditions: a) the implant can be accurately located, b) the top of the implant has not been counter-sunk too far sub-crestally, and c) the keratinized gingiva will not be totally eliminated by the punch procedure. If the implant cannot be accurately located, the advantage of a flap is obvious. If the implant has been submerged into the bone, the implant may be difficult to locate (without the aid of a small flap). As well, it is common for some bone to form over the coronal aspect of the implant. Bone that prevents proper seating of the abutment or insert must be removed at this second surgical stage (Figs. 9, 10). This delicate procedure must be done accurately so as to remove adequate bone, yet not damage the implant. This is only possible with a flap approach. It is wise for the surgeon to verify complete seating of the insert or abutment with a radiograph prior to suture placement (Fig. 11).

Mucogingival procedures
A frequently encountered problem in the resorbed mandible is the presence of minimal keratinized gingiva. It is probably fair to say that the literature does not indicate that the presence of keratinized gingiva around the implant is a critical factor that influences success rates. Clinically, however, a keratinized gingival margin is preferable to alveolar mucosa because periodontal maintenance and optimal restorative procedures are facilitated. Attached keratinized gingiva is relatively non-mobile and firm, being attached to the underlying alveolar ridge. Alveolar mucosa on the other hand, is more mobile and may make it more difficult to remove plaque around the implant. As well, a keratinized gingival margin may provide a more stable position, which in turn allows a more predictable and esthetic prosthetic margin placement.

In clinical situations where the overlying soft-tissue in the implant site is non-keratinized, a free gingival graft can be placed in order to convert...
the non-keratinized tissue to one that will be firm and keratinized. The free gingival graft should be placed at least 4-6 weeks prior to the first stage of the implant surgery. Alternatively, the free gingival graft procedure can be carried out after complete healing of the first stage, but at least 6 weeks prior to the second stage of the implant surgery (Figs. 12, 13).

Sometimes there is a narrow band of keratinized tissue present overlying the implant site. In this case, a specialized flap approach should be utilized during the second stage of the implant surgery. The technique involves strategically positioning a crestal incision such that the existing band of keratinized tissue is preserved and becomes incorporated as part of the vestibular flap (Figs. 14, 15). A full thickness or split thickness vestibular flap is then apically positioned such that the keratinized ginvival margin rests around the vestibular aspects of the abutments or implants (Figs. 16, 17). This flap approach also provides the surgeon with access and visibility, should it be necessary to recontour hard or soft tissue and/or reduce sulcus depth.

Summary
Soft tissue manipulations are an important component of implant surgery. This article has described several techniques and highlighted their respective indications and advantages.

BIBLIOGRAPHY