

THE CREATION OF ATTACHED GINGIVA IMMEDIATELY AFTER EXTRACTION

Bone augmentation procedure without wound closure

One of the characteristics of wound healing after an extraction is that the alveolar process changes shape horizontally and vertically due to bone resorption. When a bone augmentation procedure is performed at a later stage, the tissue is typically released and moved coronally. This results in the mucogingival junction moving in a coronal direction and even being positioned on the crest of the alveolar process. However, using a new bone augmentation procedure immediately after extraction, preservation of the shape of the alveolar process and of the positioning of the mucogingival junction can be achieved simultaneously. By Lodewijk Gründemann and Melle Vroom.

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Various studies have shown that after the removal of a tooth or molar the dimensions of the alveolar process decrease in size. Partially in the vertical dimension, but especially in the horizontal dimension there could be up to fifty percent bone reduction within a year. The result is a 'dent' in the alveolar process. This is undesirable if the prosthetic follow-up treatment involves a fixed bridge reconstruction or the placing of an implant. In case of a fixed bridge reconstruction it means that the pontic will become large and esthetically unattractive (certainly when in the esthetic zone). In case of placing an implant, the result will be that there is a lack of adequate bone mass or that the final position of the implant is not ideal, which necessitates the making of a larger crown and violation of good esthetic proportions.

L.J.M.M. Gründemann MSc qualified as a dentist (State University Utrecht) in 1988 and as a periodontist (ACTA=Academic centre for Dentistry Amsterdam) in 1998.

M.G. Vroom MSc qualified as a dentist (ACTA) in 1994 and as a periodontist (ACTA) in 1998.

Both authors are working as periodontists (NVvP = Dutch Union of Periodontists) and implantologists (NVOI = Dutch Union for Oral Implantology) in the Periodontal Practice Friesland, Goutum, Netherlands.

Possible treatments

In order to correct this result, various procedures for bone and soft tissue augmentation can be applied. This 'late' recovery (thus after the 'dent' has already appeared) is a challenging but difficult procedure that can only be performed with predictable results by

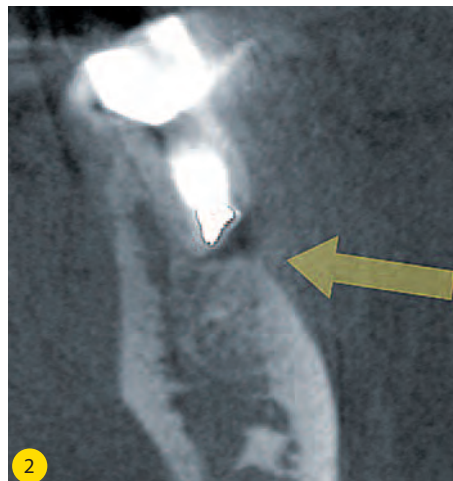
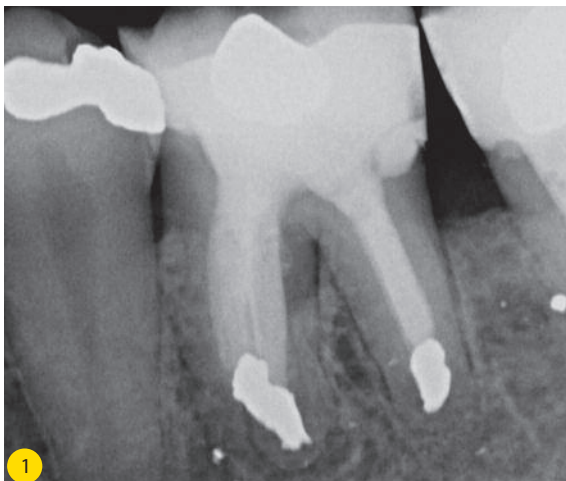


Image 1 Clinical image of tooth #19.

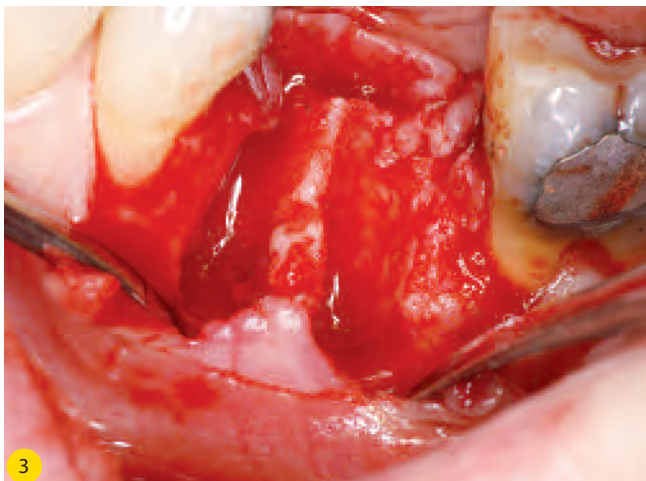
Image 2 CBCT-image of #19. The arrow indicates the considerable amount of bone loss on the buccal side.

professionals who have been trained for this and who have a lot of experience performing it. In addition, these procedures are very expensive, a burden on the patients and they take a lot of treatment time. It would therefore be a fine thing if, after an extraction, the alveolar process would not resorb and would maintain its shape. The problems outlined above that occur in 'late' alveolar ridge reconstruction may be prevented then. Many scientists and clinicians have been studying this and have developed alveolar ridge preservation and augmenting techniques. Roughly, this means that direct action is taken immediately after extraction and maximum use is made of the volume of bone and soft tissue still present. Using these techniques, after extraction the dental alveolus is scraped clean of all inflamed tissue and the periodontal ligament situated on the inner side of the extraction site. Then the alveolus is filled in/reconstructed (if several walls are lacking) and covered over with a guided tissue regeneration membrane. In this way the tissues still present and the shape and volume of the alveolar process are directly involved in the healing process, which causes the final result to come close to the original starting point. Additional bone augmentation for the sake of the placing of implants will not usually be necessary then, and, in cases of a fixed bridge reconstruction, a more esthetically pleasing prosthesis can be made.

For filling up the extraction site, autologous bone or bone substitutes can be used; it has been shown that the latter are better in countering bone resorption. For covering over the bone material a gingival transplant can be used, a membrane (resorbable or non-resorbable) or a collagen plug. The non-resorbable Gore-Tex membrane (expanded PTFE) available in the past is not suitable for this purpose.

In TandartsPraktijk (TP =Dental Practice) examples have been described in past issues of reconstructing the alveolar process in which a gingival transplant was used.

A disadvantage of this is that surgically it is a demanding procedure and a second operation area is needed. An advantage is that you will have sufficient gingiva at your disposal for a beautiful esthetic result. Other techniques make use of a resorbable membrane or a collagen plug. Both resorb relatively quickly and therefore lose their barrier function, resulting in a little more loss of bone height. The advantage, however, is that both a resorbable membrane and a collagen plug are relatively easy to put into place.



Alternative treatment procedure

One alternative is the application of a non-resorbable membrane made from dense PTFE (d-PTFE), (Cytoplast®, Osteogenics Biomedical, Inc. Lubbock, Texas, USA). This membrane gives good results for the development of underlying bone and for creating a wide zone of keratinized gingiva. Recent studies have shown that the increase of the width of the zone of keratinized gingiva is on average 5mm more in comparison with an extraction in which this membrane is not used.¹ The d-PTFE membrane does not resorb, is non-permeable to bacteria and can be (relatively simply) removed after 4-6 weeks. Due to its non-permeable property the membrane is used to cover up the dental alveolus. This technique involves the use of a planned exposure of the membrane, something we find many colleagues have some trouble getting used to. A disadvantage is that slightly less gingival thickness will be formed. The most important thing is, however, that the dentist, before taking up the extraction forceps, is fully aware of the exact treatment purpose. That is, preservation of the alveolar ridge by means of using bone substitutes and membranes, and can anticipate that by taking the right steps.

Application of the d-PTFE membrane

Within our practice we have been applying the d-PTFE membranes in combination with the approach described above for a considerable period of time, and with good results. Some examples we will discuss here in combination with the clinical photographs.

Case 1 (images 1-9)

The first case concerns a 50-year-old woman who has been referred for the treatment of periodontitis. She submits to a periodontal treatment according to the periodontology protocol. This results in a predominantly stable, healthy, reduced periodontium. On teeth 19 and 20, endodontic retreatments are performed. Tooth 19 had an apical resection in the past and subsequently an endo-periodontal problem developed with a primary endodontic cause, which ultimately required extraction (image 1-2). Tooth 19 is removed with some difficulty, and it can be clinically observed that the buccal wall is mostly lacking. (image 3).

We decided to preserve the alveolar ridge as much as possible and to repair it by applying a titanium reinforced d-PTFE membrane with allogeneic bone graft material as filler. Primary closure of soft tissue over the membrane was purposely not done. The reasons for this are:

- 1 preservation the position of the mucogingival junction;
- 2 exposure of the d-PTFE membrane doesn't have a negative impact on regeneration, so long as the edges are not openly exposed, and
- 3 after removal of the membrane the upper part of the osteoid matrix will reform into keratinized gingiva in due time, with a fine wide zone of keratinized tissue as a final result.

The membrane will be removed five weeks after it has been put into place (images 4-5). This is fairly easily done by elevating the membrane slightly and releasing the connection between the

Image 3 The ridge immediately after the removal of tooth #19. There is a lot of bone loss visible on the buccal side.



Image 4 The area adjacent to #19, five weeks after extraction. The tissue is free of inflammation and the titanium reinforcement of the d-PTFE membrane is visible.

Image 6 Three months after the removal of the membrane it has visibly healed nicely. Especially note the wide zone of keratinized tissue in the area of tooth #19.

Image 8 The placement of the implant in position 19. During the osteotomy it becomes obvious that the regenerative tissue is very dense.

Image 5 Clinical picture immediately after the removal of the d-PTFE membrane.

Image 7 Clinical picture of the #19 area prior to the placing of the implant. Compare this to image 3 to get a good idea of the amount of realized alveolar ridge preservation and rebuilding.

Image 9 A screw-retained crown is placed on top of the implant a few months after the placing of the implant.

outside of the membrane and the inside edges of the tissue, e.g. by means of a periodontal probe. After this the membrane can be removed with the help of a pair of tweezers. Sometimes topical anaesthesia is necessary, and with larger titanium reinforced membranes, local anesthesia may be required. It is important to leave undisturbed the tissue (bone matrix) that is now no longer protected by the membrane. If required, a suture can be put in for

stabilisation of the edge of the tissue. Three months after the removal of the membrane the tissues have healed nicely and there is a wide zone of keratinized tissue present ([image 6](#)).

After opening the tissues to enable the placing of an implant, the alveolar process has visibly regenerated and the preservation of the shape has been realized ([image 7](#)). Compare to image 3.

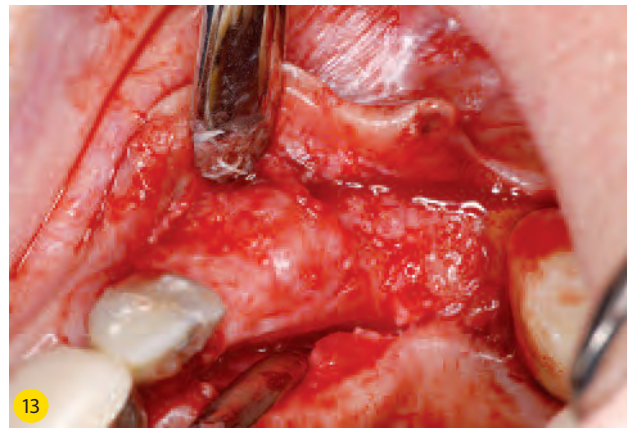
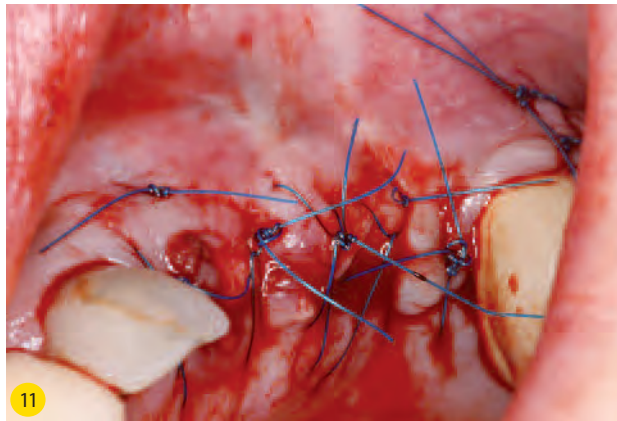
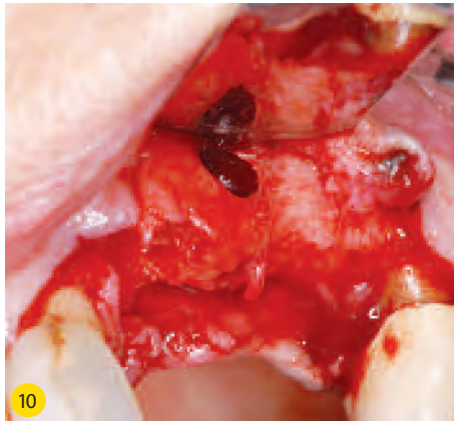


Image 10 The area #10-14 immediately after removal of #11 and the removal of apex/pigmentation remains of #12. The defect in the area of #12 is clearly visible and continues in dorsal direction.

Image 12 After healing the tissues remain nicely closed.

Image 11 Clinical picture after suturing. The extraction site at position 11 has been closed with an internal rotation flap.

Image 13 Bone situation in the area #11-14 over four months after the placing of a d-PTFE membrane.

The placing of an implant in position 36 is perfectly possible now ([image 8](#)). During the osteotomy a very good degree of hardness of the regenerated tissue is observable. Several months later the crown is placed by the referring dentist ([image 9](#)).

Case 2 (image. 10-15)

Another case concerns a 70-year-old woman who has also been referred for treatment of periodontitis. The treatment plan follows standard protocol, which results in a healthy periodontium. During the follow-up treatment we observe a locally deepened pocket at tooth #11 that was not there before. We decide to perform a diagnostic flap revealing a vertical root fracture. Extraction is indicated, however the patient insists on keeping the tooth temporarily. The treatment plan involves the removal of #11 in the short term and placing an implant in position 11 and 13 after healing. After the extraction of #11, soft tissue pigmentation from previous endodontic surgery at the apex of tooth #12 is also removed, and there is a ridge defect which extends to tooth #13. ([image 10](#)). We decide to combine an alveolar ridge preservation and reconstruction procedure with bone augmentation in the area of #12 and 13. We placed a titanium reinforced d-PTFE membrane with allogeneic bone graft material as filler. Because the palatal flap shows a fair amount of tissue thickness, it is possible to close off the

extraction site in position #11 by means of an internal connective tissue flap. ([image 11](#)).

This case shows clearly that the closure of an extraction alveolus by means of soft tissues is sometimes possible. In this situation it was also desirable because the ridge preservation and reconstruction procedure was combined with bone augmentation in the area 12 and 13. It is good to emphasize here that, as is visible in this case, the practitioner has to try to maintain the location of the mucogingival junction as much as possible in its original position. The healing proceeds without any problems and the soft tissues at the extraction site of #11 are closing well. ([image 12](#)). Over four months after placing the membrane, it is removed and it can be observed that a beautiful alveolar ridge has appeared ([image 13](#)). The placing of an implant in position 11 and 13 is now perfectly possible. ([image 14](#)). In the area of #11 we observed a thin layer of soft tissue underneath the membrane, which makes us decide to place the implant little more deeply ([image 14](#)). Underneath a d-PTFE membrane a thin layer of soft tissue is always found after removal of the membrane. Our experience throughout many years has shown us that the thickness of this layer can fluctuate. It is important to leave this soft tissue undisturbed as much as possible. In the phase-two treatment, four months later, remodelling is visible. ([image 15](#)).

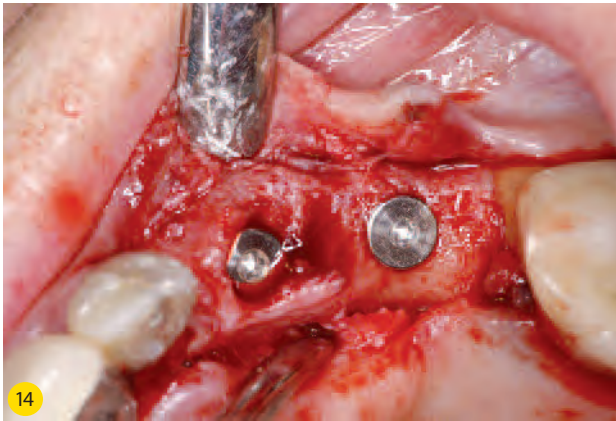


Image 14 Placing an implant in position #11 and 13 is perfectly possible.

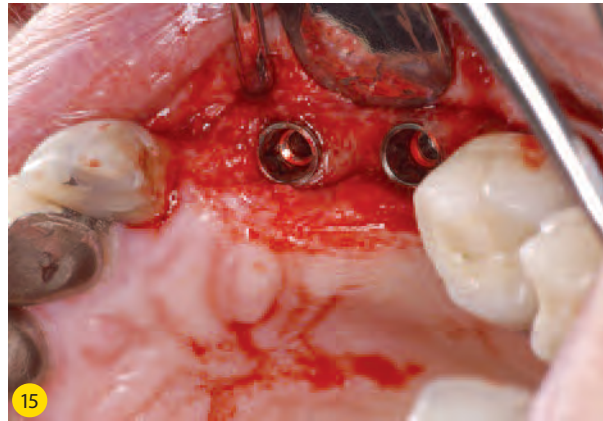


Image 15 Four months after placing an implant, the phase two treatment is performed. Clinical picture before the healing abutments will be placed.

Case 3 (image. 16-21)

The last case concerns a 55-year-old woman who is referred for placing an implant in position 14 – and possibly 15. In case of 14 there is a perio-endodontic problem with a primary endodontic cause. An apical resection was performed ten years previously. With respect to #15, the crown has become loose and a persistent apical radiolucency is present in spite of an endodontic treatment. We decide to remove the 14 and 15 and to perform a ridge preservation and reconstruction procedure in position 14. After healing, an implant will be placed. On the CBCT of the area 14-15 the extension

of the apical radiolucencies is clearly visible (image 16).

Teeth 14 and 15 are extracted. This proceeds with difficulty in case of 14, which is sectioned and substantial granulation tissue is removed. The buccal wall is missing at the mesiobuccal root (image 17). We place a titanium reinforced d-PTFE membrane underneath the tissues without a flap. The tissues are then manually sliced loose from the underlying bone. The membrane is placed between the bone and the tissues, using an allogeneic bone graft material as filler. The membrane is not covered, thus creating a purposeful exposure. After six weeks the membrane is removed and occlusal soft tissue is visible (image 18-19). This is again a normal picture; this tissue will regenerate into keratinized tissue. It

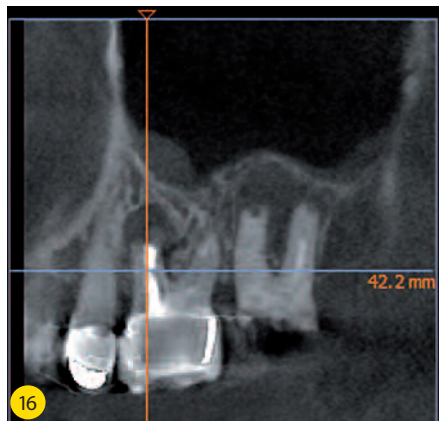


Image 16 CBCT-image of the area of #13-15. The extension of the apical radiolucencies is clearly visible.

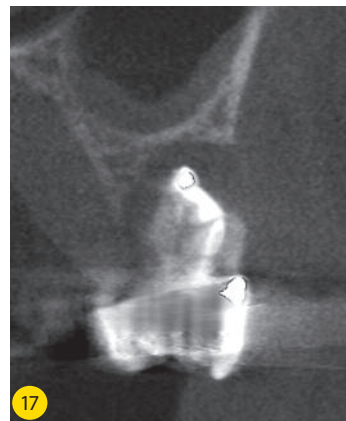
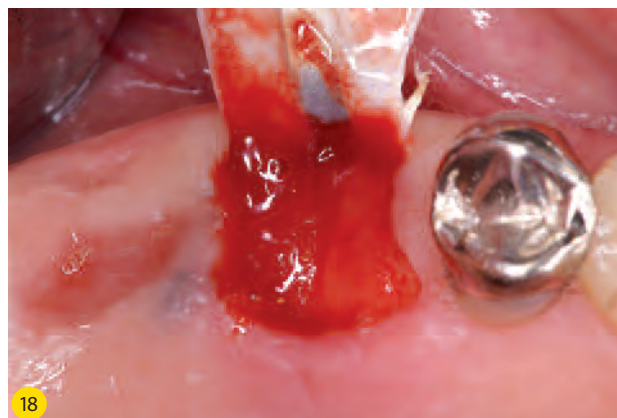


Image 17 CBCT-image of #14 showing clearly to what extent the apical radiolucency continues towards apical and palatal.

Image 18 Removal of the d-PTFE membrane six weeks after placement in the area of #14. The titanium reinforcement in the membrane is clearly visible.



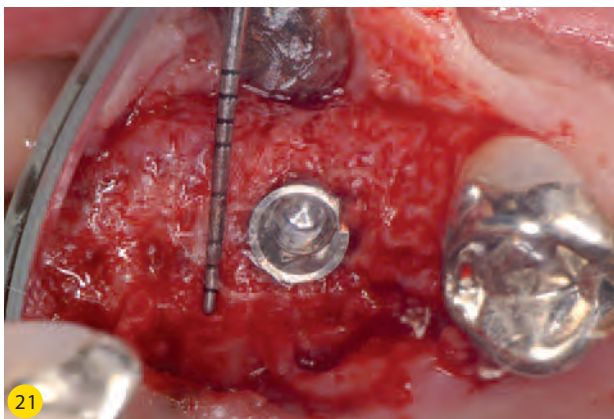
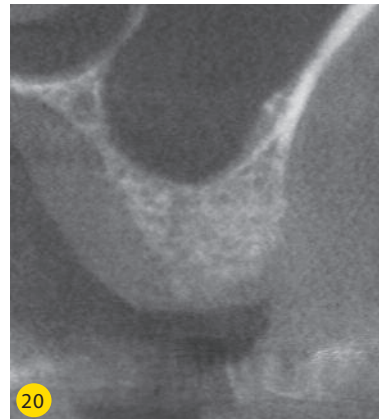
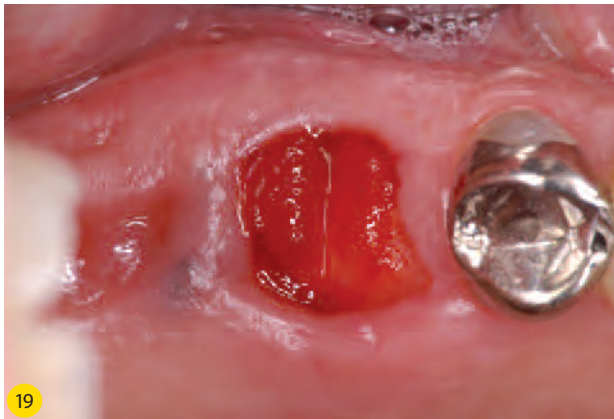


Image 19 Clinical picture immediately after removal of the d-PTFE membrane. Minimal bleeding is present.

Image 20 Three months after extraction a local CBTC is made. This shows a good preservation and a good reconstruction of the alveolar ridge compared to the pre-operative image (16).

Image 21 Four months after extraction an implant is placed on position #14. This can now be done without a sinus lift.

is interesting that in many of these treatments we concluded we were able to probe hard regenerative tissue underneath the layer of soft tissue even after 4-7 weeks. Over three months after extraction of #14 with membrane placement a local CBTC of the area of #13-15 is made for planning an implant and for a check-up. This clearly shows the preservation of the shape of the alveolar ridge (image 20). A month later the implant is placed in one phase, in the course of which during the drilling out good hard regenerative tissue turned out to be present. (image 21). Due to this procedure, a sinus lift will not be necessary.

Complication

A complication that has occurred in one single case is exposure of one of the edges of the membrane. This (edge exposure) creates a portal of entry for bacteria, which has a negative impact on the process of bone augmentation. Early removal of the membrane is required then. This doesn't mean that the entire procedure has failed if in such a case the underlying regenerative tissue has not become inflamed and the membrane has been in position for a sufficient length of time for regeneration to occur.

Conclusion

The d-PTFE membrane is perfectly applicable in alveolar ridge preservation and reconstruction procedures immediately at the time of extraction. The fact that the surface of the membrane is non-permeable to bacteria is a clear advantage in this application. The d-PTFE membrane will preserve the shape of the alveolar ridge and increase the amount of keratinized gingiva, also in compromised situations. This considerably increases the chance that after a period of healing one or more implants can be placed without an additional bone augmentation procedure. Likewise, the presence of a wide zone of keratinized tissue will also increase the chance of stable peri-implant tissues.

The authors declare they have no financial benefit and no conflict of interest from mentioning the products named in this article.

Reference:

¹ Barboza et al. Evaluation of a dense polytetrafluoroethylene membrane to increase keratinized tissue: a randomized controlled clinical trial. *Implant Dent.* 2014 Jun; 23(3): 289-94.