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Preserving and Maintaining Optimal Peri-Implant Soft-Tissue Complex for Function and Aesthetics

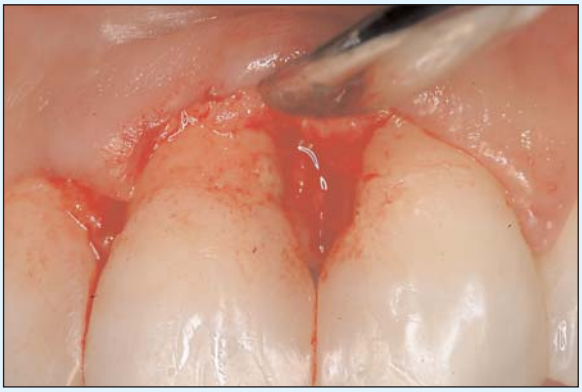
According to **Jin Y. Kim, DDS, MPH, MS**, diplomate, American Board of Periodontology; fellow, International Congress of Oral Implantologists; and lecturer, University of California-Los Angeles School of Dentistry, one of the key elements of implant maintenance and longevity is good physiological architecture of the gingiva, specifically, an abundance of keratinized tissue, and adequate thickness of tissue fibers to form an appropriate environment for implants. Good physiological architecture of the gingiva yields both functional and cosmetic benefits. Kim notes, "One way to achieve these results is through manipulation of good lab designs, but an additional aid is following, when possible, a one-stage protocol, which is allowed by many currently marketed implant systems."

Standard healing abutments have parallel wall sides and a certain angle of flare that does not reflect the emergence profile of natural teeth or proper implant restoration. Therefore, Kim says, customized healing abutments can be used as part of a one-stage protocol. He continues, "Even a provisional restoration can be used, either in function or non-function, and constructed from various materials. Acrylic resin is the most economical and easiest to manipulate, but the restoration can be cast even from metal if need be."

When this one-stage approach is followed, the gingival tissues can be modified during the integration phase and then afterward for the final prosthesis—but only if careful planning is undertaken, since perfect embrasure form can be derived from the use of a resin abutment only if there is a limit, Kim says, "to adding and subtracting as you go." Occasionally, when cases require bone augmentation at the implant site, the peri-implant tissue contour impression and transfer technique is performed in conjunction with what Kim calls a calcium sulfate compaction technique for peri-implant guided bone regeneration.

Peri-Implant Tissue Contour Impression and Transfer Technique

The optimal implant system and the optimal gingival form require, first and foremost, an abundance of keratinized gingiva in the implant placement area. Kim explains, "I'm a strong advocate of the crestal incision, and I'm a little biased toward the lingual aspect as



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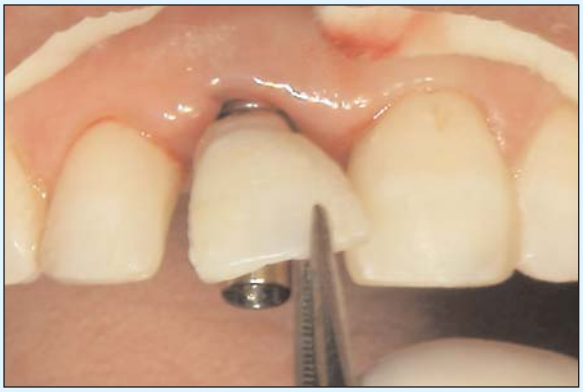

Figure 2:

opposed to the facial. By having an initial incision on the lingual aspect of where the future implant is going to be, I can translate or apically reposition that crestal gingiva towards the facial, increasing the zone of attached gingiva and at the same time thickening the facial aspect, which will definitely help in terms of buccal soft-tissue thickness and the whole plumpness of the facial gingiva."

In terms of inferior-superior placement, the major concern is how deep the implant should be buried. A traditional two-piece implant should be placed approximately 2-3 mm from the anticipated cemento-enamel junction. Such placement is more difficult with a single-piece implant since this type of implant usually has some form of embrasure form built in. Therefore, the clinician must understand what system he or she is using and what type of embrasure form is built in to that system.

Once the implant is integrated, the clinician takes the impression to maintain and record optimal embrasure form and gingival contours. The impression technique that records the artificially created embrasure form (which is to be the future embrasure form) is crucial. Once a restoration or healing abutment is removed, a carefully groomed tissue form tends to collapse very soon.

Kim uses a technique that he introduced several years ago, which requires removal of the perfectly shaped healing abutment or provisional and attachment of an implant analog in the laboratory. Then polyvinylsiloxane impression material is poured into a small plastic cup. The restoration and analog complex are dipped into the impression material, analog first, to the level where the embrasure form is recorded into the impression material. Once fixed, the healing abutment or provisional restoration is removed, which leaves a nice imprint or duplicates the soft-tissue form into a miniature of the impression that has just been taken. The

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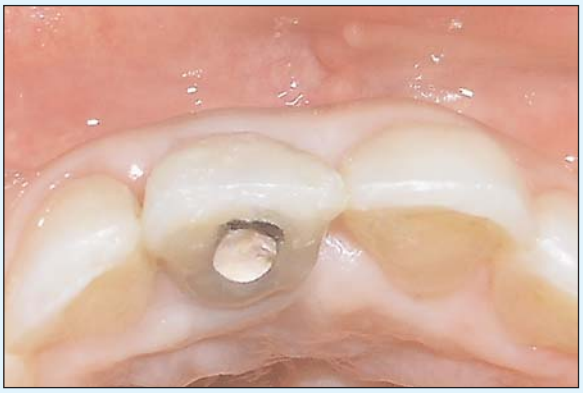

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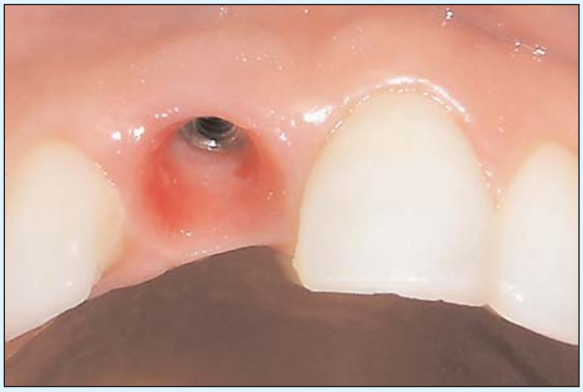

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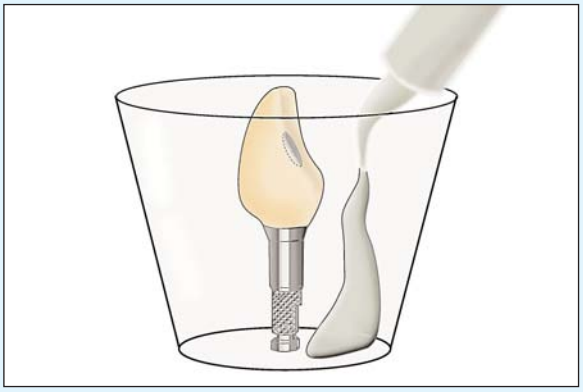


Figure 6:

clinician then places a temporary sleeve, or an impression coping, into the impression. Where there is a void between the impression coping or temporary sleeve and the tissue form, the clinician fills the area with a fixating resin.

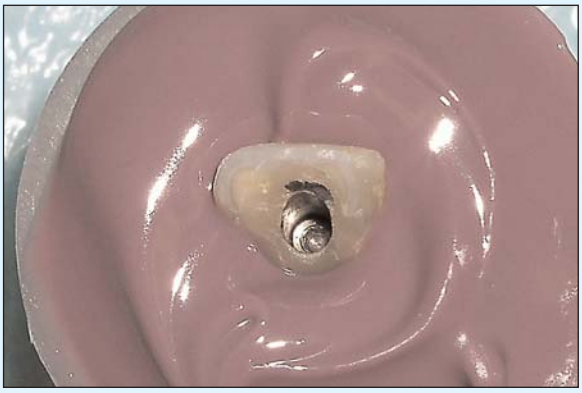
What has been potentially created is a customized impression coping that is an exact duplicate of the provisional restoration or the healing abutment. This impression coping now is placed in the mouth. Since this impression process takes place in 5-10 minutes in the laboratory, the tissue forms do not have time to collapse before the clinician places the original healing abutment or the provisional in the mouth.

At this point, the healing abutment is removed and the custom impression coping is placed. "From there on," Kim explains, "it's a traditional pick-up type impression, and now this custom impression coping is picked up as part of the impression apparatus and then goes to the laboratory." Thus, the laboratory technician now has a complete, accurate duplicate of the embrasure form that was carefully created surgically, and the clinician can transform that into a final restoration.

Kim refers to a case involving a 42-year-old, healthy female who presented with external root resorption/caries involving tooth #8 **(see Figure 1)**. The tooth was surgically extracted, and an immediate implant was placed and provisionalized with a natural tooth "shell," temporary sleeve, and direct bonding composite resin **(see Figures 2-4)**, which allowed not only immediate cosmetic gratification to the patient, but also functional preservation and maintenance of natural gingival contour and embrasure form.

Upon integration, the functional provisional restoration was removed, and the peri-implant tissue contour transfer technique was implemented **(see Figures 5-11)**. The technique followed these steps:

1. Remove the restoration, attach the laboratory analog, and pour the



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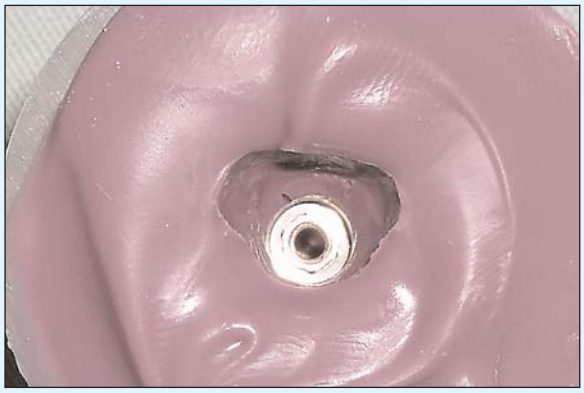

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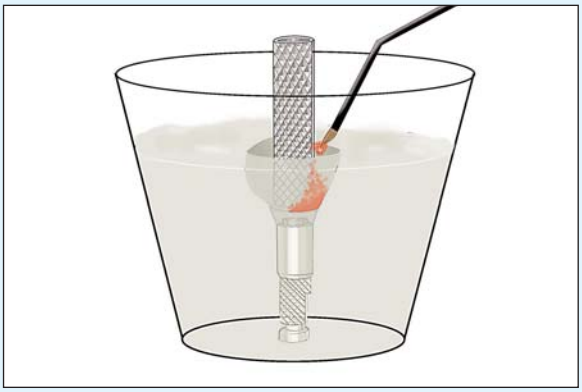


Figure 9:

Figure 10:

PVS-type impression material to register the emergence profile portion of the restoration (cervical ½) **(see Figures 6 and 7)**;

2. Unscrew and remove the restoration, and attach a temporary sleeve to the analog;

3. Fill the space created with quick-setting resin to duplicate the provisional restoration and hence the emergence form **(see Figures 8-10)**;

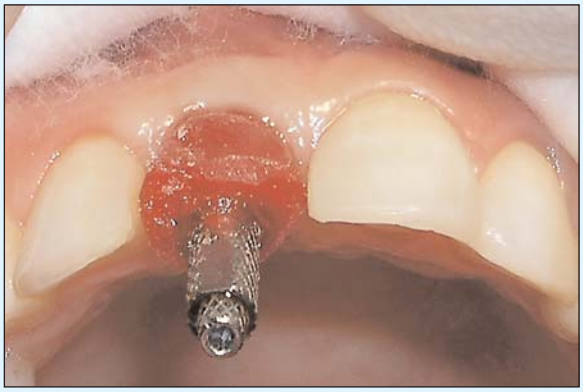
4. Use the resulting tissue registration coping or custom impression coping to take a pick-up type impression, and produce a master cast wherein exact details of the peri-implant contours can be duplicated **(see Figures 11-13)**; and

5. Fabricate the definitive restoration in the laboratory to the same contours as the emergence profile created by initial one-stage provisional **(see Figure 14)**.

Calcium Sulfate Compaction Technique for Peri-Implant Guided Bone Regeneration

A powerful aspect of this one-stage surgery is that the clinician controls the gingival form from the time of the surgery to preserve the final form of the gingiva. Careful planning of flap design and incision design is crucial. Of course, Kim notes, there are times when the clinician would like to have optimal bone level right to the crest, especially at the interproximal areas, which are sometimes very hard to predict.

For example, there are situations when one or two threads of the implant are exposed at the crestal level, and the clinician faces the dilemma of how to regenerate the bone in those very fragile areas. The traditional wisdom is to use bone grafts and some kind of barrier membrane. However, submerged guided bone regeneration is not possible because of the very nature of one-stage surgery. Kim explains, "I have experimented with various materials and products, and I have



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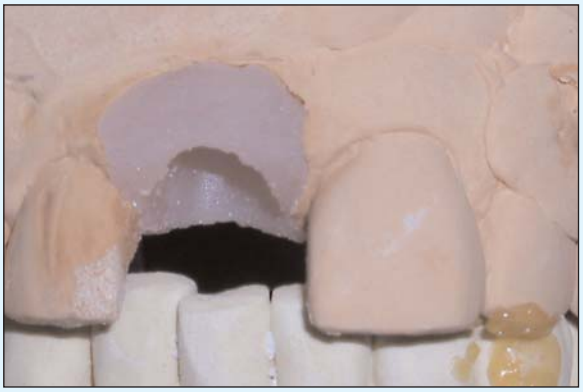

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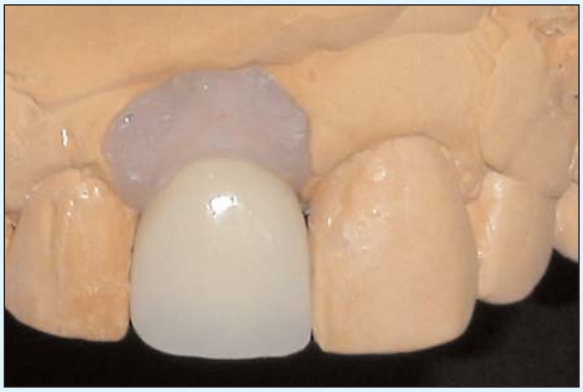


Figure 13:

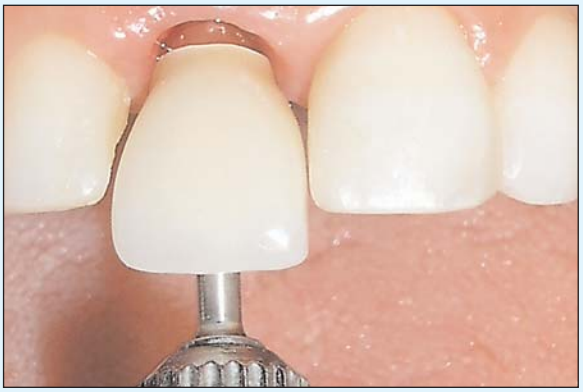
Figure 14:

discovered that calcium sulfate is one of the most tissue-friendly materials when it comes to a one-stage protocol because it is biologically inert; therefore, my patients experience less tissue reaction when I use the calcium sulfate as a barrier membrane."

Calcium sulfate has been used for bone grafting for decades. It has traditionally been used for periodontal defects and socket defects. Since calcium sulfate regained popularity about a decade ago, many physicians have advocated mixing it with bone graft materials such as allografts and alloplasts. Kim has found the material useful as a true barrier membrane. "In other words," he explains, "I lay down bone graft material of choice in the actual defect site, usually in this case the crest of the bone adjacent to the implant site." Then Kim places the calcium sulfate material (CAPSET®, Lifecore Biomedical, Inc.).

These calcium sulfate materials are available in powder and liquid form. Similar to laboratory plaster, calcium sulfate is mixed to a consistency that allows the best viscosity to hold in the grafting material. "However," Kim notes, "I have found that whatever its original viscosity, once the calcium sulfate is placed in the defect area and in the bone graft area, there is typically blood and other fluids in the vicinity that tend to make it a little more runny and very difficult to handle. I'm sure many clinicians have found that situation unappealing."

As a result, approximately two years ago, Kim started to use a pure powder form of calcium sulfate, without mixing it with liquid. Once the bone graft material is laid into the defect area and before the flap is closed over the defect, he places the dry powder on top of the graft material and gently hampers it down with wet gauze. As the material seeps into the bone graft material, and as it soaks into body fluids and blood from the vicinity, it starts to set by itself. In this way, the material is layered so that a very thick



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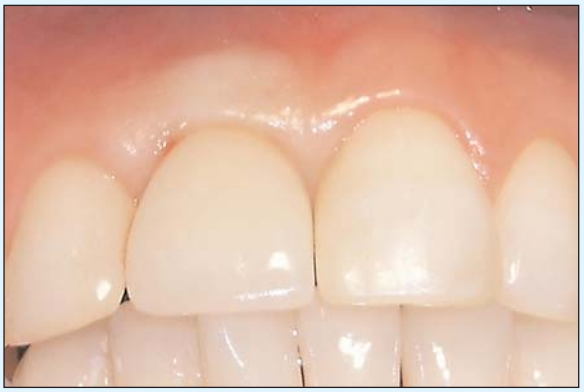

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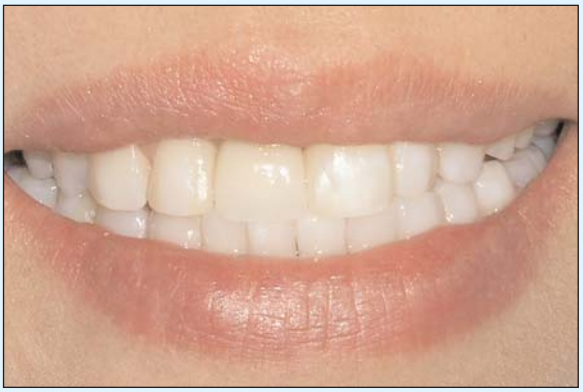

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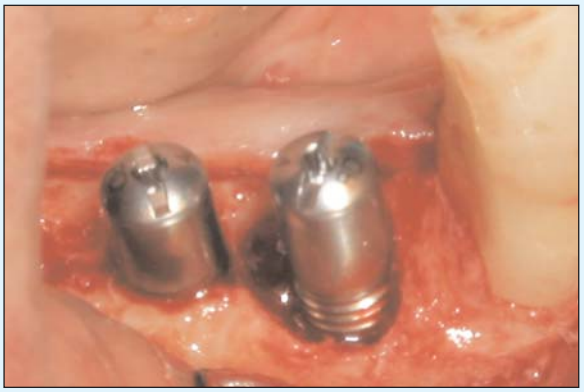


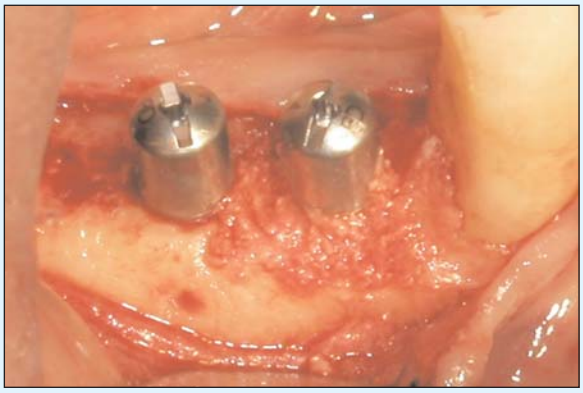
Figure 18:

layer of calcium sulfate lies on top of the bone, at least 1.5 mm and up to 2-3 mm, depending on the size of the defect. Then a fairly dry 2 x 2 gauze can be used to condense the calcium sulfate by packing it down and giving it a very uniform consistency and rigidity.

The result, says Kim, is "a very nice, stable surface where the flap can then be sutured onto." He continues, "This material is so kind to the tissue that gingiva and epithelium tend to grow right over the material even though exposure of the graft material could happen from time to time. When compared to collagen membrane or the cortex type material, exposure of calcium sulfate material is very forgiving, and tissue tends to grow right back in a very short period of time."

Though use of this material is not new, Kim has named the technique calcium sulfate compaction because the technique differs from the calcium sulfate being mixed in with liquid and powder in a traditional form that flowed in with the bone graft material. Compaction means using a dry powder and compacting the layer until it reaches firm consistency. The compaction technique has both the benefit and effect of stabilizing the graft as well as forming a fairly thick, warm membrane.

When asked if the calcium sulfate used this way is essentially a barrier membrane, Kim responds that the flap that is sitting on top of the bone graft and calcium sulfate complex is going to find it fairly difficult to penetrate into the firm mass, and, therefore, the complex is not a perfect barrier. However, it does have a significant barrier effect. He adds, "The most superficial part of the calcium sulfate most likely will be incorporated into the fiber matrix of the flap and connective tissue. But what that really does is form a thicker, more fibrous layer of desirable soft-tissue gingiva since good, firm gingiva around an implant is beneficial. So this technique not only is easy to use and manipulate, but it has many beneficial side effects."



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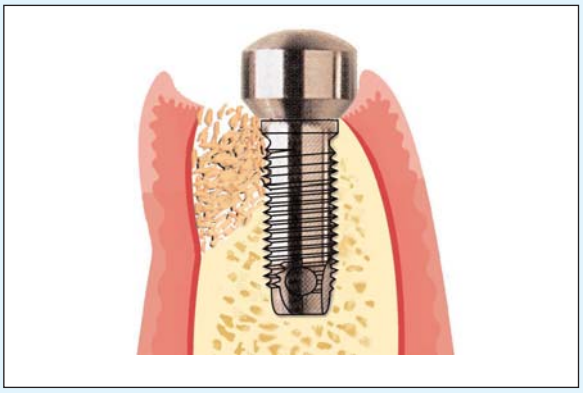

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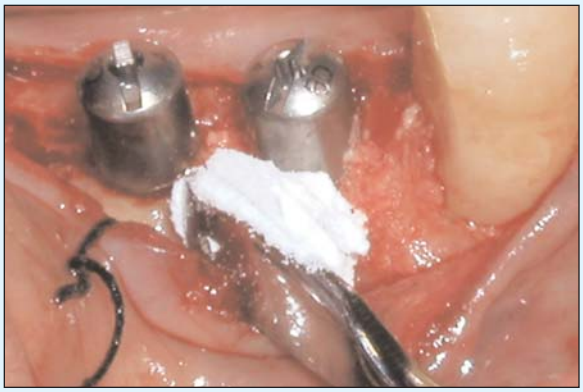


Figure 21:

Figure 22:

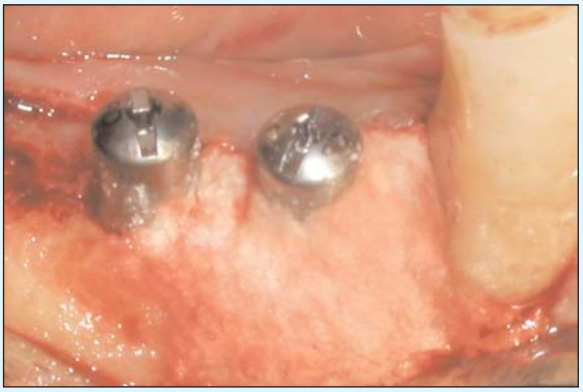
Kim notes that there is a lot of current interest in the periodontal community for using calcium sulfate in its pure form as a gingival graft material. He notes, "David Anson has published several articles involving connective tissue grafts and calcium sulfate as a sandwich graft on root coverage cases, and he's getting comparable results clinically when using calcium sulfate instead of conventional connective tissue root coverage cases."[1-3]

Kim's clinical experience of more than four years using the calcium sulfate compaction technique, in collaboration with Mihye Choi, DDS, MS (restorative dentistry), and Nazir Mohammad (laboratory support), is well illustrated in two specific cases **(see Figures 15-26)**. He notes that a thickness of 1.5-3.0 mm has been well tolerated by the overlying flap in such cases.

Clinical findings in peri-implant guided bone regeneration in which the non-submerged compaction technique is used are consistent with thickening of the soft tissue immediately adjacent to the grafted area and also with broadening the zone of attached gingiva, both of which are important features in the long-term success of implants. Kim hypothesizes that the overlying flap thickens as a result of fibrous encapsulation of the most superficial layer of the barrier.

Conclusion

In a one-stage protocol, Kim explains, "the clinician tries to dictate the form of the gingiva from day one. Damage to any area must be avoided before the site is opened again for definitive prosthetics." The clinician must study the anatomy of the tooth and the surrounding gingiva to determine not only where the future contacts and facial and lingual contours will be, even stripping and building the gingiva prior to the implant placement. From these determinations, a laboratory can fabricate either the resin or the metal provisional restoration and the clinician can execute the surgical



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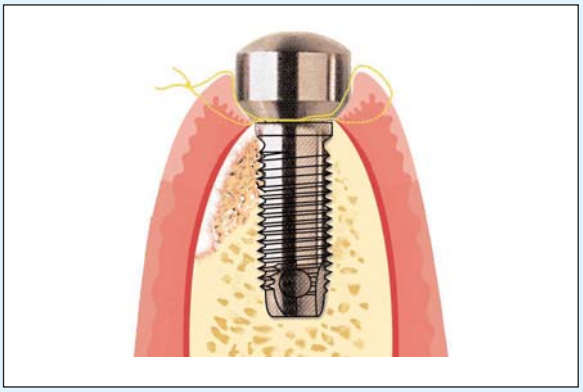

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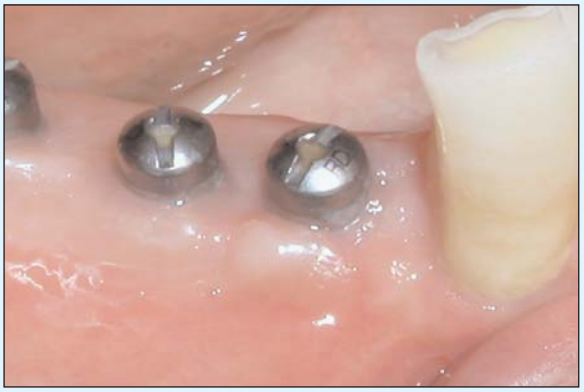

Figure 26:

procedure. Of course, careful planning is extremely important for implant positioning for buccal-lingual, medial-distal, and superior-inferior placement to ensure the proper embrasure form.

When cases require not only the peri-implant tissue contour impression and transfer technique, but also bone augmentation at the implant site, Kim's calcium sulfate compaction can be followed, he believes, because of the many advantages calcium sulfate has over ePTFE membranes, including adaptation to irregular anatomical conformities, absorbability (eliminating second surgery), absence of inflammatory or foreign body reaction, and permitting fibroblast migration over its surface.

Kim adds, "Calcium sulfate does not permeate, deposit, or attract plaque even when exposed, therefore, it allows epithelium to grow on it pretty consistently." He concludes, "It does not elevate serum calcium levels, and it stays intact for 8-12 weeks, according to my histological study, thus acting as a quasi-membrane." When the calcium sulfate does dissolve, a significant part of it is phagocytosed by the connective tissue itself, and, therefore, Kim says, "It will turn into fibrous tissue, which will add to the amount of keratinized tissue in the immediate surroundings."

References

1. Anson D. Saving periodontally "hopeless teeth" using calcium sulfate and demineralized freeze-dried bone allograft. *Compend Contin Educ Dent* 1998;19:284, 286, 288 passim.

2. Anson D. Using calcium sulfate in guided tissue regeneration: A recipe for success. *Compend Contin Educ Dent* 2000;21:365-370, 372-373, 376.

3. Anson D. Calcium sulfate-augmented soft tissue root coverage adjacent to connective tissue grafting: A new technique. *Int J Periodontics Restorative Dent* 2003;23:337-343.

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