Simultaneous implant placement and vertical bone augmentation

Use of the hangar technique for maxillary vertical bone defects

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The most effective conservative treatment for a severely compromised dentition is to preserve as many natural teeth as possible. However, if this goal can only be achieved at great expense and with an uncertain prognosis, many patients today tend to opt for extraction of the remaining teeth and implant treatment of the resulting edentulous jaw. A conservative approach can then be taken, with only the minimum number of implants placed (in line with the relevant clinical literature)—four in the mandible and four to six in the maxilla.

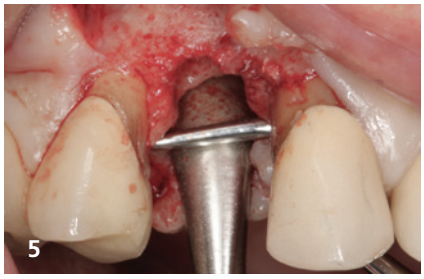
Fig. 1: Initial radiograph before extraction of the pathologically altered tooth 14. **Fig. 2:** Initial radiograph after extraction of tooth 14.

A 61-year-old woman presented with a hopeless tooth 14. The treatment plan was to provide an adequate implant-prosthetic restoration following the removal of tooth 14. In this case, vertical bone augmentation was necessary. The augmentation was performed using the hangar technique and strictly autologous bone shells. The bone shells were harvested from the mandibular retromolar region using the semilunar technique (SLT) and the Easy Bone Collector. The hangar technique allows implants to be placed directly through the occlusally fixed bone shell at the same time as vertical bone augmentation. The concept is named after the aircraft hangar, which is characterised by extraordinary stability and the typical rounded ceiling.

Introduction

Following tooth extraction and the loss of the so-called bundle bone, pronounced bone atrophy may occur.[1–3] The reconstruction of these bone defects forms the basis for the permanent restoration of healthy tissue conditions and a prosthetic restoration.

To create a sufficiently dimensioned new implant site, it may be possible to reconstruct bone defects with autologous



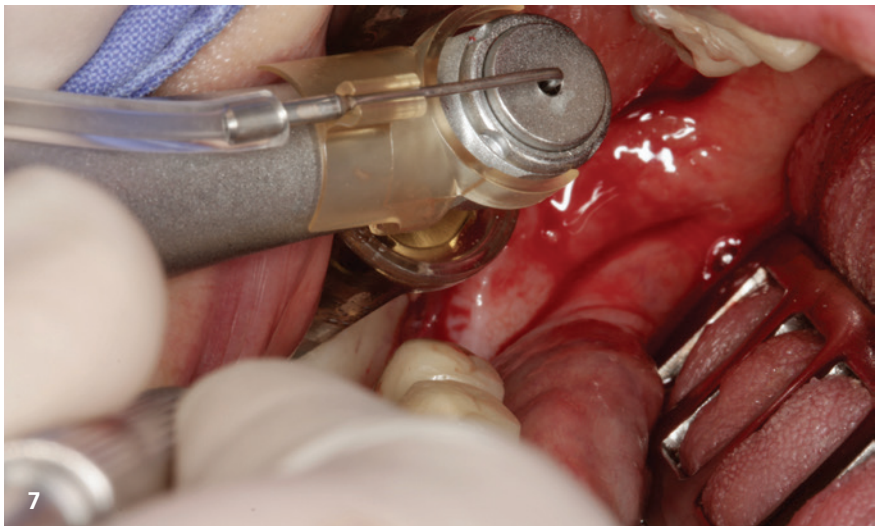


Fig. 3: Intra-oral baseline situation. **Fig. 4:** Intra-oral view of site 14. **Fig. 5:** Reflecting a flab exposes the lateral and vertical bone deficit at site 14. **Fig. 6:** The Easy Bone Collector is a bespoke instrument comprising a trephine drill, internal cooling, ceramic bearings and integrated soft-tissue protection, which facilitates the removal of bone shells. **Fig. 7:** The semilunar technique, when employed in conjunction with the Easy Bone Collector, allows for the harvesting of multiple intracortical bone shells from the retromolar region.

bone blocks, bone substitute material or a combination of the two.[4,5] In the present case, the bone augmentation was purely autologous. To make the bone harvesting process as minimally invasive as possible, it was carried out using the Easy Bone Collector and the semilunar technique, which eliminates the need to split the shells. In this type of bone harvesting, the shells are rounded, which may be advantageous in terms of exposure risk. The handling of these rounded bone shells and the reconstruction of the bone defect otherwise followed the instructions for the shell technique according to Prof. Khoury.[6,7]

A special feature of this case was that vertical bone augmentation and implant placement took place simultaneously. This was made possible using the hangar technique.

The shell shape in the hangar technique differs from that of the shells obtained using the split bone block technique (SBBT). This is due to the fact that the curvatures of the shells are a result of the trephine used during harvesting. This method of harvesting is also known as the semilunar technique, and it is made possible by using the Easy Bone Collector (EBC).

It is recommended that the surgical protocol for the hangar technique be followed as closely as possible. This involves piercing the occlusal shell after fixation with osteosynthesis screws using a trephine drill—preferably with the same di-

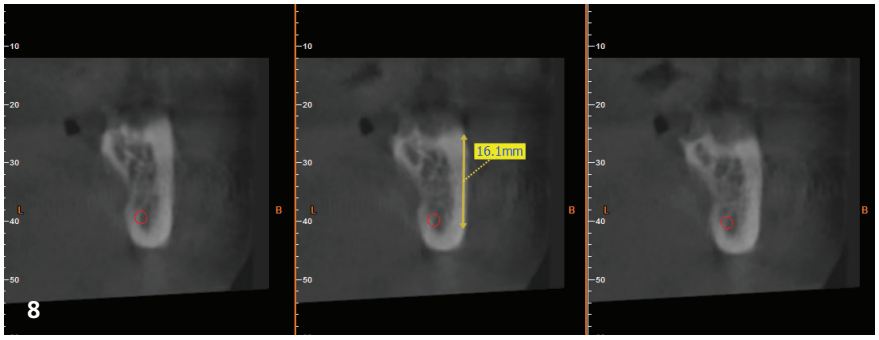


Fig. 8: The digital CBCT scan demonstrates adequate clearance from the inferior alveolar nerve, thereby enabling an estimation of the maximum permissible length of the bone shell. In this instance, the regular-size Easy Bone Collector was employed, resulting in the generation of a bone shell measuring 15 mm in length and 7 mm in width.

ameter as the implant—so that the implant can then be inserted through this trephination opening after the lacunae have been filled with autologous particles.

The semilunar technique is still relatively new, although the shell technique itself has accumulated almost 30 years of clinical experience. It is therefore possible to draw on a substantial body of evidence in support of the shell technique.

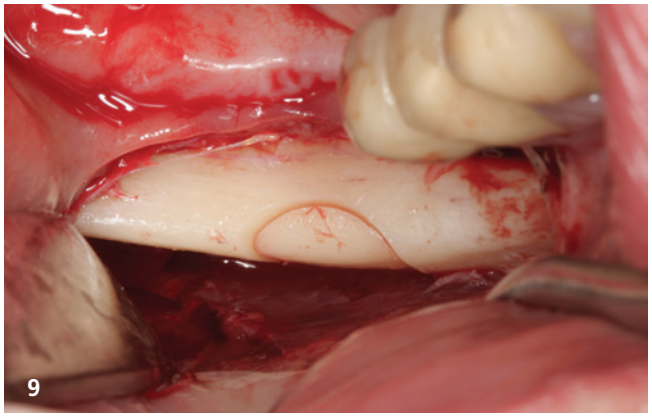
In the so-called split bone block technique (according to Prof. Khoury)[6,7], an autologous bone block is harvested from the retromolar region and sectioned. The resulting shells are secured to the alveolar ridge to create a new implant site.

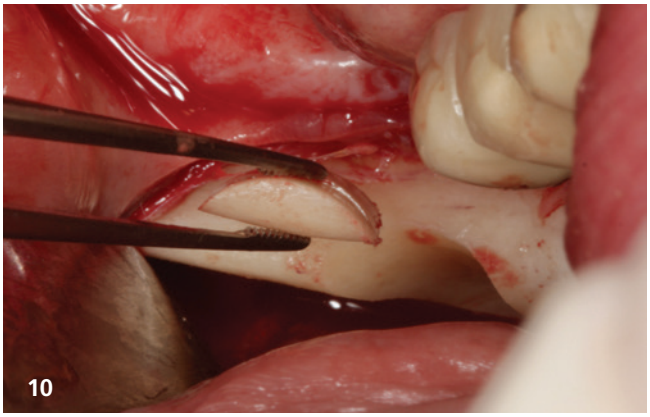
The case

The objective of the planned treatment was to achieve an adequate reconstruction of the hard and soft tissue as well as the prosthetic restoration by means of an implant-supported crown.

The bone defect was to be reconstructed by placing a previously harvested bone shell at a specific distance according to Prof. Khoury's shell technique and securing it in place with small osteosynthesis screws.

It would be advisable to aim for a ridge width of at least 7 mm to be able to insert an implant of sufficient dimensions in the premolar region.





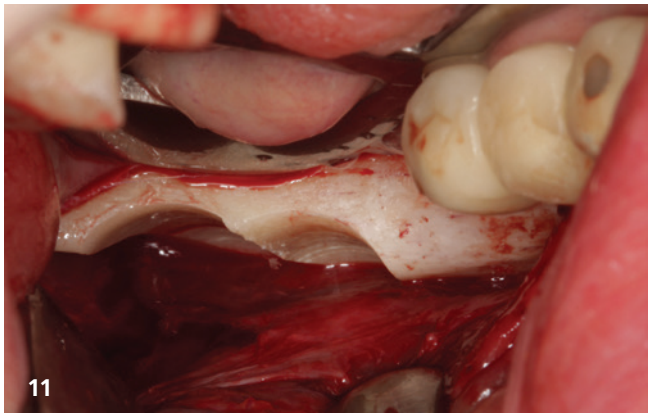
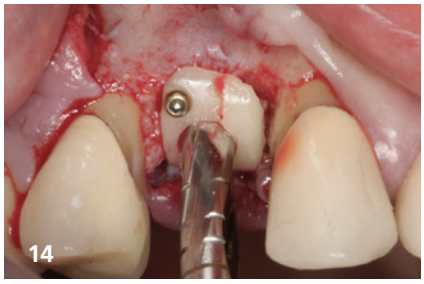
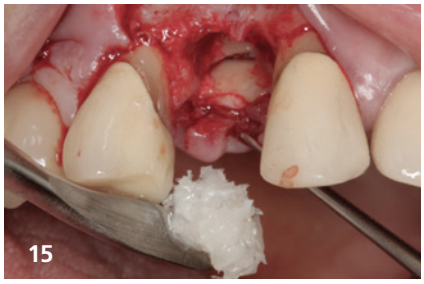


Fig. 9: Characteristic semilunar or crescent shape of the bone shells to be harvested. This shape has given the semilunar technique its name. **Fig. 10:** The semilunar bone shells have a thickness of only 2.1 mm, which makes further splitting unnecessary. The natural curvature of the shells may serve to further reduce the already minimal risk of exposure when autologous bone grafts are employed. **Fig. 11:** It is possible to harvest multiple semilunar shells side by side. **Fig. 12:** Due to the individual convexity of the alveolar ridge around the external oblique line, the bone shell can be positioned within the chamber of the Easy Bone Collector. However, the openings on the side of the trephine facilitate the harvesting process.

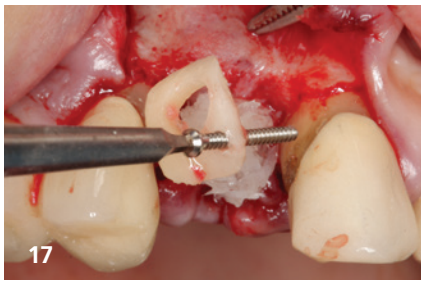
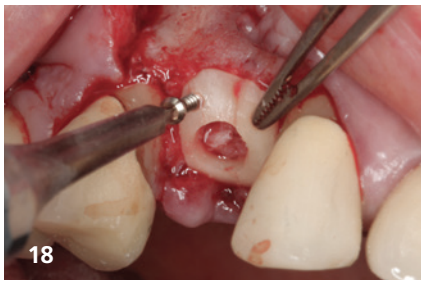
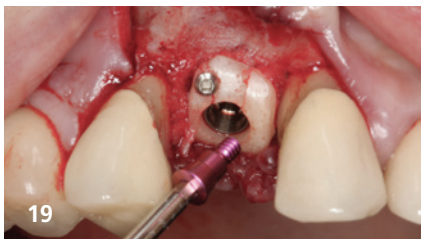




Fig. 13: After bone removal, the bone shells are further thinned with the Safescraper device. **Fig. 14:** The bone shell is secured in place with the rounded side facing upwards, using osteosynthesis screws. The shell is perforated with a trephine bur with a diameter matching the implant to be inserted. **Fig. 15:** The lacunae are filled with autologous bone chips. **Fig. 16:** Autologous bone chips are positioned within the defect. **Fig. 17:** The occlusal bone shell is repositioned. **Fig. 18:** Care must be taken to ensure stable fixation of the occlusal bone shell. **Fig. 19:** The implant is inserted subcrestally, and the cover screw is connected.

One of the benefits of the autologous bone augmentation method is that it does not require over-augmentation, as the risk of resorption is extremely low.

The existing cavity was then filled with particulated bone chips obtained from thinning the bone shells in accordance with the principles of biological autologous bone augmentation. This method differs from compact cortical blocks in that it increases the surface area of the bone, which in turn allows for a larger contact surface for the supplying vessels, thus facilitating faster nourishment and revascularisation of the augmented bone.

Restorative treatment

After taking an open impression, a master model was created in the laboratory and a cobalt-chrome bridge framework was fabricated using the CAD/CAM process. Once the framework had been fabricated, it was finished with veneering ceramic.

The crown was attached to the implant in a secure manner to prevent the onset of peri-implantitis caused by luting cement. The final clinical photograph showed no evidence of soft-tissue irritation in the peri-implant area; the peri-implant mucosa cuff appeared sufficiently keratinised.

Discussion

In the present case, thanks to the hangar technique, the implant could be inserted at the same time as the reconstruction of the vertical defect. The hangar technique allows implants to be placed directly through the occlusally fixed bone shell at the same time as vertical bone augmentation.

At the 8th European Consensus Conference of BDIZ EDI (2013), the indications for GBR and autologous bone were clearly defined. BDIZ EDI had discussed the state of the art in oral bone augmentation with experts from seven countries and devel-

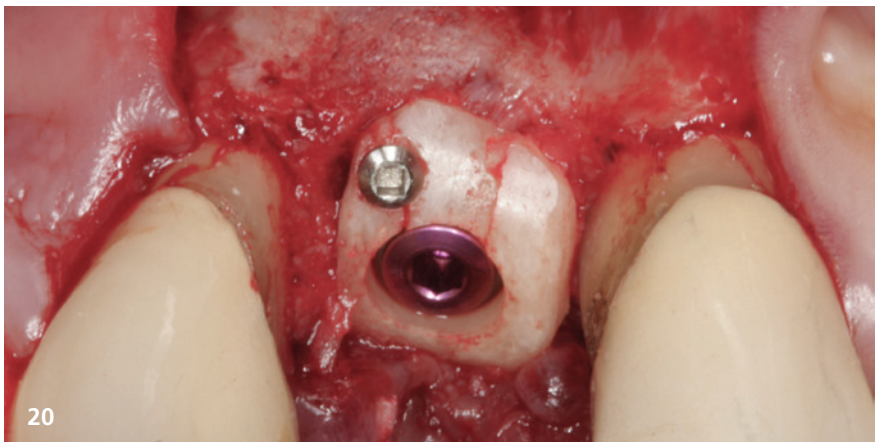
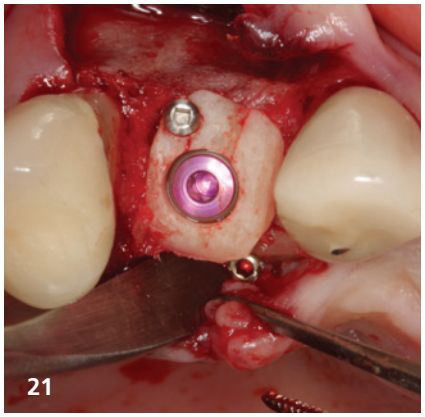
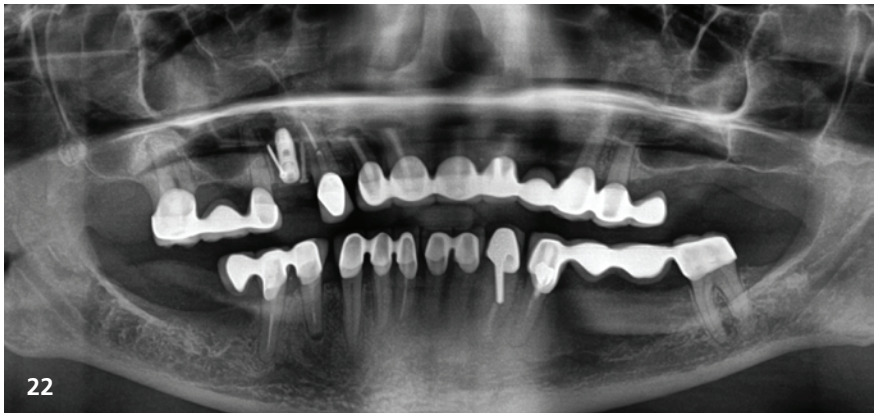


Fig. 20: In this case, only a single occlusal screw was used.





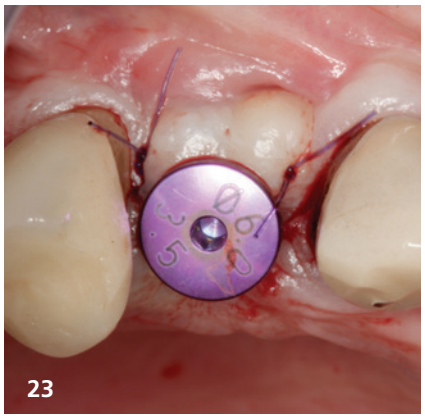


Fig. 21: Occlusal aspect of the hangar technique. **Fig. 22:** The postoperative panoramic radiograph depicts the augmented area in the upper right quadrant. Simultaneous insertion of the implant was made possible by the application of the hangar technique. **Fig. 23:** Reentry via a simple split incision, followed by the insertion of the healing abutment. **Fig. 24:** Final panoramic radiograph with the healing abutment inserted.

oped the Cologne Classification of Alveolar Ridge Defects (CCARD).

Previous defect classifications (Cawood and Howell, 1983; Seibert et al., 1988) failed to provide comprehensive coverage of hard-tissue defect situations and largely ignored the defect environment.

It is evident that the number of walls delimiting the defect and their relationship to the overall jaw structure greatly influence the success of post-augmentation procedures. Reconstructed defects still surrounded by bone walls are easier to stabilise (Khoury, Antoun et al., 2007) than extensive defects without bony delimitation (Araújo, Sonohara et al., 2002). This has a direct effect on post-augmentation success rates.

The consensus paper recommends that when using bone substitutes, autologous bone should be added wherever possible to improve the osteogenic potency of the augmentation material.

Augmenting medium-size and larger defects with bone substitutes and membranes results in significantly higher infection and exposure rates than autologous

Fig. 25: Delivery of the final restoration. **Fig. 26:** Occlusal aspect of the final restoration.

Fig. 27: Final radiograph with the final restoration in place.

bone-block augmentation (Chiapasco, Abati et al., 1999).

Onlay (vertical augmentation) grafts with osteoconductive bone substitutes outside the defect contours should be limited to minor augmentation heights of less than 4 mm, even in combination with autologous bone (Canullo, Trisi et al., 2006).

Medium-size and large defects (over 8 mm) must be reconstructed vertically outside the defect contours. The CCARD clearly states that autologous bone should be used in all cases.

Another recent (2019) study examined the ten-year follow-up after vertical bone augmentation in the maxilla in 142 patients. The results showed an average bone gain of 7.6 mm in height and 8.3 mm in width, and an average amount of bone resorption of only 0.63 mm after ten years (Khoury, 2019). The results make it clear that when using purely autologous bone, stable long-term results can be expected even in the supreme discipline of vertical reconstruction.

The author is convinced that there is no need to supplement this successful method, which has been established for years, by introducing xenogeneic substitute materials and membranes. This would jeopardise the result by increasing the risk of rejection and exposure.

The protocol presented here allows vertical bone defects to be safely reconstructed using purely autologous bone and restored with a screw-retained, fixed implant-supported prosthetic restoration with long-term aesthetic and functional results.

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References

Join team bone

Dr Frank Zastrow is a specialist dentist for oral surgery, the owner of a private dental practice in southern Germany, the author of various specialist books and the founder of the "My Implant Business" education platform.

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