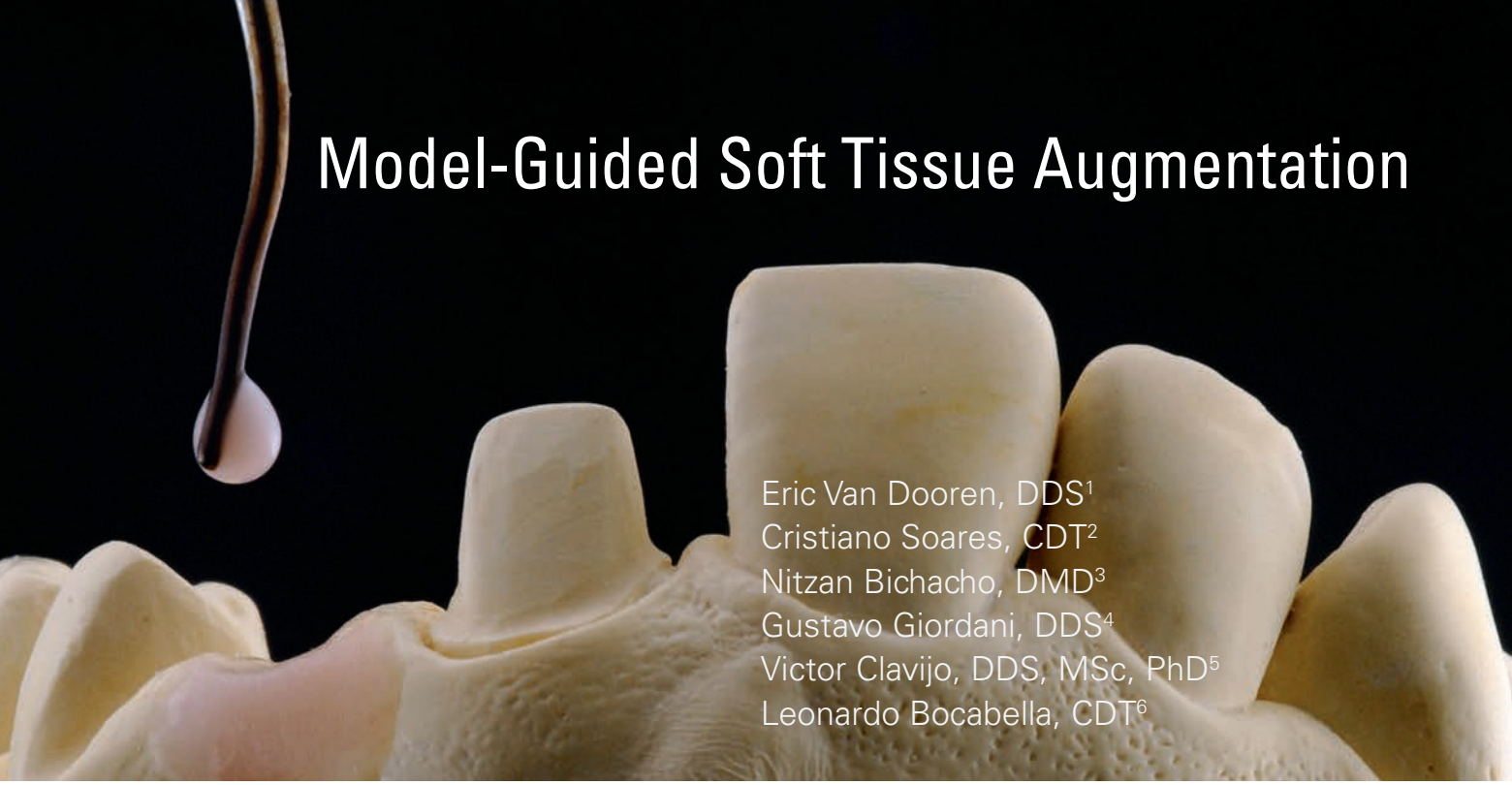


Model-Guided Soft Tissue Augmentation

Eric Van Dooren, DDS[1]
Cristiano Soares, CDT[2]
Nitzan Bichacho, DMD[3]
Gustavo Giordani, DDS[4]
Victor Clavijo, DDS, MSc, PhD[5]
Leonardo Bocabella, CDT[6]

The main challenge in modern esthetic dentistry is to simplify procedures while improving their predictability. Many articles and case reports show excellent esthetic results, but often the treatment modalities are difficult to understand and follow. This article presents a case report to describe a new technique for optimizing and simplifying the fabrication of a three-unit fixed prosthesis with predictable soft tissue augmentation for a pontic site. The "realistic" model-based soft tissue augmentation predictably guides the surgical and prosthetic procedures.

[1]Private Practice Limited to Periodontics, Fixed Prosthdontics, and Implants, Antwerp, Belgium; Visiting Professor, University of Liege, Belgium, and University of Marseille, France.

[2]Dental Technician, Campinas, Brazil.

[3]Professor and Head, R.E. Goldstein Center for Aesthetic Dentistry and Clinical Research, Department of Prosthodontics, Faculty of Dentistry, Hebrew University–Hadassah, Jerusalem, Israel.

[4]Oral and Maxillofacial Surgeon, São Paulo, Brazil.

[5]Private Practice, São Paulo, Brazil.

[6]Dental Technician, Campinas, Brazil.

Correspondence to: Dr Eric Van Dooren, Tavernierkaai 2, 2000 Antwerp, Belgium. Email: vandoorendent@skynet.be

CASE REPORT

A 50-year-old female patient presented with an old, deficient three-unit ceramometal fixed prosthesis (Fig 1). At clinical evaluation, both the maxillary left central incisor and canine teeth were vital, no periodontal pockets were detectable, and the patient's oral hygiene was acceptable. The patient wished to have the existing prosthesis replaced without the use of dental implants. As the patient's lifestyle involved extensive travel, she declined orthodontics and preferred treatment that would require a minimal number of appointments.

Without proper diagnosis and treatment planning, the esthetic results for this or any patient might be disappointing and unacceptable for both dentist and patient. Therefore, clinical/photographic documentation is mandatory. A proper sequence of intraoral and smile photographs are the minimal prerequisites for proper digital and clinical treatment planning (Fig 2). Additionally, photographs and a video of the full face need to be taken to relate the teeth to the face (Fig 3).

Although a digital smile design or semi-mathematical approach (with ideal/golden proportions) of the future restoration can be planned on the computer screen, a

CASE REPORT

1

2

3

4a

4b

Fig 1 Deficient three-unit ceramo-metal fixed prosthesis in situ.

Fig 2 Preoperative full face photograph.

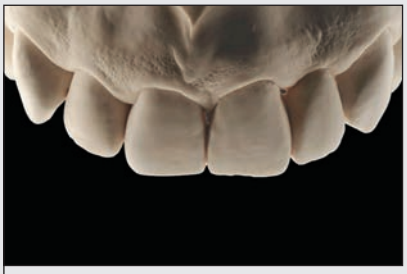
Fig 3 Sequence of preoperative smile photographs.

Fig 4a Simplified digital planning.

Fig 4b Digital smile design planning.

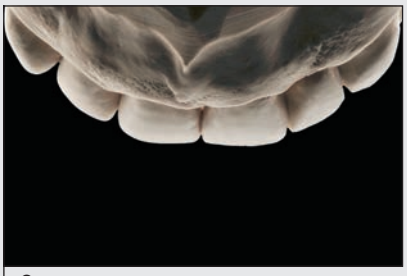

5


6


7

Figs 5 to 9 Initial wax-up and prosthetic design.


8


9

simplified digital approach will assist considerably in analyzing the limitations of the case. In fact, this pretreatment analysis is of primary importance in order to avoid future disappointing results. Drawing simple lines can provide valuable information regarding papilla heights, eventual midline shift, and gingival/incisal levels (Fig 4).

The treatment plan in this case was to replace the three-unit ceramometal prosthesis with an all-ceramic restoration and to perform soft tissue augmentation, with a connective tissue graft, of the pontic recipient site. However, the sequence and the timing of the surgical and prosthetic treatments of the case are completely different from conventional soft tissue augmentation treatment sequences.

The sequence for model-guided soft tissue augmentation is simple and straightforward:

1. Initial wax-up or prosthetic design
2. Removal of the old restoration and intraoral mock-up, followed by a provisional prosthesis for esthetic and functional evaluation
3. Final preparation of teeth and final impression
4. "Realistic" model-based wax-up and "soft tissue augmentation" on the final model
5. Development of the ideal 3D pontic recipient site on the model
6. Fabrication of the final ideal restoration
7. Surgical procedure and placement of the definitive restoration
8. Healing and maturation of the surgical site around the restoration margins and outlines

Initial Wax-up

In the model-guided soft tissue augmentation protocol, the first step is a precise silicone impression (vinyl polysiloxane or polyether) and fabrication of two accurate plaster casts. Alginate impressions are not precise enough for this procedure. The soft tissue contour, gingival margin, root contour, and tooth form should be clearly visible on all teeth.

On the first model, the dental technician defines and sculpts final teeth forms in harmony with the contralateral side. In the present case, the teeth forms were sculpted with a bur and a subtle wax-up optimized the forms. At this stage, the main objective is to create harmony in the prosthetic forms between the left and right sides (Figs 5 to 7).

Because of the significant labial inclination of the maxillary left central incisor (crown and root), the technician altered the marginal gingival soft tissue thickness on the model. This can be seen by looking at the models from different angles. A "perfect asymmetry" in design was achieved (Figs 8 and 9).

10

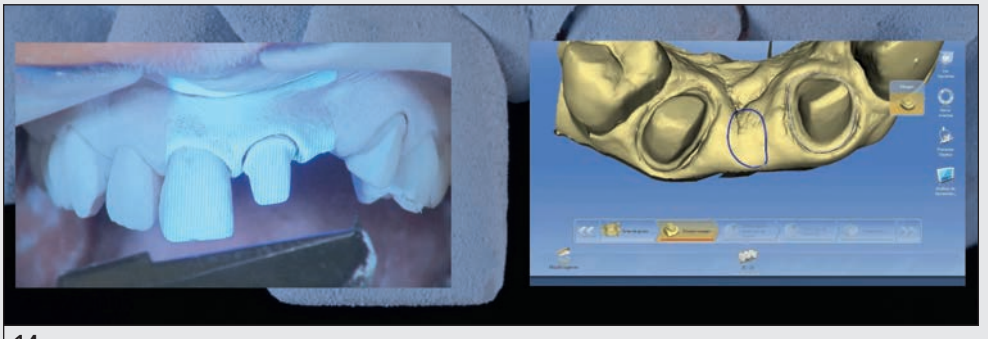
11

Fig 10 Initial preparations.

Fig 11 Supragingival preparation of the maxillary left lateral incisor.

12

13



14

Fig 12 Provisional prosthesis in situ for functional and esthetic evaluation.

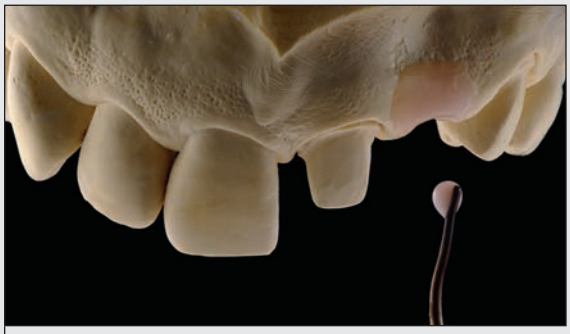
Fig 13 Retraction cord in place for final impression.

Fig 14 Optical impression and CAD/CAM designing.

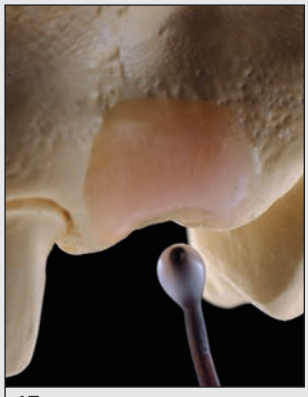
Prosthesis Removal and Provisional Fabrication

A silicone key was fabricated from the original wax-up to be used to evaluate esthetics and function with a mock-up and later with a provisional restoration. The patient's prosthesis was removed and care was taken to make initial supragingival preparations. The new preparation level was related to the marginal soft tissue level of the contralateral side (Figs 10 and 11). When measuring the thickness of the provisional retainers, it became evident that endodontic treatment of the maxillary right central incisor was necessary to create enough space for the final restorative material. This was necessary because the patient had declined orthodontic movement of the tooth. As the buccal

15



16



17

18

Fig 15 Original stone cast.

Figs 16 and 17 Realistic wax-up and soft tissue augmentation.

Fig 18 Working model after duplication.

contour of the tooth was altered on the original model by the dental technician, the buccal contour was also flattened clinically by using a bur from the new supragingval outline up to the intracrevicular level (Fig 12).

Final Preparation of Teeth and Final Impression

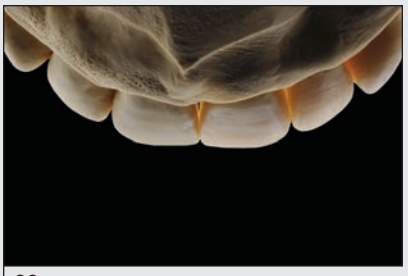
One week after teeth preparation, and with optimal soft tissue conditions, final impressions were made. A double retraction cord technique was used to ensure optimal precision and soft tissue conditioning (Fig 13). To prevent possible entrapment of thin remnants of the impression material in the sulci, the traditional impression technique was used (Impregum/Permadyn, 3M ESPE, St Paul, Minnesota, USA); however, optical impressions, CAD/CAM design, and 3D printing of models will become the standard in the near future (Fig 14).

Soft Tissue Augmentation on the Final Model

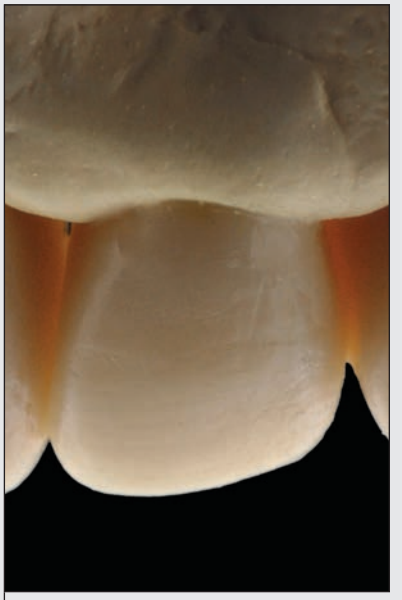
Two casts were poured, and on one of thm the dental technician made a realistic soft tissue wax-up in order to obtain the ideal 3D pontic recipient site. It is important for the dental technician to compare the wax-up and the soft tissue contour and volume with the contralateral side and to try to simulate a "realistic" soft tissue augmentation (Figs 15 to 18). This analysis should be done together with the dentist.

The wax-up model was duplicated to provide a working model with the same soft tissue dimensions. An ideal wax-up for the three-unit prosthesis was fabricated. Buccal and occlusal silicone indices were used to copy as much as possible the original model, for which the overall design, tooth forms, and incisal edge position approved by the patient at the initial evaluation served as guidelines, but this time the focus was to get the ideal 3D relation of the pontic to the model-


19


20


21


22

Figs 19 and 20 Ideal 3D relation of the pontic to the model.
Fig 21 Relation of pontic before model-based augmentation.
Fig 22 Relation of pontic after model-based augmentation.

based augmented area (Figs 19 and 20). Placing the wax-up on the model before and after model-based augmentation and duplication clearly demonstrates the difference in 3D pontic position and soft tissue contours (Figs 21 and 22).

Ideal 3D Pontic Recipient Site on the Final Model

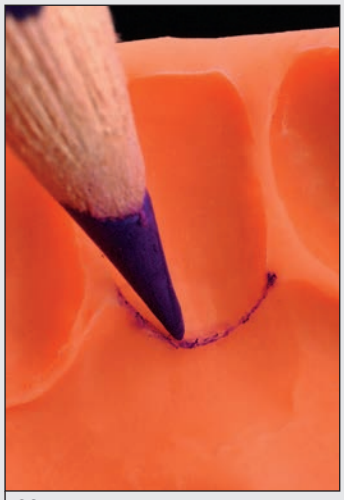
Once the wax-up was fabricated on the working model, an optimal pontic recipient site was created. To visualize the ideal buccal contour on the model before carving the model with a bur, a buccal silicone index was made. In this index, the line that expressed the transition between ideal pontic position (wax-up) and ideal but realistic model-augmented soft tissue volume was colored with a blue pencil and pressed against the model (Figs 23 and 24). The blue line on the model represented the ideal emergence line for the pontic as well as the point were the pontic would support the soft tissue in an ideal way after the surgical soft tissue augmentation (Fig 25). The same concept should be used when working with implant prosthetics and soft tissue conditioning.

Once the blue line, and thus the most buccal position of the pontic, was defined on the model, the full pontic contour was designed with a black pencil and refined with a round diamond bur (Figs 26 to 28). Now that the ideal contour, position, and form of the pontic were defined, the definitive ceramic restoration could be fabricated.

Fabrication of the Definitive Restoration

A definitive three-unit e.max Press prosthesis (Ivoclar, Schaan, Liechtenstein) was fabricated, respecting the ideal soft tissue position and contour. Care was taken to relate the framework design to the final tooth forms and to optimize the support for the veneering porcelain. The size of the connectors was important to minimize postoperative porcelain chipping and framework fractures (Figs 29 to 31).

The framework was layered with e.max Ceram porcelain, with attention placed on creating optical



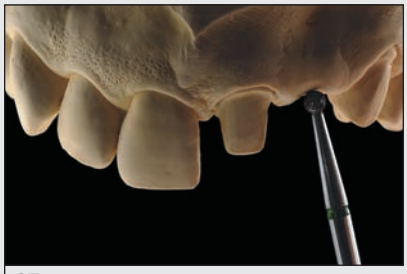
23

24

25

Figs 23 to 25 Application of blue pencil to define the ideal buccal emergence line.

26



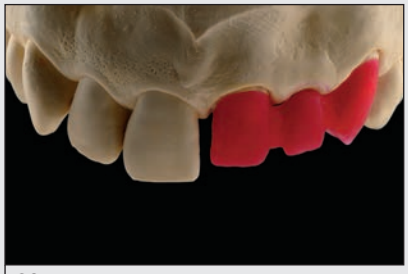
27

28

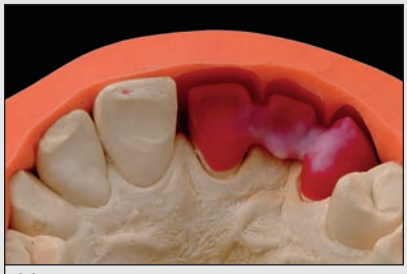
Fig 26 Designing the full-contour pontic design.

Fig 27 Refining the pontic design with a diamond bur.

Fig 28 Ideal 3D pontic design.



29



30

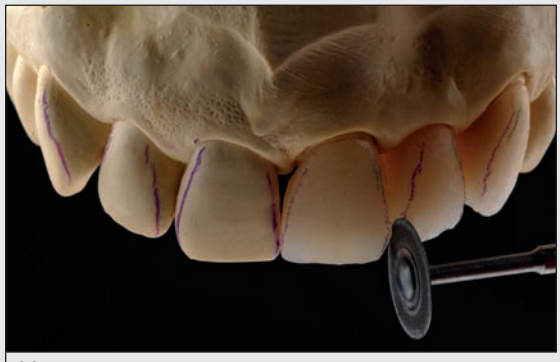
31

Figs 29 and 30 Relating the framework design to the final tooth form.

Fig 31 Three-unit e.max Press framework.

illusion effects by optimizing the line angle position, form, surface texture, space distribution, and light reflection (Fig 32). As an alternative, one could choose a monolithic framework, with only buccal layering, or a zirconia framework. The optical properties of the surface were obtained using disks and burs (Figs 33 to 35). From a prosthetic point of view, the most difficult part of this case was to match a unilateral defect and a three-unit prosthesis to the contralateral side consisting of single natural teeth with optimal contours.


32


33


34


35

Fig 32 Layering with e.max Ceram porcelain.
Fig 33 Defining embrasure size.
Fig 34 Optimizing line angle position and light reflection.
Fig 35 Final three-unit prosthesis.

Connective Tissue Grafting and Prosthesis Cementation

A connective tissue graft was harvested from the tuberosity region. The graft was reshaped to fit the pouch, and the de-epithelialized tissue was removed (Fig 36). An ophthalmological surgical blade was used to make a semilunar crestal incision, and a split-thickness pouch was made as a recipient site for the graft (Fig 37).

The incision was planned to be a copy of the blue line on the model and should become the gingival ledge to be supported by the gingival aspect of the pontic design. The graft was sutured with two sutures (Seralene 6/0, American Dental Systems, Vaterstetten, Germany) (Figs 38 and 39).

When cementing the prosthesis, care was taken to ensure that the buccal-gingival aspect of the pontic would produce the proper prosthetic support to the incision line and the grafted area. Retraction cords were placed before cementation to protect the sulci of the abutment teeth.

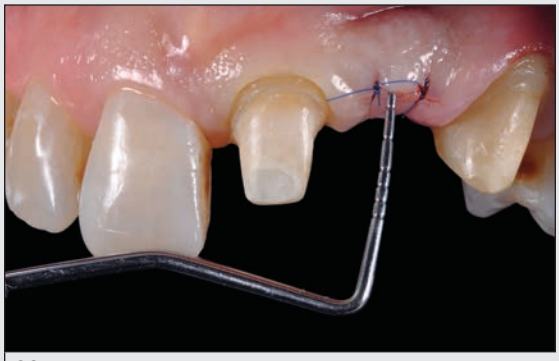
The three-unit prosthesis was adhesively cemented with a dual-cure composite cement (Variolink 2, Ivoclar) and all excess cement was removed (Fig 40).

The sutures were removed after 1 week (Fig 41), and the patient was given proper hygiene instructions. Healing was uneventful, and the esthetic outcome and gingival adaptation clearly improved in time. After 1 year, papilla heights improved, gingival stippling improved, and the prosthetic soft tissue support was optimal (Figs 42 and 43).

36

37

38



39

40

41

Fig 36 Connective tissue graft harvested from the tuberosity region.
Fig 37 Semilunar crestal incision.
Fig 38 Suturing the graft.
Fig 39 Ensuring proper prosthetic support for the graft.
Fig 40 Clinical situation after cementation.
Fig 41 One-week postoperative photograph.

Fig 42 One-year postoperative photograph.

Fig 43 Maturation and stippling of the grafted site.

42

43

CONCLUSIONS

The treatment strategy described is another step of the cervical contouring concept philosophy. Optimal tissue form is designed on the model and accordingly optimal prosthetics can be fabricated, which when transformed and placed intraorally will guide the natural tissues to the predesigned optimal shape. The case presented in this article takes this philosophy one step further, with a supplemental graft, placed in a defective site, that is guided to heal and mature around the optimally designed definitive restoration.

VIDEO LINK

Five videos demonstrating the model-guided soft tissue augmentation technique can be accessed at **handsonbrasil.com/cases/qdt2014** courtesy of the authors.

BIBLIOGRAPHY

Bichacho N. Achieving optimal gingival esthetics around restored natural teeth and implants: Rationale, concepts, and techniques. Dent Clin North Am 1998;42:763–780.

Bichacho N. Cervical contouring concepts: Enhancing the dentogingival complex. Pract Periodontics Aesthet Dent 1996;8:241–256.

Bichacho N. Prosthetically guided soft tissue topography surrounding single implant restorations: Cervical contouring concept. Int J DentSymposia 1997;IV:30–35.

Bichacho N, Landsberg CJ. A modified surgical/prosthetic approach for optimal single implant-supported crown. Part II: The cervical contouring concept. Pract Periodontics Aesthet Dent 1994;6:35–41.

Bichacho N, Landsberg CJ. Single implant restorations: Prosthetically induced soft tissue topography. Pract Periodontics Aesthet Dent 1997;9:745–752.

Coachman C, Van Dooren E, Gurel G, Calamita MA, Calgaro M, de Souza Neto J. Minimally invasive reconstruction in implant therapy: The prosthetic gingival restoration. Quintessence Dent Technol 2010;33:61–75.

Rompen E, Raepsaet N, Domken O, Touati B, Van Dooren E. Soft tissue stability at the facial aspect of gingivally converging abutments in the esthetic zone: A pilot clinical study. J Prosthet Dent 2007;97(6 Suppl):S119–S125. doi: 10.1016/S0022-3913(07)60015-8.

Touati B, Rompen E, Van Dooren E. A new concept for optimizing soft tissue integration. Pract Poced Aesthet Dent 20005;17:711–712, 714–715.

Van Dooren E, Calgaro M. The periodontal-prosthodontic interface around natural teeth and implants. In: Cohen M (ed). Interdisciplinary Treatment Planning, Vol II. Chicago: Quintessence, 2012:415–437.

Vanhoutte V, Rompen E, Lecloux G, Rues S, Schmitter M, Lambert F. A methodological approach to assessing alveolar ridge preservation procedures in humans: soft tissue profile. Clin Oral Implants Res 2013 April 4 [Epub ahead of print].

Wittneben JG, Buser D, Belser UC, Brägger U. Peri-implant soft tissue conditioning with provisional restorations in the esthetic zone: The dynamic compression technique. Int J Periodontics Restorative Dent 2013;33:447–455. doi: 10.11607/prd.1268.