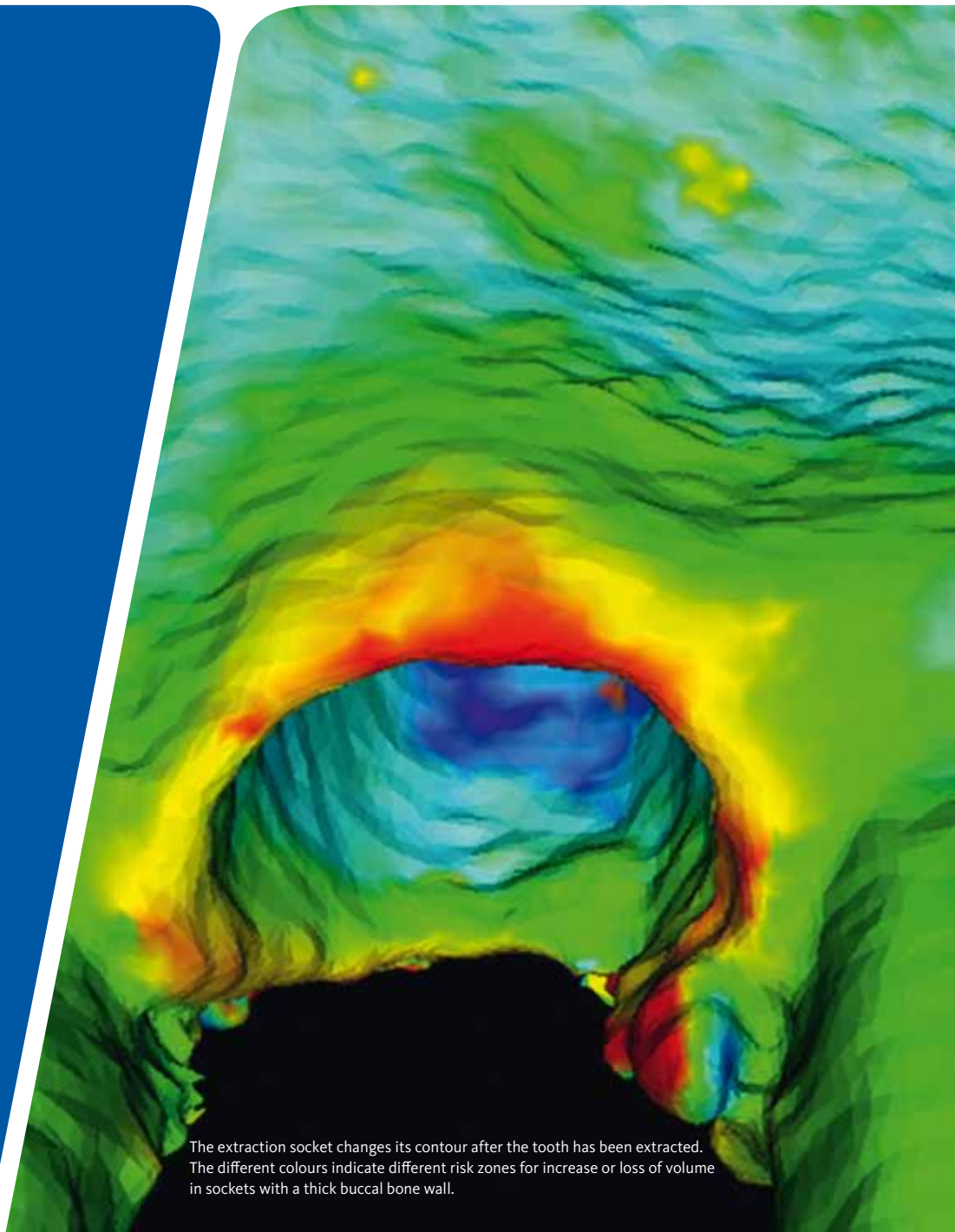
Geistlich
Biomaterials

GEISTLICH NEWS

Long-term data
CBCT images prove contour augmentation is successful

Instead of punch grafts
Geistlich Mucograft® Seal closes extraction sockets

New foundation
Geistlich sets up Osteo Science Foundation in America



The extraction socket changes its contour after the tooth has been extracted. The different colours indicate different risk zones for increase or loss of volume in sockets with a thick buccal bone wall.

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Editorial

Dear readers

Launched in October 2013 at the EAO congress, Geistlich Mucograft® Seal is the latest and smallest member of the Geistlich product family. The circular matrix was designed especially for sealing extraction sockets as part of a Ridge Preservation procedure.

It has long been known that within the first two or three months after tooth extraction some of the alveolar bone surrounding the extraction site will be resorbed, mainly because this is a natural physiological response of the body.

Although ridge shrinkage was considered by many experts to be an irreversible and acceptable process, the expert scientists at Geistlich Pharma in tandem with collaborating clinicians thought otherwise. They felt that measures to prevent bone resorption after tooth extraction would make future treatments such as implant placement or bridge reconstruction clinically easier and, most importantly, provide a much better outcome for the patient.

As a result of the dedication to discover innovative treatments, Geistlich has been a leader in the development of new Ridge Preservation methods for more than ten years. To achieve this important goal the company has collaborated with outstanding researchers such as Prof. Jan Lindhe and Prof. Giuseppe Cardaropoli in exploring the physiological basis of bone resorption in spontaneously healing extraction sites. At the same time, methods were explored for counteracting ridge shrinkage by filling the extraction socket with slowly resorbing biomaterials, such as Geistlich Bio-Oss® or Geistlich Bio-Oss® Collagen and covering it with a collagen membrane or collagen matrix. The scientific data, measurement methods and new treatment concepts that scientists at Geistlich Pharma and our collaborators generated have been crucial for the success of this treatment option.

In this issue of Geistlich News we are taking a closer look at these new concepts, including innovative approaches to how substantial bone augmentation can be achieved with biomaterials. In addition, we present new, convincing long-term data from established GBR methods.

I wish you an enjoyable read.

Terance Hart, Chief Scientific Officer

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International courses

Oral regeneration needs to be learnt and practised. To support this, Geistlich sponsors national and international courses by high-calibre experts.

LEADING REGENERATION

"The thickness of the buccal bone lamella is not important"

Bone resorption is minimised by filling the extraction socket with a bone replacement material and subsequent closure. Dr. Daniele Cardaropoli, Italy, has probed the impact of Ridge Preservation in a randomized clinical study[1,2]. He considers the relative merits of the various techniques in this interview.

Research into preserving ridge volume following dental extraction: an interview with Dr. Daniele Cardaropoli, Italy.

Dr. Cardaropoli, what was the most interesting finding from the clinical study in your view?

Dr. Cardaropoli: Ridge Preservation resulted in a volume maintenance that was found to be completely independent of whether the buccal bone wall was previously thick or thin. In sockets which had been filled with Geistlich Bio-Oss® Collagen and covered with Geistlich Bio-Gide®, we retained more than 90% of their horizontal volume instead of only 66% with spontaneous healing. As for bone height, only 0.5 mm was lost in the test group, compared to 1.5 mm with spontaneous healing. And as I said: this result did not correlate with the original thicknesses of the buccal lamellae

Why is that a surprise?

Dr. Cardaropoli: A thin buccal bone lamella is a risk factor for bone resorption. Numerous studies have shown this to be the case[3,4]. The thinner the buccal wall, the greater the proportion of bundle bone. We know that this structure resorbs when it no longer receives nutrients via the periodontal ligament. So, in the spontaneous healing of an extraction socket with a very thin buccal bone wall, there is a high probability of complete resorption. The thicker the bone, the better are the chances of preserving volume.

This correlation was very noticeable in the control group with spontaneous healing. In the group in which we carried out Ridge Preservation however, the volume was preserved equally successfully in all sockets – irrespective of whether the buccal wall was thick or thin.

There are many other factors affecting how much bone is retained. For example, whether teeth are extracted using a flap or flapless approach.

Dr. Cardaropoli: That's right. There is study data indicating the negative effects of flap formation, for example from Nobuto et al.[5,6] It shows that flap formation triggers various biological processes resulting in reduced blood supply and hypoxia in the cortical bone. This in turn intensifies bone resorption on the surface. Particularly in the case of a thin buccal bone lamella, flap-induced bone resorption is most undesirable.

If you do not form a flap, primary wound closure above the filled socket is virtually impossible. How did you go about it?

Dr. Cardaropoli: Flap formation indeed has advantages and disadvantages in terms of primary wound closure. On one hand, the graft can be optimally covered by flap formation, which affords the augmented socket protection while healing. On the other, the mucogingival border is displaced in a coronal direction by mobilizing a flap. You thus lose keratinised tissue and the mucosa moves closer to where the implant will later be placed.

This, in turn, is a disadvantage, because the implant should be surrounded by a margin of keratinised tissue, not by mucosa. Otherwise it is harder for patients to maintain good oral hygiene around the implant. We allowed the membrane to heal openly to circumvent these problems.

Did this approach work out well?
Dr. Cardaropoli: Indeed. The epithelium healed entirely between the third and fourth week. The soft-tissue cover did not take longer than four weeks to close in any patient and no infections occurred.

What has to be taken into account in the open healing approach?
Dr. Cardaropoli: It is important for the membrane to be really stable. It needs to be cut to the correct size and adapted under the sulcus. The membrane should lie directly on the graft. To secure it, a horizontal cross suture is applied across the membrane without the suture penetrating the membrane itself.

The membrane also has to be protected against infections. In addition to analgesic medicines we prescribed oral antibiotics and Chlorhexidine rinse 0.2% every eight hours for six days up to the complete wound closure.

Once again, specifically: what benefits do you see in this procedure?
Dr. Cardaropoli: I want to preserve ridge volume following dental extraction using a predictable technique which causes as little pain as possible and eliminates the need for additional regenerative surgery. At first glance the flapless approach that we used in this study is unconventional, but it has worked very well.

Interview: Natalia Bruenisholz, Claudia Bühlmann, Dr. Mireia Comellas

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[1] Cardaropoli D, et al.: Int J Periodontics Restorative Dent 2012; 32(4): 421-30.
[2] Cardaropoli D, et al: Int J Periodontics Restorative Dent 2014; 34(2).
[3] Januario A: Clin Oral Implants Res 2011; 22(10): 1168-71.
[4] Huynh-Ba G: Clin Oral Implants Res 2010; 21: 37-42.
[5] Nobuto T, et al.: J Periodontol 2005; 76(8): 1339-45
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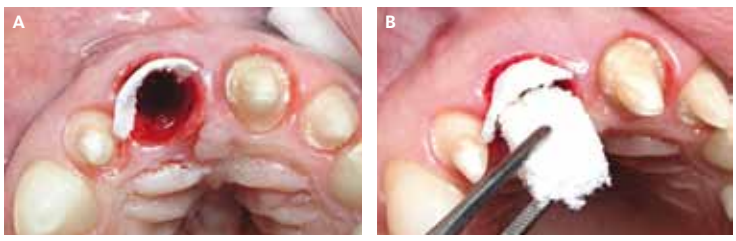
Case study by Dr. Manuel Neves and Dr. Celia Alves, Portugal

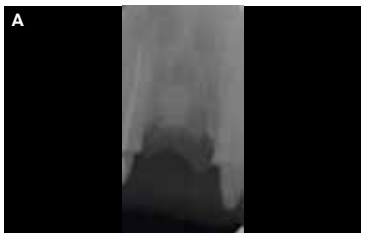
Socket management is a good idea with bridge restorations too

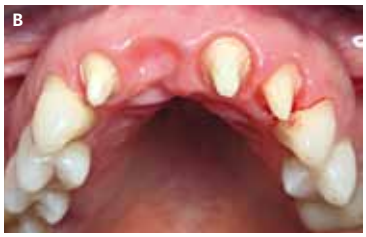
Ridge Preservation can be a good idea, not only if planning an implant, but also when a prosthetic restoration is being planned. The clinical case by Dr. Manuel Neves and Dr. Celia Alves from Oporto, Portugal, illustrates the procedure step by step.

1 Initial situation: Exploration with the periodontal probe reveals a defect in the buccal bone wall.



2 Ridge Preservation with Geistlich Bio-Gide® collagen membrane and Geistlich Bio-Oss® Collagen following flapless extraction. The socket is sealed with a cross suture and heals uncovered.





3 Radiological and clinical examinations 4 months after surgery reveal the tissue to have healed well.

4 Aesthetically appealing result 12 months on.

Don't punch – Seal!

A small, round matrix facilitates extraction socket restoration. Geistlich Mucograft® Seal can be used to complete a Ridge Preservation instead of autologous punch grafts from the palate.

Punch grafts from the palate have been in use as part of Ridge Preservation measures for ca. 20 years. Landsberg and Bichacho had already described "socket seal surgery" back in 1994[1]. Well-established transplants are both the free gingival graft and the connective tissue graft. The tissue graft is intended to ensure good soft-tissue coverage to enable the bone bed to be readied optimally for the subsequent implant placement or bridge restoration. The alternative technique – mobilising a flap of soft tissue to seal the primary wound above the socket – leaves a mucogingival border shifted in a crestal direction[2].

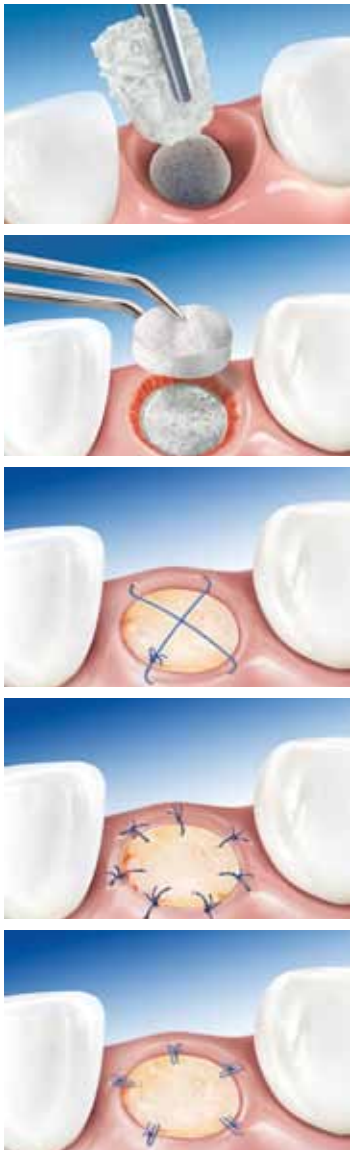
Graft harvesting involves risks

Various studies have shown the predictability and dependability of soft-tissue regeneration using punch preparations[3]. Yet the disadvantages were recognized early, too. Removing palatal tissue involves a second surgical site. It causes additional morbidity and involves risking inflammatory complications and transplant necroses.[4] Matching the colour and texture of the surrounding soft tissue can be critical, too[5].

Geistlich Mucograft® Seal: the treatment concept

Geistlich Mucograft® Seal was developed as an alternative to palatal punch preparations and launched internationally in October 2013. The small circular matrix is sutured over the extraction socket filled with Geistlich Bio-Oss® Collagen. While the bone substitute compensates for loss of volume and thus protects the fragile bone structure from collapse, the collagen matrix regenerates high quality soft tissue[6].
Before the treatment starts, the status of the buccal bone wall has to be examined.

Preserved buccal lamella: in this case it makes sense to use Geistlich Mucograft® Seal in conjunction with Geistlich Bio-Oss® Collagen.



First de-epithelise the adjacent soft-tissue edges and introduce Geistlich Bio-Oss® Collagen. Apply Geistlich Mucograft® Seal dry (spongiform structure (grooved) pointing towards the extraction socket). Geistlich Mucograft® Seal should be sutured with non-resorbable suture material and not glued.

Severely damaged/resorbed buccal lamella: the use of a membrane is indicated here. Geistlich Bio-Gide® is placed as a protective barrier between bone replacement material and buccal soft tissue because bone regeneration in the socket would not be guaranteed if bone replacement material and soft tissue were in extensive contact.

Flexible timing for implant placement

Geistlich Mucograft® Seal can be used if early, delayed or late implant placement is being planned. In 2013, the Geistlich Mucograft® Seal Advisory Board, presided over by Prof. Mariano Sanz confirmed that the matrix already ensures good soft tissue, even eight weeks on.[6]

Dr. Mireia Comellas, Verena Vermeulen

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[3] Jung RE, et al.: Int J Periodontics Restorative Dent 2004; 24(6): 545-53.

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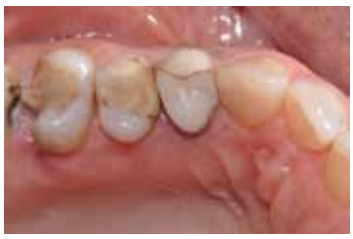
[5] Nevins M, et al.: Int J Periodontics Restorative Dent 2011; 31(4): 367-73.

[6] Geistlich Mucograft® Seal report on the Advisory Board meeting, 2013 Data on file, Geistlich Pharma AG, Wolhusen, Switzerland.

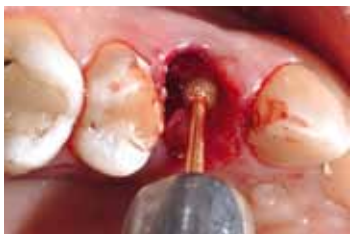
Case study by Dr. Raffaele Cavalcanti, Italy

Ridge Preservation with Geistlich Bio-Oss® Collagen and Geistlich Mucograft® Seal

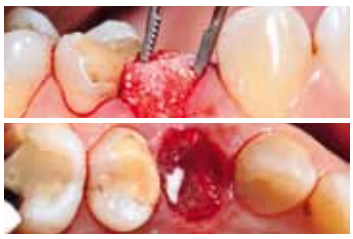
Ridge Preservation using Geistlich Bio-Oss® Collagen and Geistlich Mucograft® Seal almost completely prevents resorption of the ridge in extraction sockets with preserved buccal bone wall. After 8–10 weeks, the soft tissue has a quality and maturity that is perfect for early implant placement.



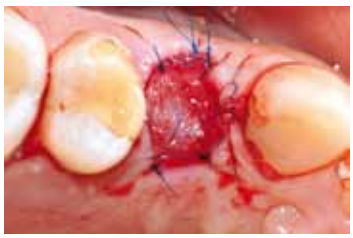
1 Initial situation before extraction of tooth 14.



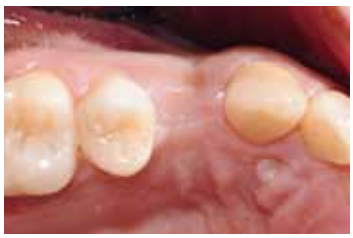
2 Empty extraction socket with de-epithelialised wound margins.



3 Extraction socket filled with Geistlich Bio-Oss® Collagen and sealed with Geistlich Mucograft® Seal.

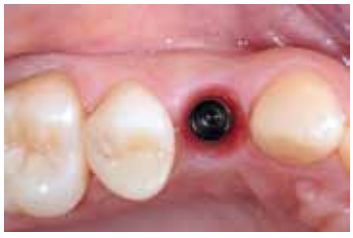


4 Geistlich Mucograft® Seal sutured with single interrupted sutures.



5 Pre-op clinical situation 10 weeks after extraction (prior to implant placement).

6 Implant placement with minimally invasive flap preparation.



7 Clinical situation of the soft tissues 4 months after implant placement.

8 Final restoration 7 months after tooth extraction (occlusal).

9 Final restoration 7 months after tooth extraction (buccal).

Variants on bone shield technique with Geistlich biomaterials

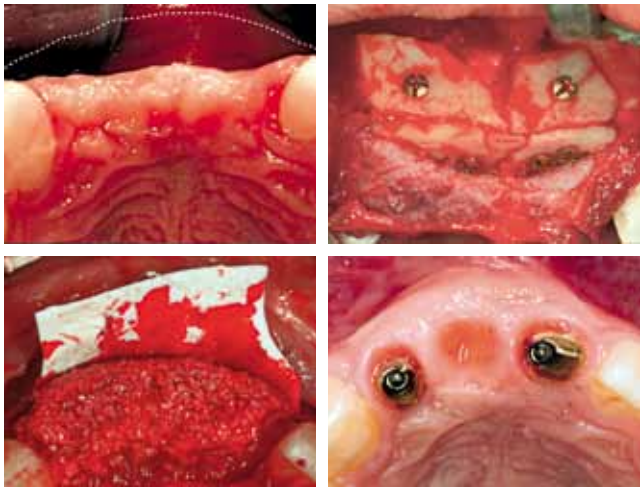
The presence of advanced resorption of the alveolar ridge indicates using a combination of a horizontal and vertical graft in order to generate sufficient bone volume for placing the implant. Modified bone shield techniques were developed for such cases using biomaterials from Geistlich. They are intended to enhance results in addition to lowering medical costs and patient morbidity.

An elegant procedure for gaining volume both horizontally and vertically is the bone shield technique. This method was originally developed by Dr. Fouad Khoury. The cortical portion of bone blocks removed from the ramus is anchored to the remaining walls of the defect with spacer screws. This causes the residual alveolar ridge and the bone shield to act as a kind of casing. The cavity between them is filled with autologous bone[1]. The procedure, however, has a number of disadvantages: removing substantial quantities of autologous bone from a second surgical site in the posterior mandible may not only induce additional morbidity, but also subsequent complications. Furthermore, the autologous bone used for the full graft is subject to a certain degree of resorption which can impair the clinical result.[2]

Surgical and technical innovations in concert with appropriate materials have contributed to these disadvantages being overcome. Drs. Mauro Merli, Luca De Stavola and Michael Korsch from Italy and Germany discovered their own way to further develop and enhance the treatment of demanding alveolar ridge defects by modifying the bone shield technique.

Counteracting bone resorption with GBR: the two-step augmentation

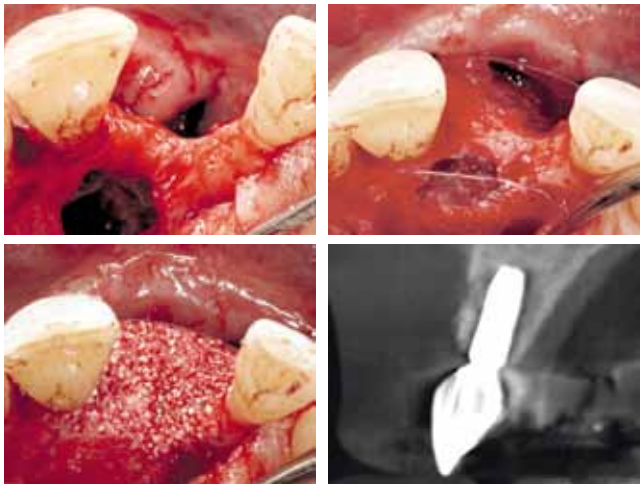
Dr. De Stavola uses a cortical bone shield from the retromolar region and autologous bone particles for the primary graft. In order to counteract the inevitable resorption of the autologous bone transplants and as a result improve the contour of the alveolar ridge, a GBR is performed – at the time of the implantation – in a second grafting procedure with Geistlich Bio-Oss® and Bio-Gide® four months on[3]. This approach reduces the risk of losing bone volume after placing the implant and enables the final result to be directly affected.



The two-step augmentation by Dr. De Stavola sets out to counteract bone resorption.

Minimise bone resorption at the outset: the one-step augmentation

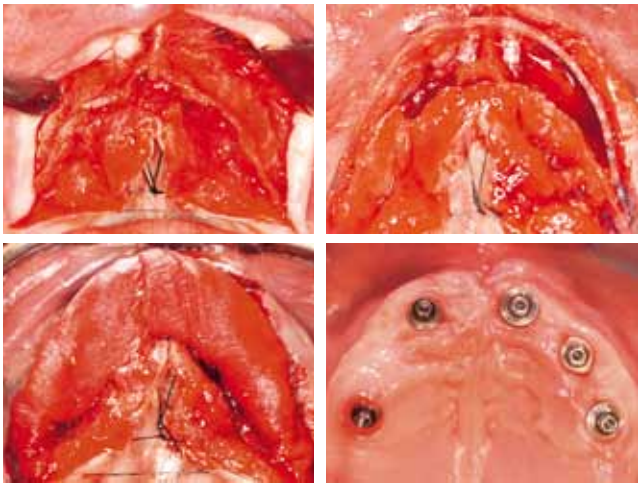
A different approach is taken by Dr. Korsch's group: this involves the autologous bone shield being replaced by a synthetic, resorbable shield made of polylactide which is anchored to the remaining bone walls with resorbable pins. The resultant cavity is filled with a 3:1 mix of Geistlich Bio-Oss® and autologous bone particles and covered with a Geistlich Bio-Gide® collagen membrane[4]. This procedure sets out to circumvent morbidity due to graft-harvesting by not having to extract any retromolar bone block. In addition, less autogenous bone is needed for the graft. The shrinkage of the graft is clearly reduced, on one hand by using resorption-resistant inorganic bovine bone[5,6], on the other by applying Geistlich Bio-Gide® membrane, which also optimises soft-tissue healing after surgery[7,8]. This makes it possible to place stable implants four months on from grafting without remaining non-resorbable products having to be removed.



The one-step augmentation by Dr. Korsch is aimed at counteracting initial bone resorption.

Fence technique for demanding defects

If alveolar ridges have atrophied completely, the situation is even more demanding as there is no longer any bone wall in existence to serve as an anchorage for the cortical bone plate or the shield. Additional dimensionally stable elements are required to create vertical and horizontal bone volume and to prepare a suitable implant site in edentulous patients, too. For this purpose, Dr. Merli and colleagues have merged elements of the bone shield technique and modern surgical procedures in their so-called "fence" technique[9].



The fence technique by Dr. Merli for alveolar ridge reconstructions.

A resorbable osteosynthesis plate resembling the polylactide shield is folded to match alveolar ridge anatomy and acts as an inherently stable element. After anchoring the plate on the facial side of the atrophied jaw, the space between the bone wall and the inner surface of the plate is filled with Geistlich Bio-Oss® and autologous bone. Combining the gradually resorbable biomaterial and the osteoinductive bone particles facilitates bone regeneration which is stable in volume. The graft, being covered with Geistlich Bio-Gide®, reduces the risk of dehiscences and prevents exposure of the transplant. This can reduce the high rate of complications normally associated with inlay or onlay transplants such as from extraoral bone and also the overall treatment costs.

Geistlich biomaterials support doctors in treating demanding defects successfully and reducing patient discomfort.

Dr. David Märki

For more cases: see also our new website www.geistlich-biomaterials.com and the corresponding section for major bone augmentation.

References:

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"CBCT images corroborate our concept for the long-term"

At the University of Bern contour augmentation has a long tradition in early implantation, four to eight weeks on from extraction. For the first time volume-tomographic images of the facial bone wall taken after five to nine years demonstrate the results of the surgical method. They show that the procedure ensures long-term stability in bone formation. Prof. Daniel Buser, Bern, reveals why.

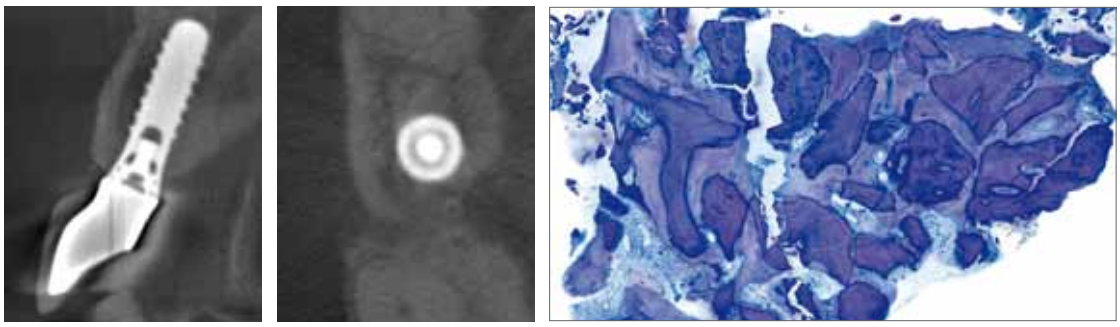
Prof. Buser, the facial bone wall is the focus of your long-term studies on contour augmentation published in 2013[1,2]. What makes it so important?
Prof. Buser: It co-determines soft-tissue aesthetics. If the facial bone wall is resorbed or absent, an aesthetically appealing convex soft-tissue architecture cannot be preserved in the long term. Regrettably, this has frequently been visible with immediate implant placement in the anterior maxilla.

So does contour augmentation set out to create a stable bone wall facially?
Prof. Buser: Precisely. Today we know that bone is resorbed after taking a tooth out. Predominantly affected is the facial bone wall which is mostly thin and is mainly composed of bundle bone. Pre-clinical studies on the canine posterior mandible have already shown this to be the case[3]. A new study involving 39 patients has now shown that vertical bone loss in the anterior maxilla is much greater. Dr. Chappuis, Senior Consultant at our clinic, has demonstrated vertical bone loss averaging 7.5 mm in a thin facial bone wall at eight weeks.[4]

Is that a problem clinically?
Prof. Buser: It isn't necessarily a disadvantage. We must distinguish between the central facial bone wall and the socket's mesial and distal approximal areas. Therefore Dr. Chappuis made a precise distinction in her study. She was able to show that bone resorption is strong centrally, but conversely weak in the approximal areas. The horizontal loss of bone, in particular, is low approximally.

This means in practice: if the mesial and distal ridge width of the extraction socket is at least 6 mm, the loss of the facial bone wall is secondary. This then means in the case of early implantation that there is a beneficial two-wall defect which is an ideal prerequisite for good bone regeneration. The facial bone wall can then be constructed in parallel to the early implantation by contour augmentation – a predictable and reliable procedure, as our long-term studies show.

"We have tapped 95% of our potential in implantology and Guided Bone Regeneration", says Prof. Daniel Buser, Switzerland.



Photos: University of of Bern

The CBCT image shows facial bone to be stable seven years after the contour augmentation. The histology of the buccal bone wall four years on shows well osseointegrated Geistlich Bio-Oss® particles.

You tracked the success of this procedure for five to nine years using cone beam computed tomography (CBCT). What did you notice?

Prof. Buser: In the two studies published in 2013 we were able to demonstrate an excellently preserved facial bone wall, even after five to nine years[1,2]. The data confirms that contour augmentation is a procedure with long-term reliability. The good result is also documented by stable clinical parameters incl. the pink aesthetic score (PES).

Is there also any histological data on this yet?

Prof. Buser: In the last eight years we have been able to take a small bone biopsy from ten patients, on average about four years after the contour augmentation. The histological analysis confirmed the low substitution rate of Geistlich Bio-Oss® particles, the proportion of which was found to be about 32% and which were very well integrated into the bone without any visible signs of resorption.

Principle:

How can the parodont be regenerated?

The first evidence is published that selectively isolating the gingiva from the periodontal defect results in the periodontal ligament and cement being regenerated.

GTR:

What barrier can selectively separate tissue?

Gore ePTFE membranes are introduced and the term Guided Tissue Regeneration (GTR) is established.

GBR:

Can bone be regenerated for implants too?

An initial study shows that staged augmentation predictably regenerates bone for implant placement. The term Guided Bone Regeneration (GBR) comes into being.

1982 1986 1990

What is that due to? We can recognize three factors. Firstly: using locally extracted and osteogenic bone chips speeds up the formation of new bone within the defect area, whereby the Geistlich Bio-Oss® particles at the surface become integrated into the bone. Secondly: the defect morphology must be two-walled to enable a sufficient number of blood vessels and osteoblasts from areas of bone marrow to grow into the defect area. Thirdly: use of the collagen membrane is crucial for protecting the area of the defect in the early phase of healing against the in-growth of soft-tissue cells and at the same time for stabilising the graft.

In the initial years of Guided Bone Regeneration the question was repeatedly raised whether the treatment is too technique sensitive. Will GBR still be of relevance in the years to come?

Prof. Buser: Absolutely. The procedures are now so predictable that they can be used by less experienced surgeons, too. And as we are no longer dependent on ePTFE membranes, we save our patients additional surgery, morbidity and complications compared to previously.

Do you see any way to simplify procedures even further?

Prof. Buser: In implantology and Guided Bone Regeneration we are long past our infancy. I would say that we have tapped about 95% of our potential. Serious failures being repeatedly referred to us in Bern are more likely linked to the fact that established procedures are not being applied properly. Therefore, more can be achieved through adequate, in-depth training of dentists than by further refining materials and techniques

Interview: Claudia Bühlmann, Verena Vermeulen

References:
[1] Buser D, et al.: Dent Res 2013; 92(12 Suppl): 176S-82S
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[4] Chappuis V, et al.: J Periodontol 2013; 84(11): 1517-27.

Membrane:

Are there any alternatives to ePTFE membranes?

Data with a natural collagen membrane (Geistlich Bio-Gide®) is published for or the first time. As the membrane is not form-stable, it is used in conjunction with a bone substitute material.

Predictable:

How predictable is the GBR technique?

Long term data covering up to 14 years shows the functional and aesthetic success of contour augmentation

Benefit:

Does the new membrane have any benefits?

It can be shown that the collagen membrane reduces wound dehiscences compared to non-resorbable membranes and does not need to be removed by follow-up surgery.

1996 1998 2013

This timeline is based on the article: Scantlebury T, Ambruster J: The development of guided regeneration: making the impossible possible and the unpredictable predictable. J Evid Based Dent Pract 2012; 12(3 Suppl): 101-17.

LEADING RESEARCH

Sinus lift: at a clear advantage using a membrane

Sinus floor elevation is a widespread technique for gaining bone volume in the posterior maxilla. In the absence of this measure often no implant could be placed, especially in the case of patients with an edentulous or only partially toothed maxilla.
Technically, there are many options such as crestal or lateral access and the use of various graft materials. As yet there is little data on what factors actually have a beneficial effect on implant survival.

Various factors are now being investigated in a meta-analysis to establish whether they improve implant survival after a sinus lift.

Photo: Pascal Valentini

Using a membrane in sinus floor elevation is the most significant factor in long-term implant survival.

The researchers covered a total of 122 studies with 16,268 implants in the grafted sinus floor. They selected special statistical evaluations to analyse interactions between individual factors and to rule out confounding effects.

One factor clearly improved implant survival irrespective of co-factors: the use of a membrane. This can induce increased formation of new bone by shielding the graft. The authors conclude that using a membrane in sinus floor elevation is the most significant factor for long-term implant survival.

Duttenhoefer F, et al.: Long-term survival of dental implants placed in the grafted maxillary sinus: systematic review and meta-analysis of treatment modalities. PLOS ONE 2013; 8 (9): e75357.

Horizontal augmentation with resorbable membrane

The alveolar ridge should be at least 6 mm wide to enable implants to be placed easily. Therefore thin, "knife blade-like" alveolar ridges first have to be widened before the placement of an implant can be begun. Blocks of bone are often screwed laterally to the remainder of the ridge to achieve this. This approach, however, has the drawback that the autologous bone block undergoes some degree of resorption and has to be removed from a second surgical site. One alternative is to construct the ridge beneath an inherently stable membrane. But inherently stable, non-resorbable membranes are generally associated with an increased rate of membrane exposure.

A group working with Prof. Istvan Urban, Hungary, has investigated an alternative to this initial scenario in a prospective series of cases. 25 patients with "knife-edge ridge" in the maxilla or mandible (≤ 4 mm) received a lateral alveolar ridge graft with a 1:1 mixture of Geistlich Bio-Oss® and autologous bone chips. A double layer of the resorbable collagen membrane Geistlich Bio-Gide® was applied and anchored buccally and lingually/palatally with pins. The clinicians achieved an inherently stable graft by packing the membrane densely ("sausage technique"). The soft tissue was mobilised by means of periosteal incision in such a way that it covered the widened alveolar ridge. Implants were placed after 9 months and the abutment connection was made on average after another 7 months had elapsed.

The procedure resulted in the alveolar ridge being widened by an average of 5.68 mm (±1.42 mm). Up to 10 mm was gained with individual alveolar ridges. A complication occurred in the form of an infection in one case. All of the 76 implants remained stable throughout the ca. 20-month follow-up. Histologically, the bone replacement material integrated well into the new bone. The authors have concluded that this kind of horizontal graft with a resorbable collagen membrane, reducing patient morbidity, is a successful alternative to the standard approach.

Urban I, et al.: Horizontal ridge augmentation with a collagen membrane and a combination of particulated autogenous bone and inorganic bovine bone-derived mineral: a prospective case series in 25 patients. Int J Periodont and Restorat Dent 2013; 33(3): 299-306.

Perio-patients: preserve teeth or place implants?

Dr. Giulio Rasperini et al. probed how crestal bone height around implants and adjacent teeth changed over a 10-year period. They spotlighted four different groups of patients: periodontally compromised patients with a positive or negative smoking status and periodontally healthy patients with positive or negative smoking status. A total of 120 patients' data was evaluated.

During the evaluation period 10 implants were lost, but no teeth. The implant survival was best over 10 years (95% for smokers and non-smokers) in the

group of periodontally healthy patients. Patients with a previous history of periodontitis and a negative smoking status continued to enjoy a 10-year implant survival rate of 90%. If the smoking status was positive, implant survival rate was only 85%.

The bone height measurement results manifested a similar trend. Bone loss over 10 years was the lowest in periodontally healthy non-smokers, followed by periodontally healthy patients with a positive smoking status, periodontally compromised non-smokers and lastly periodontally compromised smokers.

The loss of bone was also highest for the adjacent teeth if the patient had a prehistory of periodontitis and a positive smoking status. Yet the bone loss in teeth adjacent to implants with strong bone loss (≥ 3 mm) was no more pronounced than in teeth adjacent to implants with low bone loss (≤ 3 mm).

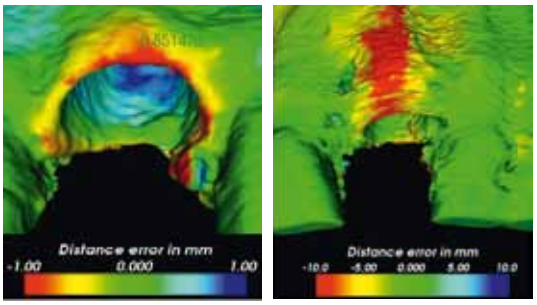
The authors conclude that teeth, despite being periodontally compromised, fare over a long period clinically at least as well as implants. They see their results backed up by numerous other studies. These have shown that teeth with a dubious prognosis in a periodontally compromised dentition achieve comparable results to implants after conservative, regenerative or resective therapy. Smoking worsens the results both for teeth and implants.

Rasperini G, et al.: Crestal bone changes at teeth and implants in periodontally healthy and periodontally compromised patients. A 10-year comparative case-series study. J Periodontol 2013, Nov 11. [Epub ahead of print]

Facial bone wall: resorption in the middle

How does the facial bone wall in the aesthetic zone alter after teeth have been extracted? For the first time Vivianne Chappuis et al. have used a new 3D analytical technique based on two consecutive digital volume tomographies to examine the resorption of facial bone in people.

An intact and sufficiently thick facial bone wall is the key to an aesthetically successful implant therapy in the aesthetic zone of the maxilla. During this prospective study, two consecutive CBCT images were taken in each of 39 patients, one immediately upon extraction and the second after 8 weeks. The two DICOM datasets were transposed and the 3D changes were evaluated. The clinical study was able to verify a risk zone for significant bone loss in the middle area of the socket, whereas the proximal areas only changed minimally. The facial bone wall was especially unstable if it was 1 mm or thinner. This situation was identified as thin-bone phenotype, whereas a bone wall of >1 mm was termed thick-bone phenotype. After an 8-week period of healing, the thin-bone phenotype showed 7.5 mm of vertical bone loss in the central risk zone, whereas a thick-bone phenotype revealed 1.1 mm of vertical bone loss. It was possible to characterise a resorption pattern for the facial bone wall based on the facial bone wall thickness. The risk zone in the central area of a thin-bone phenotype was 3.5 times higher than was known from previous literature. This accordingly provides key findings in bone biology.



Photos: University of Bern

Resorption of bone after extracting teeth in a thick-walled (left) and a thin-walled biotype.

The results of the study help clinicians to better appreciate the biological changes in bone after extraction of teeth within the aesthetic zone. If we can recognize the risk zones and the associated resorption patterns, it makes it easier to select the appropriate surgical treatment protocol in order to attain an aesthetically successful result in implant therapy.

Chappuis V, et al.: Ridge alterations post-extraction in the esthetic zone: a 3D analysis with CBCT. J Dent Res 2013 Dec; 92(12 Suppl): 195S-201S.

Keratinised tissue around implants: does it matter or not?

The need for keratinised gingiva around teeth has been discussed for more than 20 years. It is similarly now being debated whether a margin of keratinised mucosa protects implants from complications.

It is chiefly being argued that there is increased build-up of plaque, inflammation and bleeding on probing without this margin. There were also reports of more pronounced loss of bone and a greater risk of peri-implantitis. Other authors, however, do not see any evidence to support the keratinised mucosa affecting bone height, implant survival, bleeding on probing and build-up of plaque.

The authors were able to include seven of a total of 235 obtained studies in their systematic review. Yet

they do not arrive at an unambiguous conclusion as the literature data for each of the individual parameters analysed is contradictory. The authors conclude that there is a great deal signalising a beneficial role of the keratinised mucosa around implants. This, however, needs to be probed in further studies.

The authors chiefly attribute the inconsistencies in the study results to disruptive influences such as different oral hygiene, different implant surfaces, implant positioning or non-uniform smoking status. In addition, presumably not only the presence or absence of the keratinised mucosa is of importance, but also its quality.

Brito C, et al.: Is keratinized mucosa indispensable to maintain peri-implant health? A systematic review of the literature. J Biomed Mater Res B Appl Biomater 2013, Oct 7 [Epub ahead of print].

Sinus lift with only a blood clot is insufficient

Lots of different biomaterials lead to good outcomes when used in sinus floor elevation. Several authors explain this by stating that sinus membranes by themselves are fully able to form new bone. For example it was described that new bone formation and osseointegration can only be achieved by preserving the Schneiderian membrane in conjunction with a blood clot or peripheral blood. But as yet, little is known about the regenerative potential in cases in which more substantial reconstructions of bone are necessary.

In a study involving 10 partially completely edentulous patients De Oliveira et al. probed whether sufficient bone can be regenerated without biomaterial for a subsequent implantation solely by means of a blood clot. But bone volume 7 to 8 months later was not sufficient for placing the implant in 7 out of 10 cases. An average of only 2.37 mm was gained. If there were teeth directly adjacent to the sinus, the result tended to be somewhat better than in edentulous patients.

The authors list three possible aspects which might impact on bone regeneration without biomaterial: firstly the size of the defects, secondly the proximity of teeth which boost the regenerative potential of the sinus and thirdly the poor blood supply in regions with severely atrophied bone. The authors conclude that in the absence of biomaterials the treatment protocol is not suitable for regenerating bone in the posterior maxilla.

De Oliveira GR, et al.: Maxillary sinus floor augmentation using blood without graft material. Preliminary results in 10 patients. J Oral Maxillofac Surg 2013; 71(10): 1670-75.

A new technique for vertical ridge construction

Photo: Daniele Cardaropoli

Cardaropoli et al. inserted the implants directly into the partially resorbed bone, which meant that they protruded several mm over the alveolar ridge.

It is a major challenge to dentists or oral surgeons to place implants into a vertically resorbed jaw. In most cases a vertical graft is performed beforehand in order to gain height for the alveolar ridge. To do this, the surgeon, for example, screws an autologous block of bone onto the alveolar ridge or uses an inherently stable membrane to regenerate bone supracrestally. Both procedures, however, have their drawbacks. Autologous bone can only be obtained by carrying out a morbidity-increasing second operation and is strongly resorbed in the long-term. Inherently stable membranes are also associated with a higher rate of membrane exposures and soft-tissue dehiscences.

The group working with Daniele Cardaropoli, Italy, has investigated an alternative approach to vertical grafting. They inserted the implants directly into the partially resorbed bone of 20 patients which meant that they protruded several mm over the alveolar ridge. The bone defect around the implants was then filled with a mixture of Geistlich Bio-Oss® and a fibrin glue (Tisseel®, Baxter), and the graft was covered with the Geistlich Bio-Gide® collagen membrane. The fibrin glue was meant to stabilize the bone replacement material in the exposed position. The transgingival healing was complete after 6 months and the implant-abutment connection was made.

The defect, originally 4.25 ±1.34 mm in height, was able to be reduced by the vertical graft to only 0.3 ±0.54 mm, i.e. 92% of the defect was filled. All the implants healed without difficulty. The histological examination of tissue samples from the grafted area showed newly formed bone and a small proportion of Geistlich-Bio-Oss® particles embedded in new bony tissue.

The authors conclude that this procedure is a good alternative for treating vertical bone defects associated with low morbidity.

Cardaropoli D, et al.: Vertical Ridge augmentation with a collagen membrane, bovine bone mineral and fibrin sealer: Clinical and Histologic Findings. Int J Periodont Rest Dent 2013; 33(5): 583-89.

Verena Vermeulen

LEADING EDUCATION

EAO in Rome: Geistlich symposium and workshops with three prominent experts

The next EAO Symposium will be taking place in Rome from 25–27 September 2014. Focussing on the management of extraction sockets, the Geistlich symposium with Prof. Jan Lindhe, Sweden, and Dr. Dietmar Weng, Germany, will be an exceptional event. Geistlich will also, for the first time be offering hands-on workshops.

Geistlich symposium: Management of extraction sockets. Inspired by science, established in daily practice

Thursday, 25 September 2014

The extraction socket and its recovery

Speaker: Prof. Jan Lindhe, Sweden

- Quantitative and qualitative changes following tooth extraction (remodelling of the socket walls, volume loss, bundle bone resorption formation of new bone).
- Integration of de-proteinised bovine bone mineral into host bone during socket healing.
- How to preserve volume by Ridge Preservation procedures.
- Pre-clinical and clinical findings.

Clinical concepts in handling extraction sockets

Speaker: Dr. Dietmar Weng, Germany

- Knowledge of wound healing sequences following tooth extraction as inspiration in developing new surgical ideas for Ridge Preservation.
- Protocols to aid in achieving predictable and stable peri-implant hard- and soft-tissue outcomes, to minimise the need for surgery, avoid excessive augmentation procedures and maximise aesthetic and functional long-term success.

For more information please go to: www.geistlich-pharma.com/eao2014

Only a few seats left

please register at: www.eao-congress.org/registration

Geistlich workshops: Two Geistlich hands-on workshops at EAO for the first time

Friday, 26 September 2014

Extraction sockets in daily practice – Simplify your augmentation by benefitting from scientific knowledge

Dr. Dietmar Weng, Germany

Fence Technique: A new regenerative procedure with biomaterials for 3D reconstruction. Indications, benefits and limitations

Dr. Mauro Merli, Italy

International courses on oral regeneration, sponsored by Geistlich

Training and professional development events are held almost daily in more than 80 countries where Geistlich products are being sold. Furthermore, a series of special courses take place each year that Geistlich backs due to the international interest they generate. The following section presents a selection.

Advanced therapies in bone and soft-tissue regeneration and implantology

Where/ When: Zentrum für Zahnmedizin, Zürich/Switzerland, 4–6 September 2014, course language: English
Who: Prof. Christoph Hämmerle, PD Dr. Ronald Jung, PD Dr. Daniel Thoma, Dr. David Schneider, Dr. Goran Benic and Dr. Mutlu Ozcan
How: Lectures, case planning, live demonstrations, hands-on sessions on new and proven therapies (pig jaw, plastic model, stereolythographic model)

Advanced hard and soft-tissue regeneration in implantology

Where/ When: Prof. Istvan Urban's clinic, Budapest/Hungary, 2–4 October 2014 and 20–22 November 2014, course language: English
Who Prof. Istvan Urban
How: Horizontal and vertical grafts and soft-tissue reconstruction after placement of large structures in the anterior maxilla in theory, hands-on sessions and live surgery

www.implant.hu

Advanced surgical implantology techniques

Where/ When: European Institute for Advanced Implantology, 12–14 June 2014, course language: English
Who: Dr. Pascal Valentini and Dr. David Abensur
How: 1 day of theory, 2 days of anatomical dissection focussing on high risk structures such as Arteria facialis and Nervus mentalis, in addition to onlay bone grafting, sinus floor elevation, etc.

www.ieia.eu

Master courses in aesthetic implantology, sinus floor elevation and how to prevent and mitigate failed aesthetic implantations

Where/ When: School of Dental Medicine at the University of Bern/Switzerland, 11–13 June 2014 (sinus floor elevation), 3–5 September 2014 (implantology), course language: English
Who: Lead by Prof. Daniel Buser (implantology) and Prof. Anton Sculean (periodontology))
How: Lectures, live surgery, hands-on sessions and plenary discussions

www.ccde.ch

Cadaver-based courses on soft-tissue management or GBR, together with Camlog

Where/ When: Medical University of Vienna/Austria, 19–21 June 2014 & 20–22 November 2014 (dissection and GBR), 26–27 September 2014 (dissection and soft tissue), course language: English
Who: Dr. S. Marcus Beschnidt and PD Dr. Rudolf Seemann
How: Theoretical and clinical introduction on the first day, then practical exercises on human cadavers, all procedures presented step-by-step using stereomicroscopy

www.camlog.com

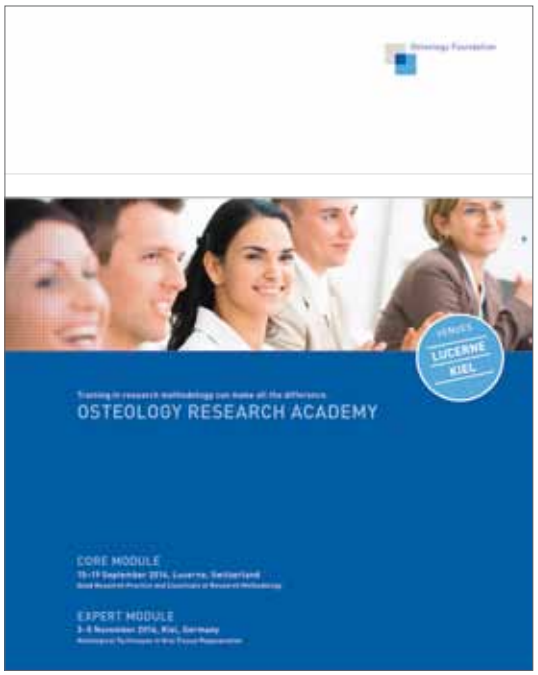
David De Keyser, Reto Falk

OSTEOLOGY FOUNDATION

Osteology research courses in Lucerne, Kiel and Boston

In September 2014 the Osteology Research Academy will offer its Core Module in Lucerne, Switzerland for the fourth time. The Expert Module on histological techniques is being held again in Kiel, Germany. The one-week course revolving around the research methodology of regenerative dental medicine will, for the first time, take place at the Harvard School of Dental Medicine in Boston, USA.

The Osteology Research Academy imparts evidence-based knowledge relating to research methodology in regenerative dental medicine. Previous participants from 22 countries very much appreciated the high quality of the course. Undergraduates and doctoral students of dental medicine, not to mention experienced dentists, scientists and representatives of industry especially gain from the possibility to discuss research projects and personal careers in an informal setting with authorities such as Prof. Niklaus Lang. One's own network and options for co-operation and dialogue have multiplied by the end of the course.



Requisite know-how for research in the Core Module

The five-day basic course (Core Module) from 16–20 September 2014 in Lucerne embraces all the aspects of current research methodology in regenerative dental medicine, imparting pre-clinical and clinical study management, analytical methods for data collection and statistics and publication strategies.

Presided over by Prof. Niklaus Lang and Prof. Reinhard Gruber, the curriculum committee have endowed the programme for 2014 with even more interactive workshop elements. The direct dialogue, question and answer rounds with experts and the group workshops are veritable highlights. Of particular note: Prof. Lang's career planning seminar.

Expert Module "Histology"

The second Osteology Research Academy Expert Module will be held from 3–5 November 2014 at the Clinic for Oral and Maxillo-facial Surgery in Kiel. Professors Henrik Terheyden, Jörg Wiltfang and Yahya Açil, making up the curriculum committee, are supported by Dr. Eleonore Behrens. Hard-tissue histologies in clinical and pre-clinical research are the centrepiece of the two-and-a-half-day course. The course will be discussing the key research questions in hard-tissue regeneration, illustrating the anatomical characteristics of this tissue and imparting histological and microscopic techniques and training in the laboratory.

The Expert Module ties theoretical background knowledge to practical tips for laboratory routine and enables discussions with experts in a small group of at the most ten participants.

The Academy expands to America

This year the Osteology Research Academy will also be making its first inroads into the USA. A course is going to be held at the renowned Harvard School of Dental Medicine in Boston from 15–19 June 2014.

The instructors Prof. Myron Nevins, Prof. William Giannobile and Dr. David Kim have put together a programme for young clinicians and scientists in conjunction with this school and the Michigan School of Dentistry. Experts from the Universities of Harvard, Stanford and Michigan will be teaching during an excellent week of training.

Go to www.osteology.org for further information on the courses and for registration forms.

Dr. Kristian Tersar

New "Best Practice" book relating to clinical research

In 2011 the Osteology Foundation published its first book from the "Osteology Guidelines for Oral & Maxillofacial Regeneration" series through the publisher Quintessence. Autumn 2014 will see the second volume on clinical research.

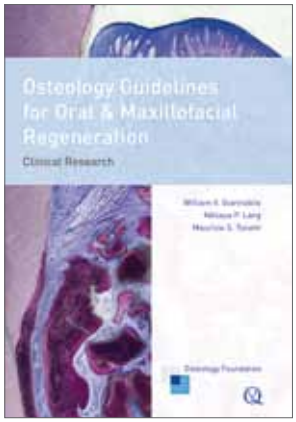
In the book Volume 1's editors, Prof. Myron Nevins and Prof. William Giannobile, along with fourteen other authors, discuss pre-clinical research models, for example for research into periodontal regeneration, peri-implantitis, horizontal and vertical bone augmentation or osseointegration.

The second book of the Osteology series, appearing in autumn 2014, is completely given over to clinical research. The editors, Profs. Giannobile, Lang and Maurizio Tonetti, are aiming the book at all those dentists working in clinical research, upcoming young researchers and clinicians and practitioners who are interested in research issues in the field of oral tissue regeneration.

The book has three parts:

- An ABC of clinical research: the authors discuss different evidence levels, elucidate regulatory and ethical aspects of clinical research, describe the development of a study protocol and explain how studies are managed.
- Tools for conducting clinical studies: the authors describe the definition of relevant study end points, the gauging of "patient reported outcomes", which are becoming ever more important, and tools for collecting data such as histology, radiology or volumetric measurements
- Clinical study protocols: this part presents study protocols for periodontal regeneration, for management of extraction sockets, for sinus floor augmentation, for regenerating keratinised gingiva and for soft-tissue augmentation.

Dr. Kristian Tersar



Take note: two new Osteology scholarships

From 2014 onwards, the Osteology Foundation is offering two new scholarships to support young clinicians and researchers. Alongside the established Osteology Research scholarships, which are awarded twice a year, there are the new "Young Researcher Grants" and the "Education Grants".

The "Young Researcher Grants" are addressed to all those clinicians and researchers working in regenerative dental medicine who are in a doctorate programme or in postgraduate studies or whose graduation is at the most five years previous. The grant is limited to 30,000 Swiss francs. The deadline for application is 15 June 2014.

The "Education Grants" are aimed at young clinicians and upcoming researchers who would like to train further in the field of research methodology. Anyone attending the courses at the Osteology Research Academy in Lucerne and Kiel can apply. The grant is limited to 2,500 or 2,000 Swiss francs. A letter of motivation, a C.V., a list of publications, a diploma or degree certificate or confirmation of study and a reference letter must be submitted. The deadline for application is 2 June 2014.

For all details on scholarships go to www.osteology.org

Dr. Kristian Tersar

ABOUT US

To keep you even better informed – the new Geistlich Pharma AG website

Geistlich Pharma AG's new website has been live since April 2014. The internet presence has not only received a fresh make-over. There is now also a great deal more information for clinical professionals and patients. The information on products and therapeutic areas is complemented by numerous clinical cases and vivid surgical videos.

Geistlich Pharma AG's new website www.geistlich-pharma.com is now online. It not only provides visitors with background information on the company, it also features plenty of information relating to products and application areas.

Learn from surgical videos and clinical cases

There are case studies and surgical videos on the various therapeutic areas or indications in oral regeneration to explore. For example, anyone browsing in the therapeutic area "soft-tissue regeneration" will encounter surgical videos on the topics "Obtaining keratinised tissue" (Dr. Karin Jepsen, Germany), "Covering multiple recessions" (Dr. Daniele Cardaropoli, Italy) and "Socket sealing" (Dr. Ronald E. Jung, Switzerland).

Anyone who would like to learn about the topic of peri-implantitis can discover information on the Geistlich website about the important distinction between mucositis and peri-implantitis. In addition, a case study by Prof. Giovanni Salvi, Switzerland reveals how typical crater-like peri-implant bone defects can be regenerated using biomaterials.

Everything for patient counselling

Video material for computers or tablets specially for counselling patients can be downloaded. Each film describes a procedure for bone regeneration: Ridge Preservation, sinus floor elevation or treating peri-implant bone defects. PDFs of brochures for printing and passing to patients are also available there. They describe such issues as general bone regeneration, the treatment of extraction sockets, recession coverage and the widening of keratinised gingiva.

Finding the right contact

Anyone visiting Geistlich Pharma AG's new website not only finds a fresher design, but also a more user friendly interface. On one hand, this means a central database for key documents and, on the other, a search function for locating distributors and sales teams in any country served by Geistlich Pharma AG.

Geistlich Pharma AG firmly believes that it offers customers added value through its new website by providing clear relevant information within a modern web layout. Here you can see for yourself: **www.geistlich-biomaterials.com**

Sebastian Schöpke

Geistlich launches the American Osteo Science Foundation

Dr. Peter Geistlich, along with Geistlich Pharma AG, launched the Osteo Science Foundation in the USA in October 2013. The foundation specializes in oral and maxillo-facial surgery.

The Osteo Science Foundation, launched by Dr. Peter Geistlich, has been up and running since October 2013. The foundation based in Philadelphia supports basic and applied research in North America. For example, it contributes to developing new therapy approaches in oral and maxillo-facial surgery and cranio-maxillo-facial surgery.

Late honour for pioneer Prof. Philip Boyne

The Osteo Science Foundation was set up to honour Prof. Philip Boyne's surgical excellence and outstanding research and to realise his vision of bone and tissue regeneration. In the 80's, together with Dr. Peter Geistlich, Prof. Boyne pioneered the release of organic components from the bone material without changing the natural microstructure and composition of the bone.

Greg Bosch, CEO of Geistlich Pharma North America, Prof. Alan S. Herford, Dr. Peter K. Moy and Dr. Jay P. Malmquist make up the Foundation Board.

Osteo Science Foundation

For further information on the Osteo Science Foundation go to: www.osteoscience.org.

Angelika Gätzi

Peek behind the scenes at Geistlich: "The Art of Innovation"

The new film "The Art of Innovation" provides rare insight into development, production and quality control at Geistlich Pharma in Wolhusen, Switzerland.

Everything starts with an idea. How is it then continued up to the finished product and production? The development of Geistlich Bio-Oss® is legendary as a joint pioneering achievement between Dr. Peter Geistlich and Prof. Philip Boyne, USA. But a pioneering achievement is not all that is needed.

Walk through the high-tech installations

Geistlich Pharma is continually working on new products, on refining established materials and processes. What that means in day-to-day business, Chief Scientific Officer Dr. Terance Hart explains in a behind-the-scenes tour of the company.

In doing so, an on-looker can admire the high-tech installations, partly developed by Geistlich Pharma itself, with which the biomaterials are manufactured. Dentists can appreciate what goes into the products that they know from their daily practice.

Anyone wanting to accompany Terance Hart on his tour is welcome to view the film on the Geistlich homepage or YouTube.

Roger Schuler

This way to the film in English.

Geistlich
Mucograft® Seal

Geistlich
Bio-Oss® Collagen

Minimise invasion, maximise soft-tissue outcome

Benefits at a glance

- minimal invasion [1,2]
- less morbidity [2]
- good wound healing [1–3]
- easy to use [2]
- unlimited availability [2]
- good tissue integration [2,3]
- constant quality [2]
- natural color and texture match [2,3]
- reduced surgical chair time [2]

Higher patient satisfaction

[1] Jung R. E. et al., JCP 2013
[2] Geistlich Mucograft® Seal Advisory Board Report, 2013. Data on file, Geistlich Pharma AG, Wolhusen, Switzerland
[3] Thoma D. et al., JCP 2012

www.geistlich-pharma.com

Japan welcomes Geistlich Bio-Gide® too

Japan is a major economic power and thus provides great growth potential for Geistlich Pharma AG. In 2012 the Swiss company was able to gain a foothold in this market with Geistlich Bio-Oss®. In 2013 the Japanese authorities also gave the green light for the sale of Geistlich Bio-Gide® in their country. This is a real quality commitment for Geistlich Pharma and its products.

Geistlich Pharma AG is the world market leader in regenerative dentistry thanks to its pioneering products. The use of Geistlich Bio-Oss® and Geistlich Bio-Gide® is now regarded as the state of the art treatment for oral tissue regeneration.

Expansion strategy milestone

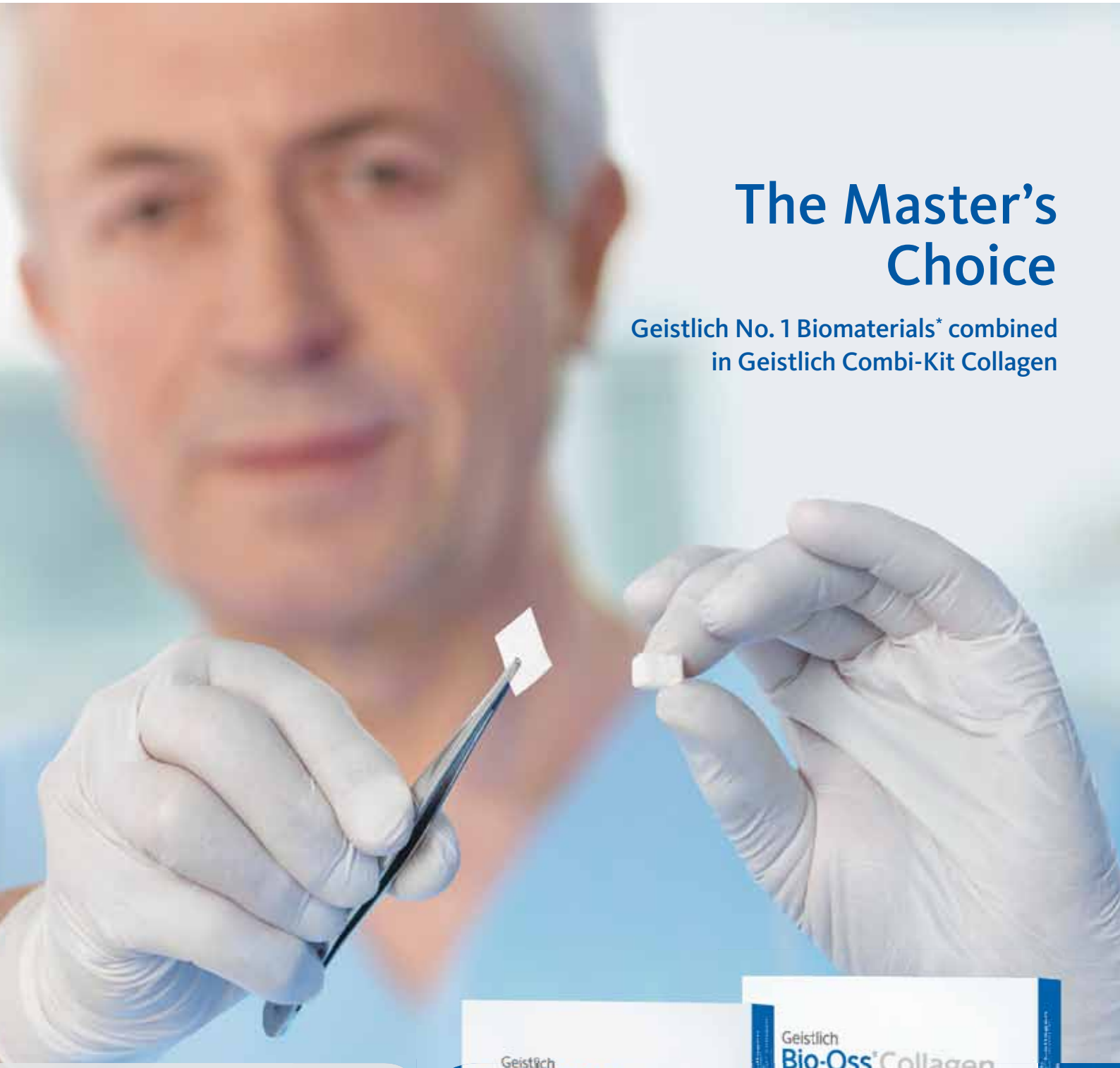
Following the successful registration of Geistlich Bio-Oss® in 2012, the Japanese authorities also granted a licence for the collagen membrane Geistlich Bio-Gide® last year. As Japan is known as the most difficult market to enter, this commitment is a real proof of concept for Geistlich Pharma and its products.

Sales started at the end of 2013

Mario Mucha, COO of Geistlich Pharma AG, commented: "Japan is an extremely important market for us, as it has enormous growth potential. We are therefore really proud to be able to supply the Japanese dental profession with both products". The sales of Geistlich Bio-Gide® started at the end of 2013 and will be handled – like the sale of Geistlich Bio-Oss® – via the distribution partner Hakusui Trading Co.

Angelika Gätzi

Geistlich
Combi-Kit Collagen



The Master's Choice

Geistlich No. 1 Biomaterials* combined in Geistlich Combi-Kit Collagen

- Ideal for Ridge Preservation and Minor Augmentations
- Excellent Biocompatibility
- Scientifically Proven

swiss made

* iData Research Inc., US Dental Bone Graft Substitutes and other Biomaterials Market, 2011
iData Research Inc., European Dental Bone Graft Substitutes and other Biomaterials Market, 2012

Geistlich
Biomaterials

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