

# Experiences with a collagen composite in socket preservation

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## Introduction

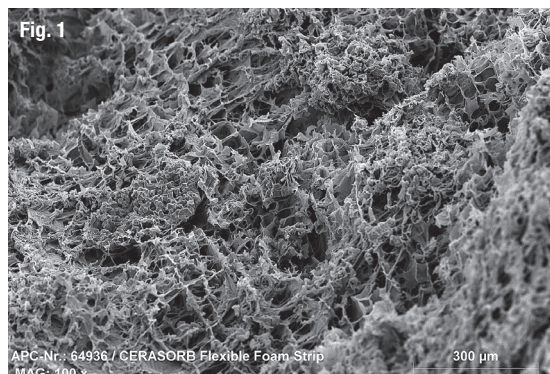
In the first year after tooth extraction, there is bone loss of up to 60 %, and the loss in width tends to be greater than in height as has been shown in multiple studies.<sup>1,2</sup> Bone loss by itself is a negative result in procedures where immediate or future placement of an implant is planned. Within today's implantology, there is therefore a need for constant material improvement and innovative products that are easy to use, present no risk for patients, and promote bone remodelling that allows implantation without bone augmentation. One such material is CERASORB Foam (curasan), a novel bone regeneration material composed of 85 % beta-tricalcium phosphate ( $\beta$ -TCP) and 15 % collagen. The organic phase of bone consists of collagen, contributing to the viscoelasticity of the bone, and a wide variety of collagen-based scaffolds have been proposed to mimic the native bone tissue micro-environment and thereby improve bone regeneration.<sup>3</sup> CERASORB Foam is a collagen composite material built from collagen matrix in which  $\beta$ -TCP granules are homogeneously distributed in a very structured order (Fig. 1). The collagen content is used to embed the granules and fix them in its fibres. The special mixture of both allows for a granular content of 85 % by weight and a high-volume stability.

A split-mouth clinical study with 35 patients was designed to evaluate the performance of CERASORB Foam

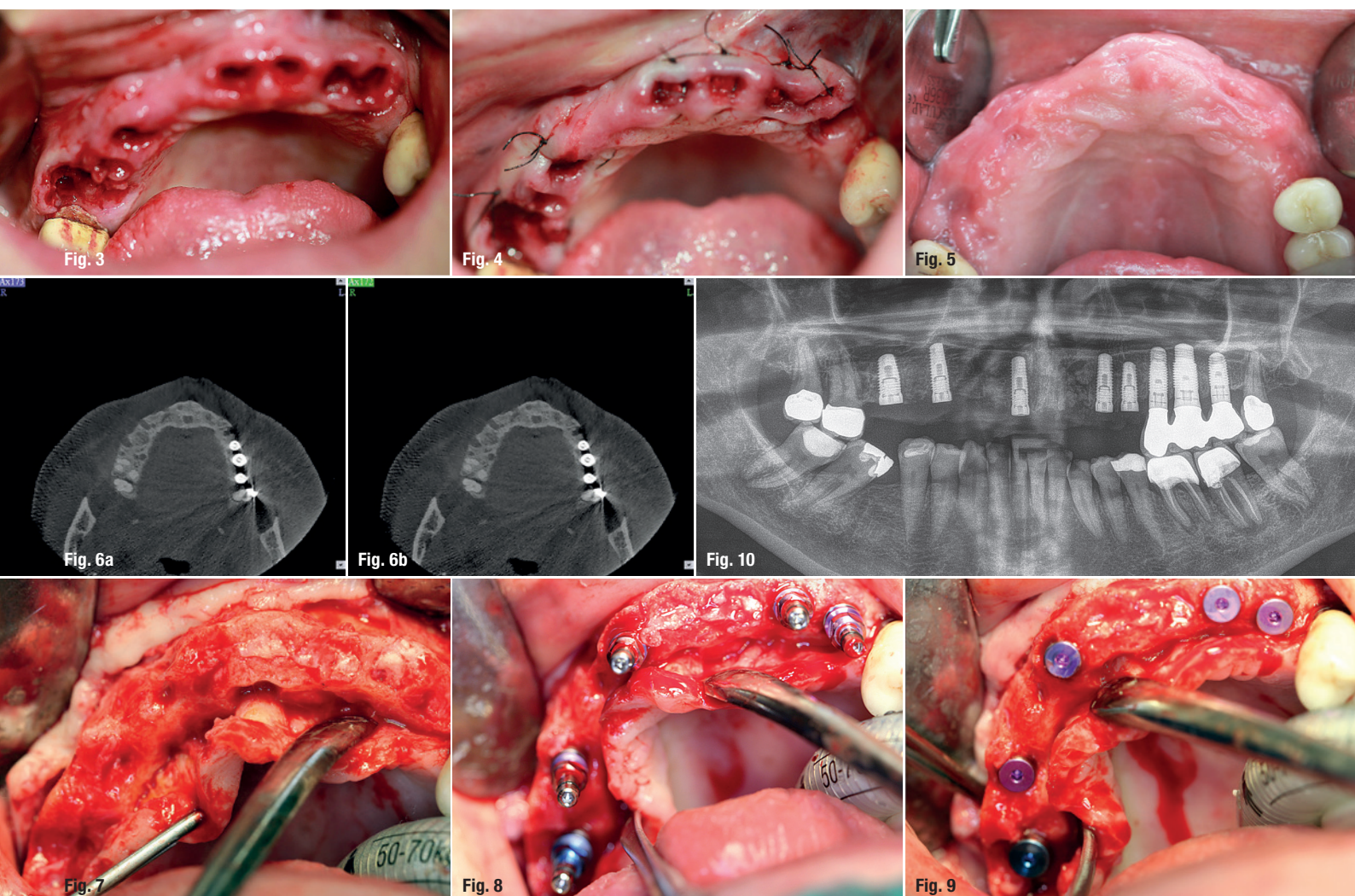
in socket preservation procedures. As a comparative material, a gelatine haemostatic sponge (stypro, curasan) was chosen owing to similarities in the application techniques of both products. In this article, the authors describe two clinical cases that were part of the study.

## Case 1: Socket preservation after severe periodontal disease affecting the bone

A patient presented to the clinic complaining about periodontal problems. The patient had been treated in the same clinic 20 years before with a sinus lift with CERASORB M (curasan) and the placement of three implants. A panoramic radiograph taken preoperatively revealed the advanced stage of the periodontal disease and indicated the unsalvageable teeth that needed extraction before the treatment could be carried out (Fig. 2). Natural bone tissue could be seen around the implants, whereas remnants of the previously placed material and additional bone tissue were absent. In the first quadrant, teeth #16, 14 and 11 were extracted and grafted with stypro cubes. In the second quadrant, teeth #21, 22 and 23 were extracted and grafted with CERASORB Foam. In all extraction sockets, minor debridement was performed, and after the application of the material, single returned sutures were performed (Figs. 3 & 4). After four weeks, both grafted sites showed very good healing without any signs of inflammation (Fig. 5). However, it could be seen clearly that the gelatine-based product was not



**Fig. 1:** CERASORB Foam, REM image. **Case 1—Fig. 2:** Pre-op panoramic radiograph.



**Case 1—Fig. 3:** Vestibular view after multiple extractions. **Fig. 4:** Application of sutures. **Fig. 5:** One-month post-op follow-up. **Figs. 6a & b:** CBCT scan four months post-op. **Fig. 7:** Elevation of the mucoperiosteal flap. **Figs. 8 & 9:** Insertion of the implants and coverage with healing caps. **Fig. 10:** Post-implantation panoramic radiograph.

able to preserve the structure of the bone as efficiently as the CERASORB Foam did. In the CBCT scan taken after four months, this was evident too (Figs. 6a & b). It is worth mentioning that a dental barrier membrane was not used during grafting, nor during any of the other procedures performed in the study.

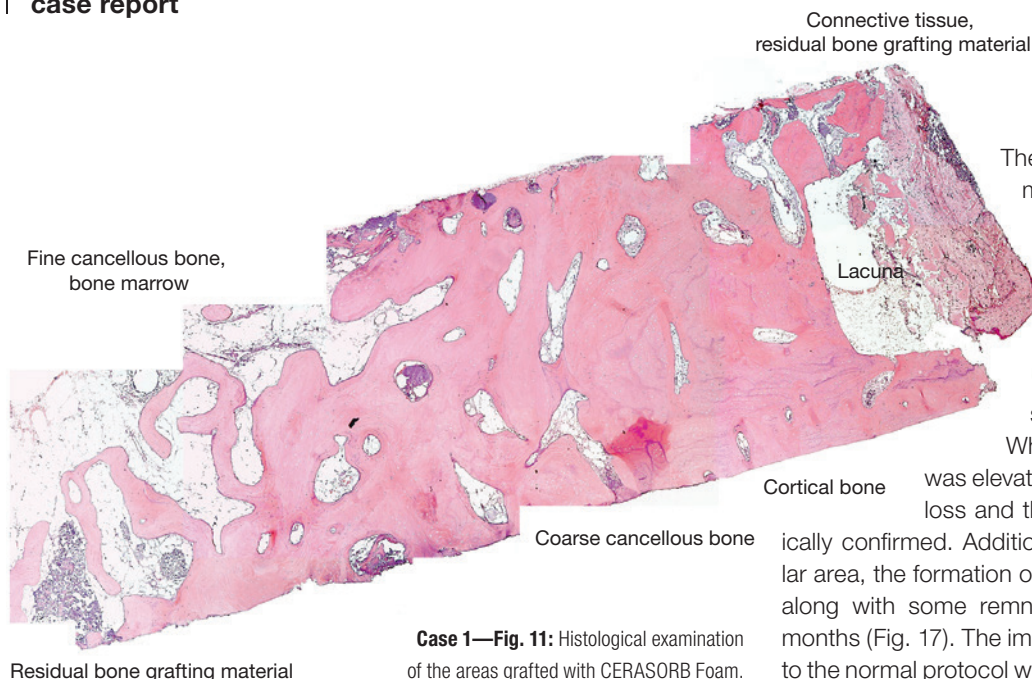
Once a full mucoperiosteal flap had been elevated, the grafted areas were clearly visible (Fig. 7). It was notable that bone had been preserved in the sockets grafted with CERASORB Foam and some small remnants of the particles were visible. In the areas grafted with stypro, the bone was insufficiently preserved and a smaller area of new bone tissue could be seen. In the same area, there was also a small ingrowth of soft tissue where the roots of the teeth had been prior to extraction. The implants were placed in the desired positions (Figs. 8 & 9), and the rest of the procedure was performed consistently on both sides. A control radiograph was taken immediately after

the procedure (Fig. 10). In addition, in the area grafted with CERASORB Foam, a biopsy sample was punched and taken for further histomorphological examination. The biopsy showed mature bone in the grafted sites, and only small remnants of the material could be observed. Overall, a large amount of new bone structure was present (Fig. 11).

## Case 2: Alveolar ridge preservation with CERASORB Foam

In this case, a comparative treatment was performed. Five teeth were extracted (Figs. 12a–d). The sockets of extracted teeth #11, 12 and 16 were closed with stypro cubes and of teeth #26 and 27 were augmented with CERASORB Foam (Fig. 13). It is notable that, in the right molar area, the Schneiderian membrane was perforated during the extraction and the Valsalva test was positive. The normal treatment in this situation is to release





**Case 1—Fig. 11:** Histological examination of the areas grafted with CERASORB Foam.

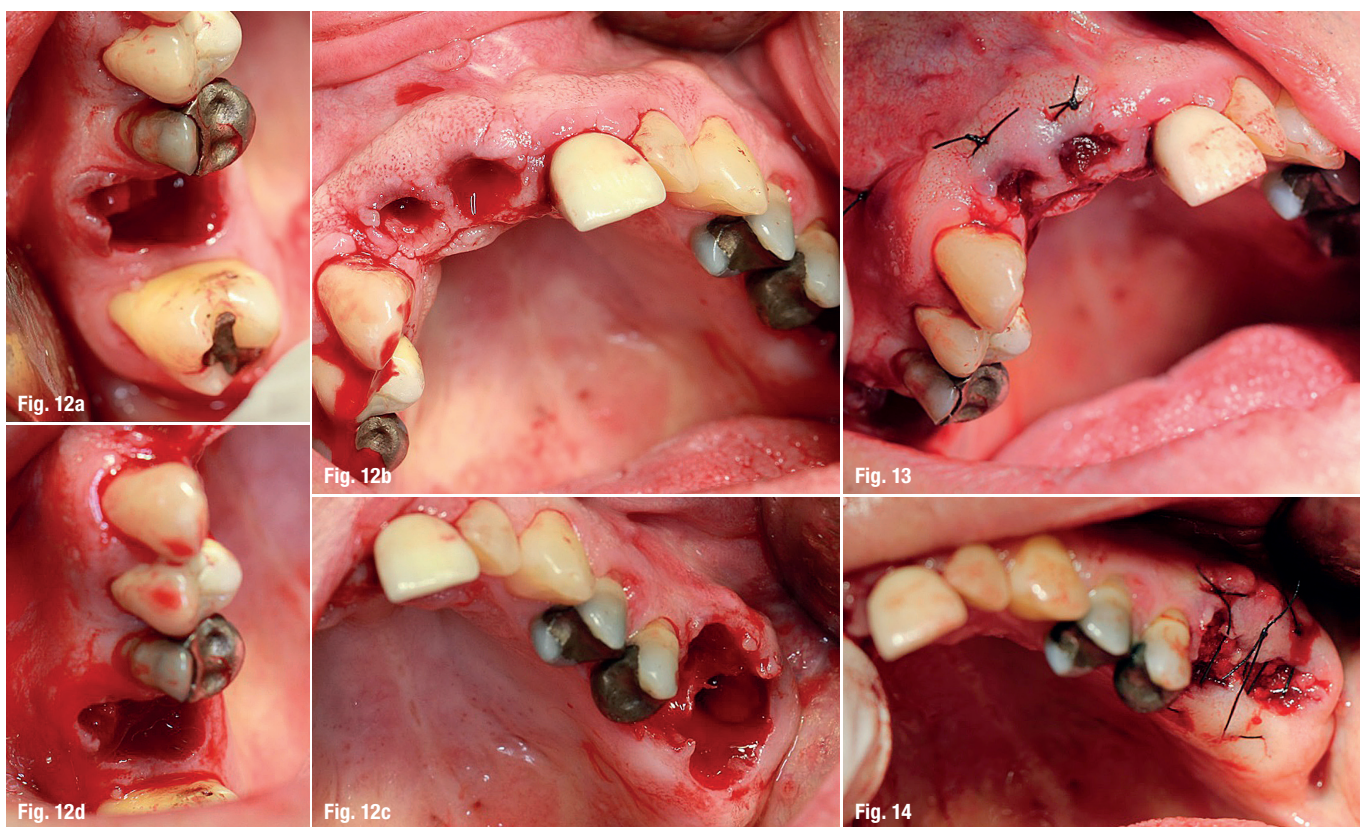
a small flap to close the sinus; however, because the CERASORB Foam is stable and compact, this is not necessary. It is only applied with medium compression and lightly pressed against the haematoma without the need for any soft-tissue repositioning. The defect was closed with very single returned sutures to adapt the margins and keep the implanted material stable (Fig. 14). Both clinical control photographs after ten days and after one month showed very good healing.

The radiograph taken after four months of recovery showed that the areas treated with only stypro had almost no bone preservation and had increased resorption (Figs. 15a & b). The areas treated with  $\beta$ -TCP and collagen, however, preserved significantly more bone (Fig. 16).

When a full mucoperiosteal flap was elevated in the treated areas, the bone loss and the bone preservation were clinically confirmed. Additionally, in the maxillary right molar area, the formation of new bone tissue was detected along with some remnants of the material after four months (Fig. 17). The implantation proceeded according to the normal protocol without any unusual observations. Only a control radiograph was taken after the procedure (Fig. 18). The histological images showed, once again, that new bone had formed and that few remnants of the material were present.


## Conclusion

The healing in the CERASORB Foam group was as good as the healing in the stypro group. Both materials stabilised the haematoma, which was very good for the healing process. It should be additionally mentioned



**Case 2—Figs. 12a–d:** Extraction of teeth. **Fig. 13:** Closure of sockets with stypro cubes. **Fig. 14:** Augmentation with CERASORB Foam and closure with single returned sutures.





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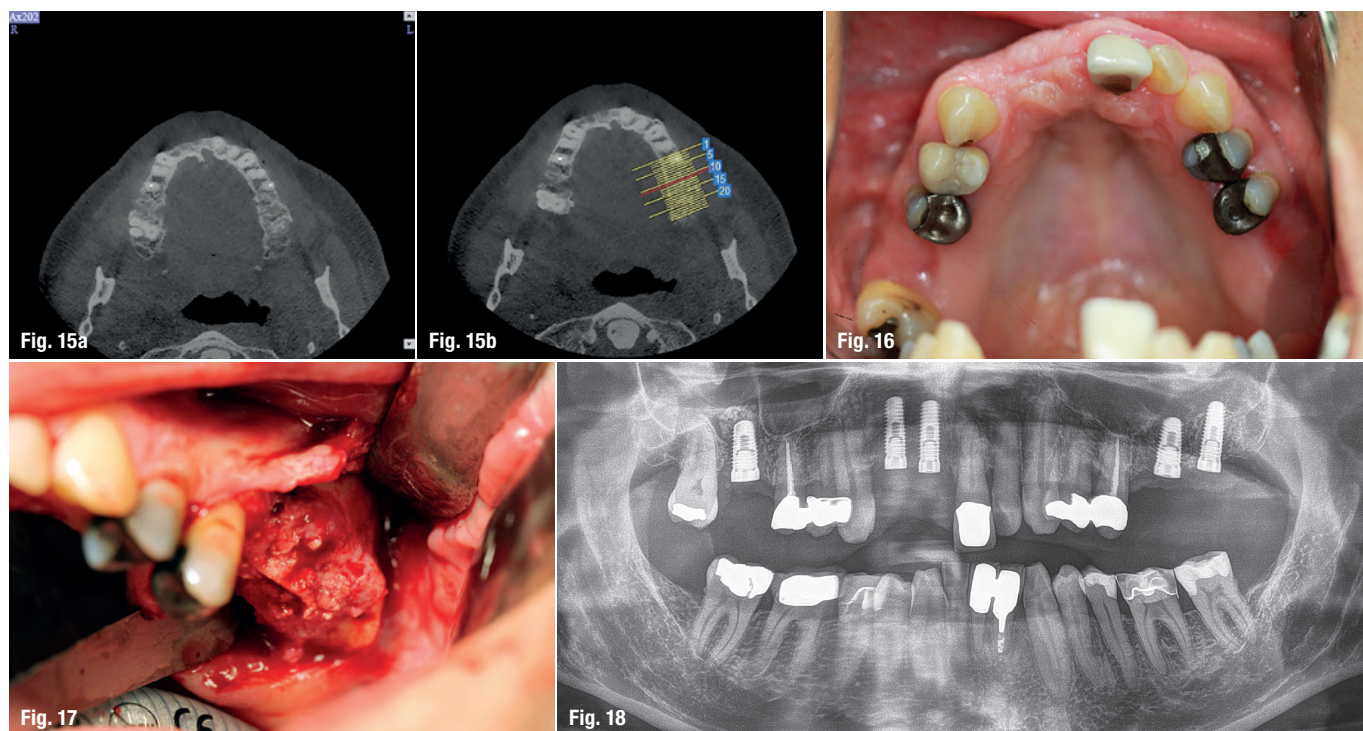
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**Case 2—Figs. 15a & b:** CBCT scans after four months of recovery. Increased bone resorption can be observed at the styro site (a) and good bone preservation at the CERASORB Foam site (b). **Fig. 16:** Clinical situation at the follow-up after four months. **Fig. 17:** Formation of bone visible after mucoperiosteal flap elevation. **Fig. 18:** Post-op control radiograph.

that, to achieve good healing, both materials should be inserted without compression. There is almost no difference in the surgical steps when using both products; however, a simple suture is recommended. Surgery for oroantral communication can be avoided by applying CERASORB Foam. However, the bone loss in the styro group was significantly higher than in the CERASORB Foam group. The reason for the higher bone loss might be related to there being no calcium in the styro product. It is well-described scientific fact that calcium ions ( $\text{Ca}^{2+}$ ) increase osteoblastic activity. For instance, back in 1990, it was reported that the increase of calcium inhibits the resorption of bone tissue.<sup>4</sup> Teti et al. showed that an increase in extracellular calcium concentration reduced the resorbing activity of osteoclasts.<sup>4</sup> Riccardi and Gamba found that the activation of calcium receptors triggers an intercellular cascade of secondary messengers, producing a cascade of biological activity, including bone-derived cell lines.<sup>5</sup> Both papers indicate that, by increasing  $\text{Ca}^{2+}$  around the bone, we can not only speed up the formation of bone but also inhibit the resorption of the same tissue. In 2006, Kondo et al. implanted highly purified  $\beta$ -TCP in canine dorsal muscles and found that the material had osteoinductivity even without the use of bone marrow cells or cytokines.<sup>6</sup> Research by Ahlstrom et al. showed that *in vitro* it only takes 60 minutes for the effect of  $\text{Ca}^{2+}$  stimulation to take place.<sup>7</sup> The extracellular calcium-sensing receptor expressed in bone cells is essential

in the regulation of skeletal homeostasis.<sup>8</sup> Further scientific studies are needed to confirm the findings of the research reported on in this article.

Literature



## about the author



**Prof. Frank Palm** is a specialist in implantology and oral surgery. He completed his first implant surgeries at the University of Göttingen in Germany in 1991. Today, he works in a joint practice in Constance in Germany, where over a thousand implants are placed each year. Prof. Palm is one of the founding members of the International Society of Metal Free Implantology.

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