bone & tissue regeneration

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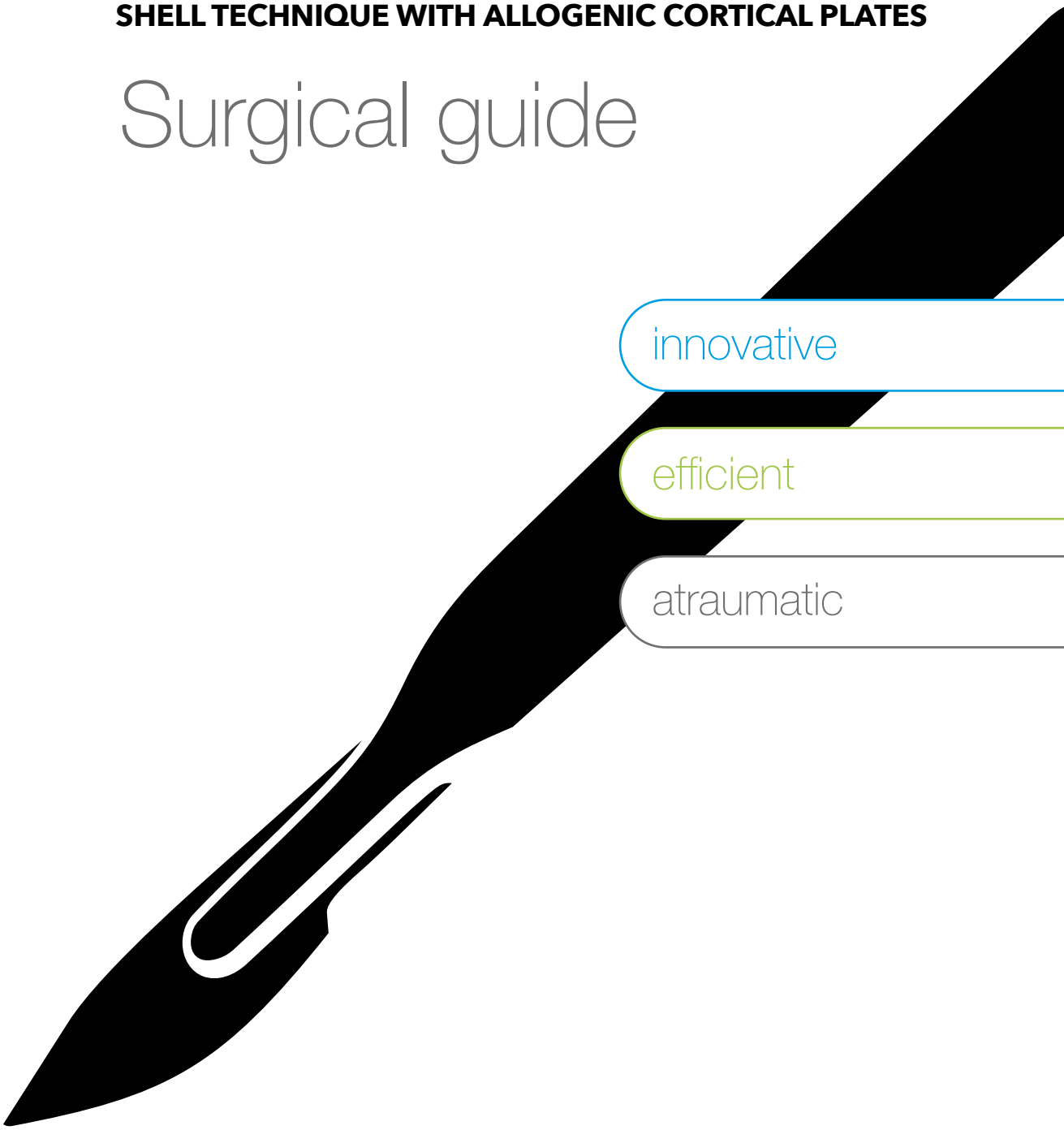
# maxgraft® cortico

**SHELL TECHNIQUE WITH ALLOGENIC CORTICAL PLATES**

# Surgical guide



innovative

efficient

atraumatic

**hard** tissue

# Introduction

This surgical guide provides clinically-based information for the correct handling and application of maxgraft® cortico. It was created with the support of renowned clinical experts to assist you in achieving the best possible results.

maxgraft® cortico is a prefabricated cortical strut from post mortem donors, that can be used for the shell technique. The concept of the shell technique is the preparation of a biological container, which creates the necessary space for the full incorporation of particulate bone graft material to rebuild new bone for dental implant placement.
maxgraft® cortico was developed to avoid donor-site morbidity and to prevent the time-consuming harvesting and splitting of autogenous intraoral bone blocks. It acts as cortical strut that is firmly integrated for optimal stabilization of the particulate augmentation material that is filled in the gap[1,2].



## INDICATIONS

Implantology — Oral Surgery — CMF Surgery

- Vertical augmentation
- Horizontal augmentation
- Complex three-dimensional augmentation
- Single tooth gap
- Fenestration defect

Good success rates have been reported in augmentations of horizontal or vertical defects with a width or height of up to 6 mm[1].

## PRODUCT PROPERTIES

- Acellular cortical bone from the femur diaphysis (post mortem donors)
- Fully mineralized for natural stability, no flexibility
- Standardized size of 25 x 10 x 1 mm
- 5 years shelf life at 5-30°C

## SPECIFICATIONS

### maxgraft® cortico

| Art.-No. | Product | Content |
|---|---|---|
| 31251 | cortical strut*, 25 x 10 x 1 mm | 1 x |

*post-mortom donors

### cortico trimmer

| Art.-No. | Product | Content |
|---|---|---|
| 34000 | cortico trimmer | 1 x |



## USE OF MAXGRAFT® CORTICO IN CONJUNCTION WITH OTHER BIOMATERIALS

maxgraft® cortico creates a stable biological container that can be filled with particulate bone substitute material, facilitating revascularization and migration of bone-forming cells into the defect zone for rapid bone regeneration[1]. Filling the gap with a mixture of autogenous bone chips and maxgraft® granules is recommended. maxgraft® granules can also be used alone. Another alternative option is a mixture of autogenous bone chips or maxgraft® granules and bovine granules (e.g. cerabone®)[2]. The final decision depends on the treatment plan of the surgeon and the preferences of the patient.

# Preoperative assessment and precautions

Key elements for an optimal surgical procedure and long-term treatment success include:

- Careful patient selection in terms of health status, compliance and patient‘s dental status
- Consideration of patient-related factors that may affect bone healing (e.g., diabetes, smoking)
- Consideration of the soft tissue, preoperative soft tissue management may be required
- Treatment of any inflammation and infection prior to surgery (especially the periodontal conditions should be perfectly treated to reach an inflammation-free status)
- Antibiotic treatment starting prior to surgery and to be continued for 7-10 days
- Postoperative rinsing with chlorhexidin solution is recommended
- Comprehensive patient information about the treatment plan and origin of the bone substitute materials

Courses or hands-on workshops should be attended prior to initial use. Preferably, the surgeon should be experienced in harvesting autogenous bone grafts. The difficulty of the shell technique increases with the size of the defect, when the contact with the local bone is reduced, or when a second cortical plate is fixed on the opposite side of the ridge.

# Surgical procedure

## Step 1 **FLAP PREPARATION**

A flap large enough to allow full access to the entire defect should be elevated. Adequate revascularization of the particulate bone grafting material is also critical and needs to be ensured. The required size and position of the bone plate can be determined either during the digital planning of the surgery or in situ after flap elevation.

## Step 2 **TRIMMING**

maxgraft® cortico cannot be bent to follow the contour of the alveolar ridge. The plate is completely mineralized cortical bone and is not flexible. When used in the anterior region or in extremely curved alveolar ridges, the cortical plate can be divided and fixed in multiple pieces. By using the cortico trimmer and a rotating diamond disk, maxgraft® cortico is cut extraorally to the appropriate size. Shaping to the bony contour is essential.

**Note:** Rehydration of maxgraft® cortico is recommended. It has been shown that rehydration of maxgraft® cortico (10 minutes in saline solution) results in increased flexibility and improved fracture resistance of the cortical plate[5].

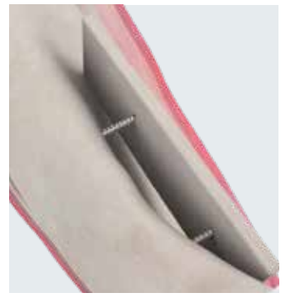


## Step 3 **PLACEMENT AND FIXATION**

In order to create a fixed compartment, maxgraft® cortico must be placed at the appropriate distance but still in contact with the local bone. Based on the ideal implant position, the cortical plate should be positioned with at least a 1 mm distance from the implant surface when placed laterally. Tension-free fixation without bending of the cortical plate is highly important.

**Note:** Augmentation outside the alveolar ridge contour should be avoided, as this may lead to either non integration of the plate or even worse dehiscence [2].

**Note – screws:** Predrilling is mandatory to reduce the risk of plate fracture [2]. The drill head must be smaller than the diameter of the screw (e.g., 0.8 mm drill with a 1.0 mm screw) in order to maintain the stability of the cortical plate. It is recommended to use osteosynthesis screws with a flat head. Screws with a conical shaped head have to be avoided absolutely. Screws with a diameter of 1.0 - 1.2 mm and a length of 6 to 14 mm are suitable for most defects. Self-tapping screws should be avoided as they may result in fracture of the bone plate due to the aggressive thread design. Sinking the screw head into the bone plate should also be avoided, as this may result in a loss of stability and weakens the plate leading to higher risks of fractures.



### OPTIONAL: GROOVE TECHNIQUE

Some surgeons use the groove technique. An approximately 1 mm wide and straight groove, in which maxgraft® cortico can be positioned before fixation, is cut in the local bone using piezoelectric or rotating instruments.

## Step 4 **ADAPTATION OF THE EDGES**

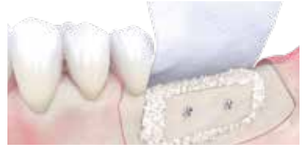
To prevent perforations of the soft tissue, sharp edges need to be removed entirely, e.g., by using a diamond bur. Smoothening of the sharp edges should usually be done outside the mouth but can of course also be finished after fixing the plates.

## Step 5 **FILLING THE DEFECT**

The space between local bone and cortical strut is filled with particulate bone grafting materials. The use of either pure autogenous particles or a layered filling of the defect with allogenic chips (e.g. maxgraft®) covered by pure autogenous bone chips is recommended[2].

## Step 6 **COVERAGE BY A BARRIER MEMBRANE**

The augmentation area needs to be covered with a barrier membrane (e.g., Jason® membrane). The barrier membrane prevents the ingrowth of soft tissue into the particulate material.



## Step 7 **WOUND CLOSURE**

The suture has to be tension-free and saliva-proof. Proper soft tissue management is crucial for the surgical success. A tension-free wound closure and a sufficient quality of the soft tissue significantly reduce the risk of complications such as dehiscences. An overlapping mobilization of the soft tissue before suturing should be possible.

### Tension-free suture technique

Single interrupted sutures alternating with horizontal mattress sutures should be used for primary closure. Deep apical sutures with elastic Gore-Tex® threads can be used to immobilize the flaps, eliminating any tension at the wound edges that could lead to dehiscence.

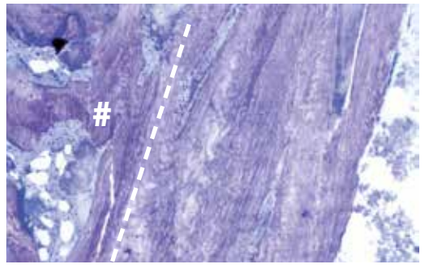
## POST-OPERATIVE CARE

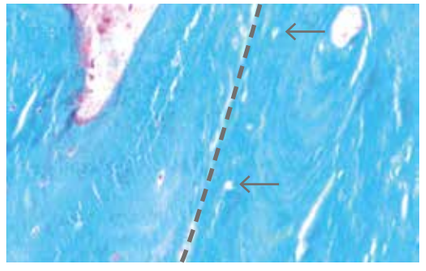
- Postoperative  CBCT or X-ray should be considered.
- Postoperative X-ray is mandatory to control appropriate placement of screws.
- A thorough analgesics protocol should be followed directly after surgery.
- Chlorhexidine rinse 3 times daily should be prescribed until suture removal.
- Usually an antibiotic prophylaxis should be continued for 3-10 days.
- Sutures should be removed after 14 days.
- Arrange follow-up visits in 4-6 weeks intervalls to control early wound-healing problems.



## HEALING, REMODELING, AND INTEGRATION

Post-operatively, maxgraft® cortico usually gets primarily integrated. Since the bone plate consists of cortical bone, it acts as a resorption protection and is gradually remodeled. Resorption occurs primarily in areas outside the contour. New vital bone is formed directly adjacent to the allogenic plate on the side facing the local bone. In comparison to autogenous grafts, maxgraft® cortico demonstrates long-term stability.



The histological images show an integrated maxgraft® cortico bone plate (right side of dashed line) with allogenic particles (#) stabilized in the container after five months of healing time. maxgraft® cortico is characterized by empty osteocyte lacunae (arrows), whereas the newly generated bone shows a large number of vital osteocytes.

Biopsy provided by Dr. Jan Kielhorn (Öhringen, Germany) processed by Prof. Smeets (UKE Hamburg, Germany).

## RE-ENTRY AND IMPLANT PLACEMENT

Depending on the location, type, and extent of the defect, the entire healing time is four to six months when using a mixture of allogenic and autogenous bone particles. However, the right time for the re-entry needs to be assessed individually by the surgeon. After flap preparation usually a slight smoothening of the plates is necessary before placing the implants.

The implant has to be anchored securely in the cancellous bone and should not be in contact with the plate.

## AUGMENTATIVE RELINING AFTER IMPLANTATION

The additional use of augmentative relining is recommended. The additional layer of xenogenic bone substitute material (e.g. cerabone®) and a collagen membrane (e.g. Jason® membrane), aims to prevent bone resorption in the period between implantation and prosthetic restoration, especially in the first 24 months after augmentation, during which the bone undergoes continuous remodelling[1,4].

# Complication management

## Fracture of the bone plate

maxgraft® cortico is a highly stable bone plate. It must be fixed without any movement and without excessive pressure or tension. In the unlikely event of a fracture, it must be fixated with an additional screw or replaced by a new bone plate. Additionally the use of the cortico trimmer reduces the risk of a fracture during cutting and is ideal for precise adaptation.

## Wound dehiscence

maxgraft® cortico is acellular; even exposed maxgraft® cortico is resistant to bacterial degradation. In absence of any signs of infection, optimimize oral hygiene by incorporating mouth rinsing solutions (0.2% chlorhexidine), up to three times a day [2]. Avoid removing the cortical plate in cases without a putrid infection or pain or other compelling reasons. Smoothen sharp edges or reduce free-standing parts of the cortical plate below tissue level if possible.

## Soft tissue perforations

Late soft tissue perforations after normal wound healing: In absence of any signs of infection, reduce sharp edges or remove free-standing parts of the bone plate. Avoid removing the cortical plate in cases without a putrid infection or pain or other compelling reasons. In the case of irritations of surrounding soft tissue, use rinsing protocol as described above.

## Detached maxgraft® cortico at the time of re-entry

In rare cases, it can occur that the plate is not connected to the bony site and must therefore be removed. The augmentation site is usually fully regenerated. Usually detachment of the plate is a complication when placed outside of the contour.

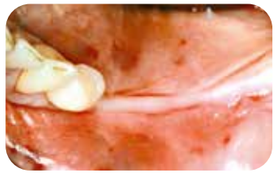




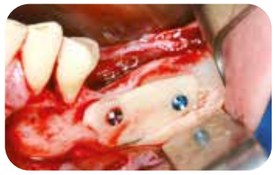
## CLINICAL CASE BY

Dr. Jan Kielhorn, Öhringen, Germany

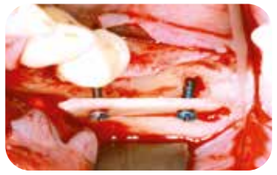
## FREE-END SITUATION IN THE MANDIBLE



Clinical situation

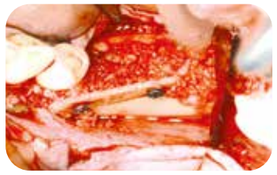


Fixation of maxgraft® cortico, taking into account the bone level of the next tooth and thorough removal of sharp edges

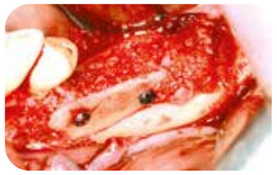


Adequate distance to the local bone, angulated positioning of the screws and application of the groove technique

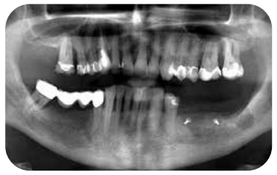
Mix of allograft and autogenous chips



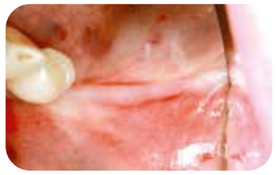
Filling of the defect



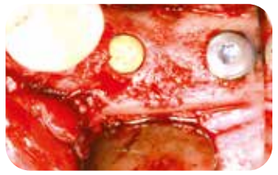
Contouring with particles also outside of maxgraft® cortico to prevent perforations



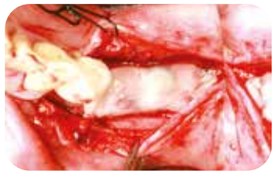
OPG post-augmentation



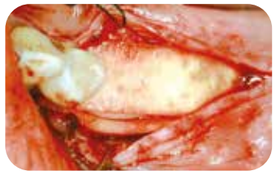
Uneventful soft tissue healing



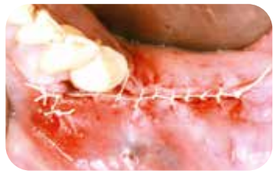
Implant insertion eight months after augmentation



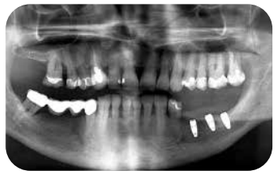
Covering with PRF matrix



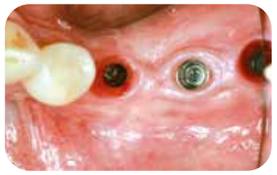
Soft tissue improvement with mucoderm® crestally and laterally



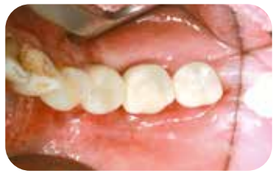
Tension-free wound closure



OPG post-implantation



Emergence profile prior to installation of provisionals



Provisional restoration in place

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## CLINICAL CASE BY

Dr. Jochen Tunkel, Bad Oeynhausen, Germany

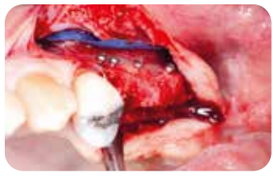
### RIDGE AUGMENTATION IN THE MAXILLA AND SIMULTANEOUS SINUS LIFT

Clinical situation pre-operative

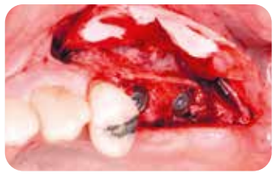
Mobilization of the Schneiderian membrane and adaptation of maxgraft® cortico and fixation buccally and lingually with 1 mm micro-screws

Filling and contouring of the defect with autogenous and allogenic chips in a layered approach and closure of the lateral window with permamem®

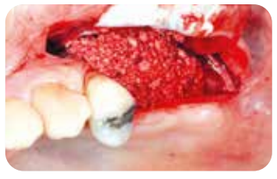
Saliva-tight and tension-free wound closure



Solid bone formation and integration of maxgraft® cortico and removal of permamem®

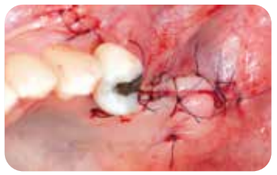


Implant placement 4 months after augmentation



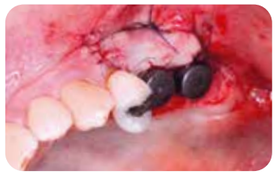
Relining technique with cerabone®

Covering of the augmentation site with Jason® membrane

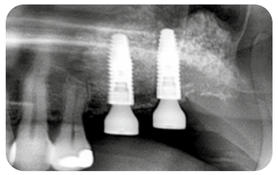


Saliva-tight and tension-free wound closure

Uneventful soft tissue healing 4 months after augmentation



Reentry using an apically repositioned flap



Final X-Ray

Final dental crowns

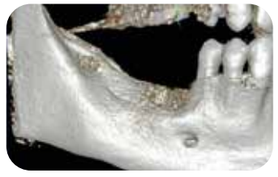




## CLINICAL CASE BY

Dr. Robert Würdinger, Marburg, Germany

### COMPLEX THREE-DIMENSIONAL AUGMENTATION

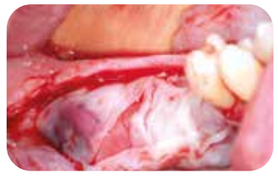


Preoperative CBCT-scan; vestibular view

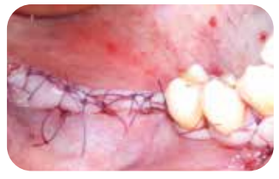
Situation after defect uncovering: careful detachment of the lingual mucosa from the suprahyoid muscles for flap mobilization

Adaptation of the cortical plates and fixation buccally and lingually with 1 mm microscrews

Defect fill and contouring using autogenous and allogenic (maxgraft®) particles; covering of the augmentation site with Jason® membrane



Additional application of L-PRF matrices for improved wound healing



Saliva-tight and tension-free wound closure by a combination of horizontal mattress and single knot sutures

Implantation of two implants in accordance with the attachment level of the neighboring teeth

Situation after re-entry via stab incision with soft tissue displacement

Final dental crowns with temporary restoration of the screw channels

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