

Cross-linked or natural collagen membrane?

Fewer complications and good bone regeneration with natural structure

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Recent study results show that artificial cross-linking of collagen membranes does not confer any additional benefit: bone regeneration is as good with Geistlich Bio-Gide® as compared with a cross-linked collagen membrane. The natural collagen structure of Geistlich Bio-Gide® has the additional advantage that the membrane is outstandingly bio-compatible and that it ensures secure wound healing and fewer complications.

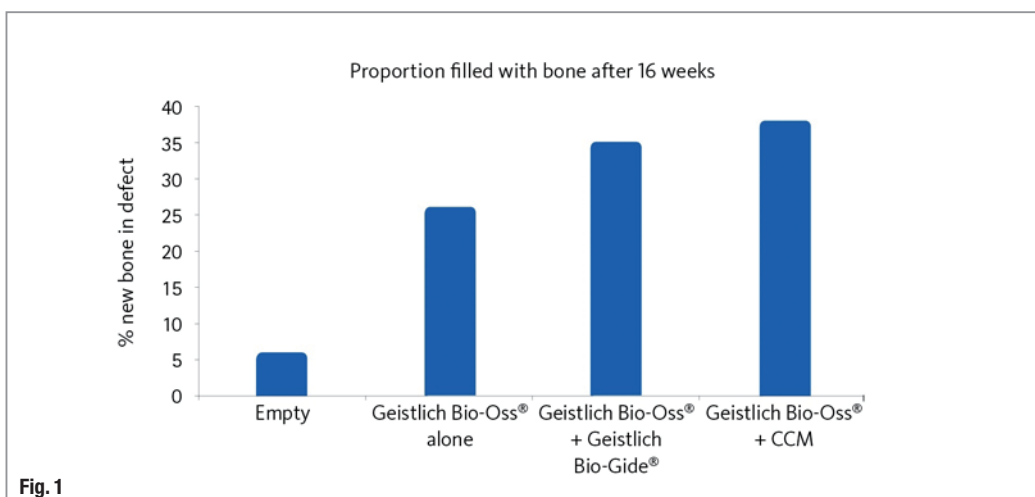
Absorbable collagen membranes are used more and more frequently in dentistry for guided bone regeneration (GBR) or for guided tissue regeneration (GTR). The great advantage of using absorbable membranes is that a second procedure to remove the membrane is not necessary, unlike in the case of non-absorbable ones. In connection with absorbable membranes, however, how long they have to be present for their barrier function to be sufficient for optimal bone regeneration is repeatedly a topic of discussion.

No additional benefit for bone regeneration through cross-linking

Artificial cross-linking of collagen is an attempt to increase the barrier function of collagen membranes. Recent results from clinical and preclinical studies have shown, however, that this is unnecessary as the barrier function of the natural non-cross-linked collagen membrane Geistlich Bio-Gide® is already sufficient to enable effective and predictable bone regeneration (Becker, Al-Nawas et al. 2009; Bornstein, Heynen et al. 2009).

In a clinical study by Becker et al. (54 patients) of the treatment of dehiscences around implants, bone regeneration was similar with an experimental cross-linked collagen membrane and with the natural non-cross-linked membrane Geistlich Bio-Gide® (Becker, Al-Nawas et al. 2009). Both collagen membranes were used in combination with Geistlich Bio-Oss®.

Fig. 1 Use of Geistlich Bio-Gide® or an experimental cross-linked collagen membrane (CCM) combination with Geistlich Bio-Oss leads to comparable bone regeneration in the pig model. The bone regeneration is better than in empty defects and defects filled only with bone material (Bornstein, Heynen et al. 2009).



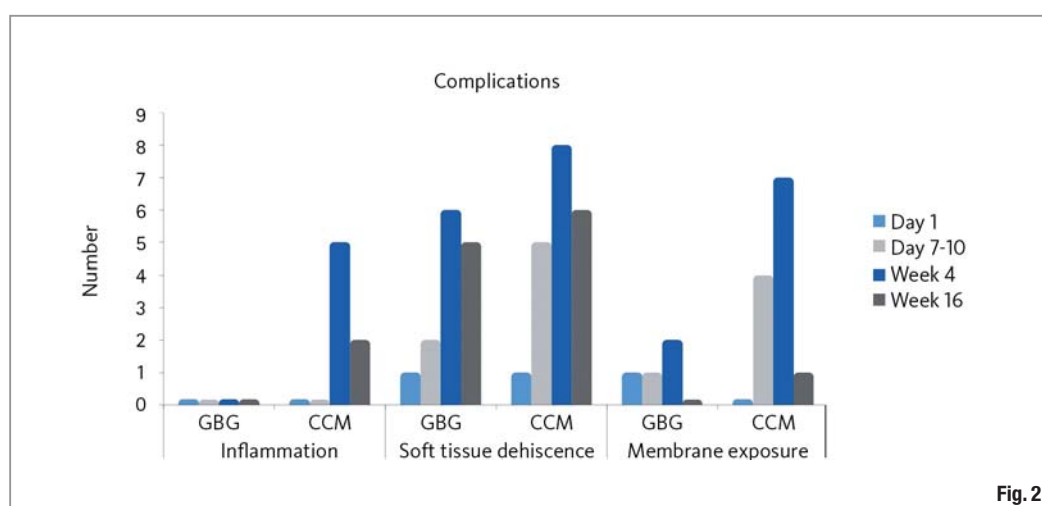


Fig. 2 Use of the natural collagen membrane Geistlich Bio-Gide® (GBG) led to fewer complications in wound healing than use of an experimental cross-linked collagen membrane (CCM). Inflammation, soft tissue dehiscence and membrane exposure occurred more often up to 16 weeks after the procedure when the cross-linked membrane was used (Becker, Al-Nawas et al. 2009).

These data agree with the results of a preclinical study in the pig model (N = 17). This showed that the proportion of newly formed bone in experimental bone defects of the skull was similar when Geistlich Bio-Gide® was used to when an experimental cross-linked collagen membrane was employed—in each case in combination with Geistlich Bio-Oss® and independent of the size of the defect (Fig. 1). Both membranes also showed significantly better bone regeneration in combination with Geistlich Bio-Oss® than when the bone substitute was used without a membrane (Bornstein, Heynen et al. 2009).

Fewer wound dehiscences with Geistlich Bio-Gide®

Compared with the cross-linked collagen membrane, it is also apparent that the use of the natural collagen membrane Geistlich Bio-Gide® leads to better wound healing. In the clinical study by Becker et al. wound dehiscences and membrane exposures over 16 weeks were fewer with Geistlich Bio-Gide® than with an experimental cross-linked collagen membrane (Fig. 2). Whereas inflammation did not occur with Geistlich Bio-Gide® it was significantly more with the cross-linked membrane after four and 16 weeks (Becker, Al-Nawas et al. 2009).

The recent data are thus confirmed by the results of a clinical study by Tal et al. (2008), who showed that membrane exposure occurs significantly more often with the cross-linked collagen membrane Ossix® than with Geistlich Bio-Gide®. Wound dehiscences occurred about twice as often in the study when the artificially cross-linked membrane was used (Tal, Kozlovsky et al. 2008).

Cross-linking reduces biocompatibility

The better wound healing achieved with Geistlich Bio-Gide® is based on the superior biocompatibility

of the natural membrane in comparison with collagen membranes that were artificially cross-linked. With the cross-linked membranes, vascularisation is lower and/or much slower and tissue integration is diminished (Rothamel, Schwarz et al. 2005; Schwarz, Rothamel et al. 2006). In addition, Rothamel et al. observed a foreign body reaction with different cross-linked membranes in the rat model, but not with the natural Geistlich Bio-Gide® (Rothamel, Schwarz et al. 2005). In an *in vivo* study, moreover, it was shown that the natural non-cross-linked collagen membrane promotes proliferation and adhesion of cells. After seven days, the number of osteoblast-like cells and fibroblasts of the periodontal ligament was highest in cultures with Geistlich Bio-Gide® (Rothamel, Schwarz et al. 2004).

References

1. Becker, J., B. Al-Nawas, et al. (2009). "Use of a new cross-linked collagen membrane for the treatment of dehiscence-type defects at titanium implants: a prospective, randomized-controlled double-blinded clinical multicenter study." *Clin Oral Implants Res.* 20(7): 742–9.
2. Bornstein, M. M., G. Heynen, et al. (2009). "Effect of two bioabsorbable barrier membranes on bone regeneration of standardized defects in calvarial bone: a comparative histomorphometric study in pigs." *J Periodontol* 80(8): 1289–99.
3. Rothamel, D., F. Schwarz, et al. (2005). "Biodegradation of differently cross-linked collagen membranes: an experimental study in the rat." *Clin Oral Implants Res* 16(3): 369–78.

Editorial note: The whole literature list can be requested from the editorial office.

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