

bone & tissue  
regeneration

botiss  
biomaterials

muco<sup>derm</sup><sup>®</sup>

## 3D-REGENERATIVE TISSUE GRAFT

Scientific basics and clinical cases



native

stable

three-dimensional

soft tissue

# botiss regeneration system



# Periodontal surgery and soft tissue grafts

## Importance of periodontal plastic surgery

The growing demand for aesthetic procedures has recently led to an increase in the importance of periodontal plastic surgery, resulting in the development of new surgical techniques and concepts. Gingival recessions as well as reductions of the mucosa around pontics/dental implants or the reduced width of the keratinized gingiva may have a significant impact on the patient's aesthetics. Beside aesthetic reasons, several indications require the treatment of soft tissue deficiencies.



## Clinical consequences of soft tissue reduction

Despite the ongoing debate about the meaning of keratinized gingiva, most scientists and clinicians agree that a sufficiently broad band of keratinized tissue exerts a positive effect on the tooth health and long-term prognosis of dental implants. Not only the attached gingiva does provide protection against mechanical traumas, it also acts as a barrier against the penetration of bacteria and food particles. Studies have demonstrated that a reduction in the width of the keratinized gingiva is associated with an increased risk of infections, loss of attachment, and higher plaque accumulation. Such situations may favor gingival recessions, which in turn may lead to hypersensitivity of tooth roots, root caries, and, at worst, tooth loss.

## Mucosal- and connective tissue grafts

Today, modern techniques of the plastic-aesthetic periodontal surgery ensure a satisfactory regeneration of soft tissue deficiencies in the majority of cases. Free mucosal- and subepithelial connective tissue grafts, both commonly harvested from the palate, are frequently used. Despite their clinical success, their use is associated with significant disadvantages. For instance, when harvesting autologous tissue a second surgical site is created, which may result in increased post-operative pain as well as a higher risk of infections and complications. In addition, the quality of the harvested tissue varies from patient to patient, and its limited availability may be an issue, particularly for the correction of larger soft tissue defects or multiple recessions.

In order to overcome these issues, allogenic and xenogenic acellular collagen matrices have been developed. mucoderm® is a xenogenic matrix produced by botiss that offers a valid alternative to autologous soft tissue grafts.

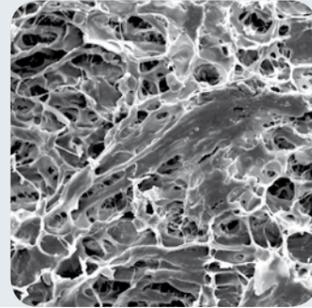
## Development / Production / Distribution

cerabone®	maxgraft® cortico	maxgraft®	maxgraft® bonebuilder	maxgraft® bonering	maxresorb® inject	maxresorb®	maxresorb® flexbone
Natural bovine bone graft	Processed allogenic bone plate	Processed allogenic bone graft	Patient matched allogenic bone implant	Processed allogenic bone ring	Synthetic injectable bone paste	Synthetic biphasic calcium phosphate	Flexible blocks (CaP / Collagen composite)
Straumann® Emdogain®	collacone® max	collacone®	Jason® fleece	mucoderm®	collprotect® membrane	Jason® membrane	permamem®
Enamel matrix derivative	Flexible cone (CaP / Collagen composite)	Collagenic hemostat (Cone)	Collagenic hemostat (Sponge)	3D-stable soft tissue (Collagen) graft	Native collagen membrane	Native pericardium GBR / GTR membrane	High-density PTFE barrier membrane

# muco<sup>®</sup>derm

## 3D-regenerative tissue graft

muco<sup>®</sup>derm is a natural, non-cross-linked tissue matrix, consisting of collagen type I and III and strongly resembling the native structure of the human dermis. In a natural enzymatic process muco<sup>®</sup>derm is integrated into the surrounding tissue and replaced by the patient's own connective tissue. The natural collagen network of muco<sup>®</sup>derm that results from the multistep purification process acts as a scaffold for soft tissue cells and blood vessels.

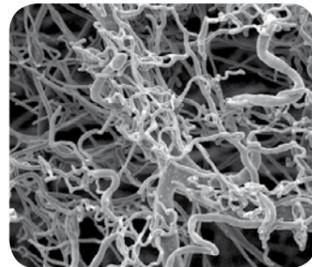


The porous structure of the muco<sup>®</sup>derm surface enables the ingrowth of microvessels and soft tissue cells

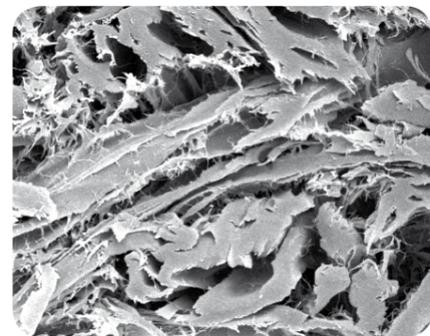
During the healing process, muco<sup>®</sup>derm is vascularized and integrated into the surrounding tissue. For a broad range of indications muco<sup>®</sup>derm serves as a safe alternative to autologous connective tissue grafts.

### Natural, three-dimensional collagen structure

The muco<sup>®</sup>derm matrix is made of pure porcine collagen without any artificial/chemical cross-linking. Scanning electron microscopic pictures of muco<sup>®</sup>derm show its rough and open-porous collagen network that acts as a guiding structure for soft tissue cells and blood vessels.



Corrosion preparation showing a vascular network running through the muco<sup>®</sup>derm matrix



Compact collagen structure of muco<sup>®</sup>derm

### Properties

- Native collagen matrix
- Fast vascularization and integration
- Soft tissue graft avoiding the need for autograft harvesting
- Complete remodeling into patient's own tissue in ~six to nine months
- Rapid hydration
- Easy handling
- Thickness ~1.2 to 1.7 mm



# Handling of the muco<sup>®</sup>derm

## General product handling

### HYDRATION

A sufficiently long hydration of muco<sup>®</sup>derm prior to application is necessary. Hydration should be performed in a sterile saline solution or blood for five to 20 minutes, depending on the technique used and the desired flexibility of the matrix—the flexibility of the muco<sup>®</sup>derm graft increases with hydration time.

### TRIMMING

The size and shape of the matrix should be adapted to the size of the defect. After hydration, muco<sup>®</sup>derm can be easily trimmed to the desired size with a scalpel or scissors. Rounding off the edges following brief hydration of the matrix can prevent a perforation of the gingival tissue during flap closure.

For the coverage of multi-recession defects, the surface of muco<sup>®</sup>derm can be extended by cutting the matrix on alternating sides (mesh-graft technique) and pulling it.



Trimming of hydrated muco<sup>®</sup>derm with a scalpel

### EXPOSURE

muco<sup>®</sup>derm should only be left for open healing, if a revitalization from the surrounding or underlying wound bed is ensured. Exposure should always be avoided when used for recession coverage. Open healing is feasible in the case of a vestibuloplasty, if muco<sup>®</sup>derm is sutured to the periosteum.



Convenient handling of muco<sup>®</sup>derm after rehydration with blood

## HANDLING TIPS

### Hydration

from five to 20 minutes

### Trimming

use a scalpel or scissors to cut to desired shape

### Exposure

muco<sup>®</sup>derm should only be left for open healing, if a revitalization from the surrounding or underlying wound bed is ensured

### Fixation

suturing of muco<sup>®</sup>derm helps to prevent micromovements

### FIXATION

When a split-thickness flap is used, a close contact between the periosteal wound bed and the immobilized muco<sup>®</sup>derm matrix should be ensured by suturing the matrix to the intact periosteum using single-interrupted- or crossed sutures.

### SUTURING

A tension-free flap closure is always recommended.



muco<sup>®</sup>derm trimmed for application with the mesh-graft-technique

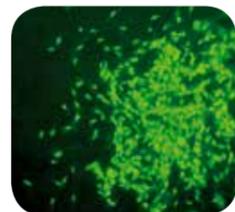
# Scientific results



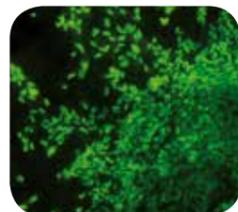
## Biocompatibility proved by MTT *in vitro* viability assay<sup>1</sup>

The viability assay confirmed the high biocompatibility of the mucoderm<sup>®</sup> three-dimensional collagen matrix *in vitro*.

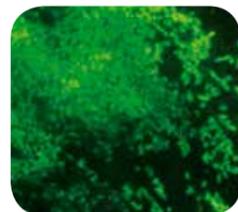
The MTT test demonstrated a significantly higher viability of gingival fibroblasts, endothelial cells, and osteoblasts on mucoderm<sup>®</sup> compared to the control at day six *in vitro* (p<0.05).



Gingival fibroblasts on mucoderm<sup>®</sup>

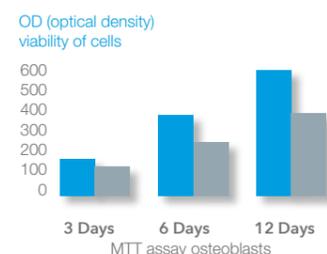
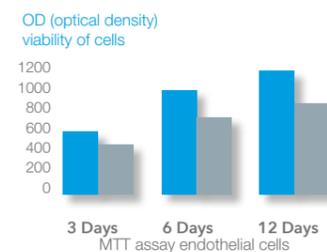
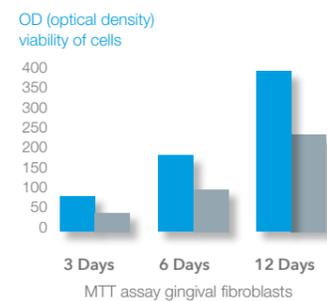


HUVEC cells on mucoderm<sup>®</sup>



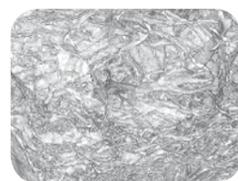
Osteoblasts on mucoderm<sup>®</sup>

## *In vitro* testing



## mucoderm<sup>®</sup> is characterized by an open porous collagen structure

Visualization of the open porous collagen structure of mucoderm<sup>®</sup> by the innovative synchrotron-based x-ray tomography<sup>2</sup>.



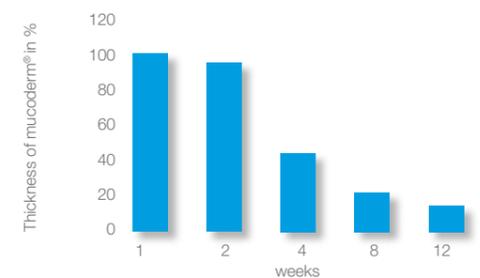
The unique structure of the matrix strongly resembles that of the human dermis and supports the ingrowth of cells and blood vessels, thereby promoting a fast tissue integration of mucoderm<sup>®</sup>.



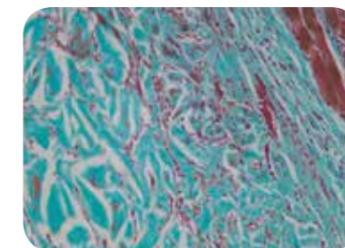
# Tissue integration and degradation of mucoderm<sup>®</sup>

## Results from Prof. Dr. Daniel Rothamel after subcutaneous implantation of mucoderm<sup>®</sup> in rats<sup>3</sup>

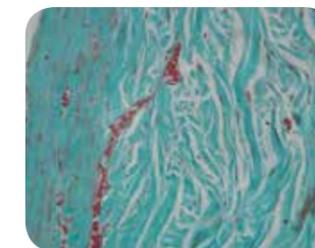
After only two weeks, mucoderm<sup>®</sup> showed an extensive ingrowth of blood vessels as well as an inflammation-free healing with superficial cell invasion. In the following four to eight weeks, a continuous degradation with an increasing homogeneous cell distribution can be observed. After eight weeks, 20% of the original matrix volume remained as scaffold for the formation and reorganization of connective tissue.



After 12 weeks, mucoderm<sup>®</sup> was almost completely replaced by newly formed connective tissue (please note that a period of one month in rats corresponds to approximately three months in humans).



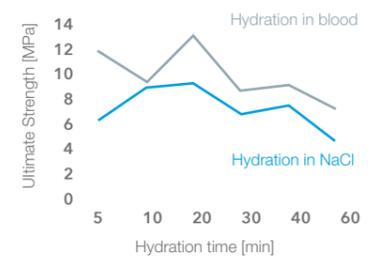
mucoderm<sup>®</sup> demonstrates a very good tissue integration and initial cell invasion after two weeks



Complete remodeling of mucoderm<sup>®</sup> and inflammation-free connective tissue were observed after 12 weeks *in vivo*

## Biomechanics and hydration of mucoderm<sup>®</sup>

The hydration protocol and its influence on the biomechanical properties of mucoderm<sup>®</sup> were analyzed in a study of Prof. Dr. Adrian Kasaj<sup>4</sup>. mucoderm<sup>®</sup> demonstrated optimal mechanical properties after ten to 20 minutes hydration. A rehydration in blood can improve the biomechanical properties of mucoderm<sup>®</sup>. Notably, prolonged hydration (30 to 60 minutes) showed only minor effects on the biomechanical properties of the collagen matrix.



<sup>1</sup> Pabst et al. (2014): In vitro and in vivo characterization of porcine acellular dermal matrix for gingival augmentation procedures. In J Periodont Res 49 (3), pp. 371–381. DOI: 10.1111/jre.12115.  
<sup>2</sup> Pabst et al. (2015): Synchrotron-based X-ray tomographic microscopy for visualization of three-dimensional collagen matrices. In Clinical oral investigations. 19(2):561-4, DOI: 10.1007/s00784-014-1312-4.

<sup>3</sup> Rothamel et al. (2014): Biodegradation pattern and tissue integration of native and cross-linked porcine collagen soft tissue augmentation matrices – an experimental study in the rat. In Head Face Med 10 (1), p.10, DOI: 10.1186/1746-160X-10-10.  
<sup>4</sup> Kasaj et al. (2015): The influence of various rehydration protocols on biomechanical properties of different acellular tissue matrices. Clin Oral Investig. 20(6):1303-15, DOI: 10.1007/s00784-015-1614-1.

# Application of mucoderm® in plastic-aesthetic periodontal surgery

Gingival recessions are not only an aesthetic issue. They can also lead to clinical problems, such as root hypersensitivity, cervical root caries, and root abrasion. Today, autologous connective tissue grafts are considered the "gold standard" for the treatment of periodontal recessions; however, harvesting is often associated with pain and discomfort for the patient. The application of a regenerative tissue graft avoids autologous connective tissue harvesting, thereby enhancing the patient's acceptance for a surgical procedure.

Collagen triple helix

The correct application and handling of the graft material is a prerequisite for aesthetically optimal, clinical results.

The following application guidelines, based on clinical results, have been developed together with Prof. Dr. Adrian Kasaj, specialist for Periodontology at the Department of Operative Dentistry and Periodontology at the University of Mainz.

## Selection of patients

mucoderm® offers a safe and effective alternative for covering recession defects, especially when patients do not agree to undergo palatal autograft harvesting. Nevertheless, expectations concerning the clinical and aesthetic outcome of the surgery should be carefully considered and discussed with the patient. Compliance with the post-operative treatment plan, as well as an unimpaired or controlled state of health, are indispensable for a successful treatment.

## Product Specifications

Regardless of the applied technique, the clinical success of the treatment of Miller class I/II defects is more predictable than that of class III/IV defects. In principle, a complete recession coverage can only be obtained for Miller class I/II defects. Likewise, the predictability and success rate for the treatment of defects in the maxilla are higher than those of mandibular defects. mucoderm® can be used in combination with all mucogingival surgical techniques, including the coronally advanced flap, envelope technique, and tunnel techniques.

## Post-operative treatment

After surgery it is necessary to avoid any mechanical trauma of the treated site. Patients should be instructed not to brush their teeth at the respective side for four weeks following surgery. Plaque accumulation can be prevented by rinsing with a 0.2% chlorhexidine solution. Post-operatively, the patient should be recalled weekly for plaque control and healing evaluation.

## CLINICAL CASE BY

Prof. Dr. Dr. Adrian Kasaj, University of Mainz, Germany

## RECESSION COVERAGE WITH THE MODIFIED CORONALLY ADVANCED FLAP TECHNIQUE (ZUCHELLI TECHNIQUE)



Multiple gingival recessions at teeth 12, 13, and 14 before treatment with mucoderm®



A sulcular incision from tooth 11 to 15 is made and a split-full-split thickness flap is raised



Hydrated mucoderm® is trimmed and placed over the denuded roots and fixed on the periosteum



The flap is coronally repositioned over the root surfaces and the matrix fixed with sling sutures



Three months post-operative: Significant coverage of the roots and increased thickness of the marginal tissue



Clinical situation 18 months post-operative



## Handling Tips

- Contact of mucoderm® with the periosteal wound bed and immobilization should be ensured by suturing the matrix to the periosteum using single-interrupted- or crossed sutures
- Rounding off the edges of a briefly hydrated matrix prevents damage of the gingival tissue during flap closure

## RECESSION COVERAGE WITH THE CORONALLY ADVANCED FLAP TECHNIQUE



Initial situation with gingival recession and muscle strain on tooth 24



mucoderm® hydrated, cut-to-shape, and sutured to the periosteum



Repositioning and suturing of the flap over mucoderm® and the tooth root



Situation after a healing period of three months

**CLINICAL CASE BY**

Prof. Dr. Dr. Adrian Kasaj, University of Mainz, Germany

**RECESSION COVERAGE WITH MUCODERM® BY THE ENVELOPE TECHNIQUE**



Gingival recession at tooth 13 before the treatment with mucoderm®; previous surgery with FGG is visible



mucoderm® is hydrated and cut to shape for placement over the root



A subepithelial pouch is prepared by a partial thickness incision; mucoderm® is placed in the pouch



After positioning of mucoderm®, the flap is fixed to completely cover the graft



Clinical situation at three months: significant root coverage and increased thickness of marginal tissue



Situation after gingival plastic for leveling of the FGG



**Handling Tips**

- For the tunnel technique a prolonged hydration of mucoderm® is recommended (ten to 20 minutes)
- Fixation of the matrix can be done with single interrupted or cross-sutures

**COVERING OF MULTIPLE RECESSIONS WITH MUCODERM® BY THE TUNNEL TECHNIQUE**



Clinical view before treatment with mucoderm®; gingival recessions at teeth 23 and 24



Preparation of roots by scaling and planning with sonic scaler



Conditioning of roots with 24% EDTA gel for two minutes



Sulcular incisions around teeth 22 to 25; a partial-thickness dissection by undermining the papillae using tunneling instruments



Hydrated and trimmed mucoderm® is checked to fit into the defect and placed over the roots by pulling it through the tissue tunnel



The flap is repositioned over the mucoderm® and sutured



Three months post-operative: previously exposed roots are significantly covered; in addition, the thickness of the marginal tissue has increased



Clinical situation 12 months post-operative

**CLINICAL CASE BY**

Dr. Dávid Botond Hangyási, University of Dentalstory Private Practice, Hódmezővásárhely, and University of Hódmezővásárhely-Szeged, Hungary

**RECESSION COVERAGE WITH MUCODERM® USING THE MODIFIED CORONALLY ADVANCED TUNNEL TECHNIQUE (MCAT)**



Preoperative clinical situation



Measurement of the recession depth



Modified coronally advanced tunnel technique with mucoderm®; dermal matrix pulled into the tunnel



Repositioning and suturing of the flap over mucoderm® and the tooth roots



Situation after three-months of healing



Clinical outcome three years post-operative



**Handling Tips**

Exposure of mucoderm® should always be avoided in the treatment of gingival recessions. Make sure that the repositioned flap completely covers the mucoderm® matrix. Achieving primary closure over the mucoderm® allows blood vessels to penetrate and incorporate the soft tissue graft material. Early exposure may lead to soft tissue graft failure.

**CLINICAL CASE BY**

PD Dr. Raluca Cosgarea, University of Marburg, Germany and Prof. Dr. Dr. Anton Sculean, University of Bern, Switzerland

**COVERING OF MULTIPLE RECESSIONS IN THE LOWER JAW WITH THE MODIFIED TUNNEL TECHNIQUE AND MUCODERM®**



Situation before surgery



Preparation of the tunnel



Hydration of mucoderm® and cutting to shape



mucoderm® inserted into the tunnel and sutured



Repositioning of the flap over the mucoderm® and suturing



Healing after one week



Clinical situation at suture removal after four weeks



Healing after two months



Healing after 12 months

**CLINICAL CASE BY**

PD Dr. Raluca Cosgarea, University of Marburg, Germany and Prof. Dr. Dr. Anton Sculean, University of Bern, Switzerland

**COVERING OF MULTIPLE RECESSIONS WITH THE MODIFIED CORONALLY ADVANCED TUNNEL (MCAT) TECHNIQUE<sup>5</sup>**



Clinical situation before surgery: multiple recessions



Preoperative measurement of the recession depths



Using a microsurgical blade and tunneling knives, mucoperiosteal flaps were raised beyond the mucogingival junction at each involved tooth



Flaps were then extended laterally from each recession forming a mucoperiosteal tunnel. Interdental papillae were left intact, having only been slightly undermined



Hydration of mucoderm® for about five minutes in sterile saline or blood and adapting its shape according to the width of the recession defects



For a tension free coronal movement of the flap all muscle insertions and collagen fibres were cut. mucoderm® is pulled into the tunnel by mattress sutures and fixed to the inner aspect of the flap



mucoderm® was fixed at the CEJ of each treated tooth by means of sling sutures. The tunnel flap was moved coronally and fixed by sling sutures, to cover completely the mucoderm® matrix



Stable clinical situation at 24 months post-surgery

5. Cosgarea R, et al. 2016. Clinical evaluation of a porcine acellular dermal matrix for the treatment of multiple adjacent class I, II, and III gingival recessions using the modified coronally advanced tunnel technique. Quintessence Int.;47(9):739-47.

**CLINICAL CASE BY**

Prof. Dr. Dr. Adrian Kasaj, University of Mainz, Germany

**RECESSION COVERAGE WITH THE CORONALLY ADVANCED FLAP TECHNIQUE IN COMBINATION WITH MUCODERM® AND STRAUMANN® EMDOGAIN®**



Initial situation with recessions at teeth 13 and 14



Lateral view of baseline situation



Root surface conditioning with 24% EDTA gel



Preparation of a flap with vertical releasing incisions



Application of Straumann® Emdogain® to the root surface



Hydrated mucoderm® cut-to-shape, adapted to the donor bed, and sutured to the periosteum



Coronal repositioning and suturing of the flap over mucoderm® and the roots



Healing after six weeks



Clinical situation three months post-operative



Clinical situation three months post-operative, lateral view

**CLINICAL CASE BY**

Prof. Dr. Dr. Adrian Kasaj, University of Mainz, Germany

**RECESSION COVERAGE WITH A COMBINATION OF MUCODERM® AND STRAUMANN® EMDOGAIN®<sup>6</sup>**



Multiple gingival recessions at teeth 21, 22 and 23 prior to surgery



Sulcular incision from teeth 21 to 23



Preparation of a split-full-split thickness flap and de-epithelialization of the anatomical papillae



Application of Emdogain® to the conditioned root surfaces



Adaptation of the hydrated and cut-to-shape mucoderm®, and suturing to the periosteum



Repositioning of the flap over mucoderm® and the root surface



Wound closure, occlusal view



Healing four weeks after surgery



Clinical situation eight weeks post-operative



Satisfactory coverage of the roots and thickening of the marginal gingiva, nine months post-operative



**Handling Tip**

Emdogain® can be directly applied to the tooth roots and then covered with mucoderm®. Alternatively, mucoderm® may be coated with Emdogain® prior to application.

<sup>6</sup> Kasaj et al. (2016): Gingival recession coverage: Do we still need autogenous grafts? Quintessence Int. 47:775-783.

## ATTACHED GINGIVA—

protection of teeth and implants

Under healthy conditions, the teeth are lined by a band of attached gingiva of about five millimeters in width, which is anchored to the underlying alveolar bone and cementum through connective tissue fibers. This particular arrangement creates a barrier around the teeth, protecting the tooth roots against penetration of bacteria and food particles.



Moreover, the attached gingiva reduces the mechanical strain from the lip-, cheek-, and mimic muscles, shielding the teeth from the strain. A reduction or lack of attached gingiva may cause root recessions and inflammation (periodontitis), which may lead to bone resorption and tooth loss.

Likewise, a sufficient width of the attached gingiva around the dental implants may improve their survival by facilitating the plaque control in the peri-implant area and preventing recessions at the implant. In particular, prior to or immediately after implant placement, an augmentation of the attached gingiva is indicated.

## AUGMENTATION OF THE ATTACHED GINGIVA

The current standard technique to widen the attached gingiva is the vestibuloplasty, which is performed in combination with a free mucosal graft<sup>7</sup>. Following the preparation of a mucosal flap, the soft tissue graft is fixed to the exposed periosteum (donor bed) and left for open healing.

However, the harvesting of the graft presents additional stress for the patient and may cause further post-operative discomfort, an increased risk of swelling, post-operative bleeding, paresthesia, and inflammation<sup>8</sup>. In some cases, post-operative discomfort may persist for several weeks.

The application of a xenogenic collagen matrix, such as mucoderm<sup>®</sup>, can avoid the painful harvesting procedure and consequently increase the patient's acceptance of the treatment plan.

## APPLICATION OF MUCODERM<sup>®</sup>

### IN PLACE OF A FREE MUCOSAL GRAFT

The mucoderm<sup>®</sup> matrix may be applied instead of a free mucosal graft for the coverage of the prepared donor bed during vestibuloplasty. Following hydration and shaping, the matrix is adapted to the periosteum and fixed with sutures.

A close contact between the periosteum and mucoderm<sup>®</sup> is essential to ensure fast integration and revitalization of the matrix by the ingrowth of blood vessels and cells. mucoderm<sup>®</sup> serves as a scaffold for the formation of connective tissue and is completely remodeled into the patient's own tissue within weeks following surgery.

## AUGMENTATION OF THE ATTACHED GINGIVA

with mucoderm<sup>®</sup>

### RESULTS FROM A CLINICAL STUDY

Dr. Dr. Andres Stricker, Konstanz, Germany<sup>9</sup>

Dr. Dr. Andres Stricker investigated the efficiency of mucoderm<sup>®</sup> for the augmentation of keratinized peri-implant gingiva. The width of the keratinized gingiva as well as the health of the peri-implant tissue and the patient morbidity were assessed up to 12 months post-operative.

At six months post-operative, a significant widening of the attached gingiva and improved health of the peri-implant tissue were observed. The clinical situation was stable and could be confirmed after 12 months.



Clinical situation: lack of keratinized gingiva



Preparation of a mucosal flap



Hydration of mucoderm<sup>®</sup> in sterile saline



Adaptation of mucoderm<sup>®</sup> to the recipient site



mucoderm<sup>®</sup> sutured to the periosteum



Clinical situation after two weeks



Clinical situation after four weeks



Clinical situation after three months

7 Fröschl and Kerschler (1997): The optimal vestibuloplasty in pre-prosthetic surgery of the mandible. In Journal of Cranio-Maxillofacial Surgery 25 (2), pp. 85–90. DOI: 10.1016/S1010-5182(97)80050-9.

8 Griffin et al. (2006): Postoperative complications following gingival augmentation procedures. In J Periodontol 77 (12), pp. 2070–2079. DOI: 10.1902/jop.2006.050296.

9 Stricker et al. 2014, Evaluation of a porcine collagen matrix to create new keratinized tissue at deficient implant sites: 12 months results from a controlled prospective clinical study. Clin Oral Implants Res. 2014 Sep;25 Suppl. 10:490.

**CLINICAL CASE BY**

Dr. Attila Horváth, Semmelweis University, Budapest, Hungary

**TREATMENT WITH MUCODERM® TO INCREASE THE PERI-IMPLANT KERATINIZED MUCOSA<sup>10</sup>**



Lack of sufficient keratinized mucosa is visible as a result of considerable horizontal ridge augmentation



The split-thickness flap was prepared; the buccal peri-implant mobile mucosa was positioned apically, creating an immobile periosteal recipient bed



The xenogenic dermal matrix (mucoderm®) was trimmed and rehydrated in sterile saline



mucoderm® was immobilized with modified deep periosteal and superficial mattress sutures to attain a tight contact to the periosteum



No allergy, rejection, suppuration, or ulceration were detected; following maturation of the graft, three Straumann SLActive® implants were inserted according to the prosthetic indication



Sufficient peri-implant keratinized mucosa and deep vestibulum were achieved around all implants



Six months after insertion of the xenogenic dermal matrix, the new peri-implant keratinized mucosa showed matured and stable properties



<sup>10</sup> Horvath et al., (2014): Comparison of different approaches aiming at increasing peri-implant keratinized mucosa. ITI Poster presentation.

**CLINICAL CASE BY**

Dr. Bálint Mólnar and Prof. Dr. Péter Windisch, University of Budapest, Hungary

**AUGMENTATION OF THE ATTACHED GINGIVA WITH MUCODERM®**

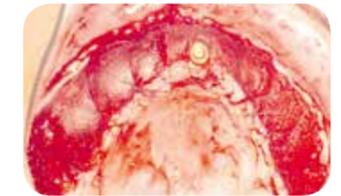
Full arch reconstruction of insufficient vestibular depth and lack of keratinized tissues. Application of mucoderm® with an apically repositioned split thickness flap.



Insufficient keratinized mucosa and extremely shallow vestibulum on the edentulous maxilla following bilateral sinus floor elevation and horizontal GBR therapy



Apically repositioned flap by palatal incision along the maxilla. Split-thickness flap preparation with an intact periosteal layer over the augmented bone



Fixation of the buccal flap to the exposed periosteum deep in the vestibular fold. Fixation of mucoderm® with resorbable monofilament (Monolac) single and cross-typed sutures



mucoderm® fixed to the periosteum with single and cross-sutures



Clinical situation one week post-operative: secondary epithelization and newly formed capillary vessels detectable



Two weeks post-operative: secondary healing continued over mucoderm® treated areas, remaining sutures were removed



Clinical situation four weeks post-operative: secondary healing completed

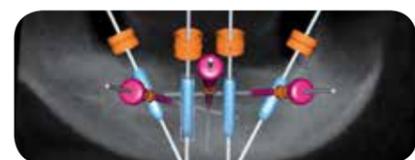


Clinical situation six months post-operative: excellent tissue maturation, favourable color and thickness of the newly formed soft tissue around the implants

**CLINICAL CASE BY**

Dr. Dávid Botond Hangyási, Dentalstory Private Practice, Hódmezővásárhely, and University of Hódmezővásárhely-Szeged, Hungary

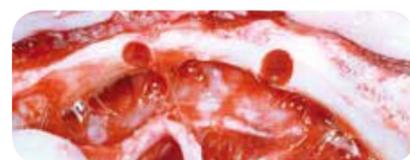
**RIDGE AUGMENTATION AND LATER SOFT TISSUE AUGMENTATION WITH MUCODERM®**



CBCT planning for navigated implantology



Preoperative clinical view of the surgical site



Mandibular ridge found to be thinner than expected; placing of implants is not feasible



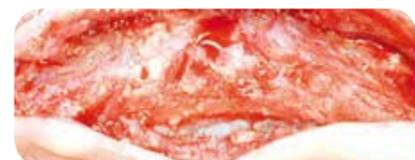
Modified "sausage technique": Horizontal ridge augmentation (GBR) with a combination of autologous bone particles and cerabone® covered with Jason® membrane and fixed by resorbable periosteal sutures



Flap closure with 6/0 monofil continuous sling sutures



Clinical situation six months after GBR



Newly formed mandibular ridge at the time of the re-entry



Appropriate amount of bone for standard-size implants



Thick mucoderm® (~three millimeters) ready for gingival augmentation



Periosteum closed over the submerged implants and covered with mucoderm®; flap is sutured to the dermal matrix (6/0 monofil sutures), mucoderm® partially left uncovered



Clinical situation three weeks after the second surgery



Gingival contour five months after implant placement; sufficient amount of keratinized gingiva around implants

**CLINICAL CASE BY**

Dr. Stefan Scherg, Karlstadt, Germany

**GBR AND SIMULTANEOUS SOFT TISSUE AUGMENTATION WITH MUCODERM®**



Clinical situation before surgery, vestibular view



Clinical situation before surgery, occlusal view



Situation after implant placement, demonstrating a buccal defect



Augmentation with maxresorb® and covering with a non-resorbable PTFE membrane



Fixation of the membrane with titanium pins



Soft tissue thickening of the buccal side with mucoderm® and recession treatment of tooth 23



Additional placement of mucoderm®, crestally and lingually



Fixation of mucoderm® and suturing of the flap



Implant exposure and membrane removal four months post-operative



Abutment insertion



New soft tissue augmentation with mucoderm®



Wound closure and mounting of provisional prosthesis



Situation after long-term healing with provisional prosthesis



Final restoration 15 months after implant placement and stable root coverage of tooth 23 and stability of root coverage in region 23



Final restoration 15 months after implant placement



X-ray control 15 months post-operative

# Periimplant soft tissue thickening

Studies have shown that the initial thickness of the mucosa plays an important role in the etiology of early bone loss around dental implants<sup>11</sup>. It has been demonstrated that a thickness of 2 mm or less increases the risk of crestal bone lack.

In order to prevent bone loss and to improve the long-term stability of dental implants, it is recommended to thicken the periimplant soft tissue in cases of thin gingiva biotypes. Soft tissue thickening can be performed prior or simultaneously to implant placement. The application of a xenogeneic soft tissue matrix, such as mucoder<sup>®</sup>, helps to avoid soft tissue harvesting from the palate. For simultaneous implant placement and soft tissue augmentation, mucoder<sup>®</sup> can be applied as a "poncho" over the healing cap. In that indication, mucoder<sup>®</sup> should be covered by vital tissue (flap) to guarantee revitalization of the matrix by ingrowing cells and blood vessels. Prevention of tension is crucial for a complication-free wound healing.

## mucoder<sup>®</sup> for the thickening of periimplant soft tissue MUCOSAL THICKENING AROUND BONE LEVEL IMPLANTS<sup>12</sup>

### CLINICAL CASE BY

Dr. Algirdas Puisys, Vilnius, Lithuania



Crestal incision of the edentulous ridge and raising a full-thickness flap buccally and lingually



Bone preparation for Straumann® Bone Level implant placement



Implant insertion and contouring crestal bone with a straight handpiece



Hydrated mucoder<sup>®</sup> perforated and pulled over the healing cap



The margins of the flap are adapted and sutured leaving the abutment open



Situation after suture removal, one week post-operative



Wider healing abutment after four months



Smooth emergence profile visible after removal of the healing abutment



Final restoration five months post-operative



Stable clinical situation after five years

<sup>11</sup> Puisys A, Linkevicius T (2015). The influence of mucosal tissue thickening on crestal bone stability around bone-level implants. A prospective controlled clinical trial. Clin Oral Implants Res ;26(2):123.

<sup>12</sup> Puisys A, Schlee M, Vindasiute E, Linkevicius T (2015). Vertical soft tissue augmentation with porcine-derived collagen matrix membrane: A prospective study with 20 consecutive patients. EAO Stockholm. Manuscript in preparation.

# Indications for mucoder<sup>®</sup>



## PERIODONTOLOGY

mucoder<sup>®</sup> is indicated for guided tissue regeneration procedures as well as for periodontal and recession defects for periodontal plastic surgery.

It can be used in conjunction with:

- Coronally advanced flap technique
- Laterally advanced flap technique
- Envelope technique
- Tunnel technique

## Implantology, Oral Surgery and CMF

- Soft tissue augmentation in combination with GBR
- Widening of the attached gingiva
- Closing of extraction sockets (socket seal technique)
- Thickening of the periimplant soft tissue



mucoder<sup>®</sup> punch

## Product Specifications

Art.-No.	Dimensions	Content
701520	15 × 20 mm	1 × matrix
702030	20 × 30 mm	1 × matrix
703040	30 × 40 mm	1 × matrix
710210	Ø 10 mm	1 × punch





# Innovation. Regeneration. Aesthetics.

soft tissue

botiss biomaterials GmbH  
Hauptstr. 28  
15806 Zossen / Germany

education

Tel.: +49 33769 / 88 41 985  
Fax: +49 33769 / 88 41 986

hard tissue

[www.botiss.com](http://www.botiss.com)  
[www.botiss-dental.com](http://www.botiss-dental.com)  
facebook: botissdental