mucoderm®
3D-Regenerative Tissue Graft
Handling, Clinical Application and Cases
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Author and co-author of more than 80 scientific publications within the field of periodontology and biomaterials; numerous national and international courses and lectures in the fields of regenerative periodontal therapy and plastic periodontal surgery.

Curriculum Vitae

1994-2000 School of Dental Medicine, Zagreb, Croatia

2000-2001 Dentist in a private practice in Neustadt/Weinstrasse, Germany

2001-2009 Research associate at the Department of Operative Dentistry and Periodontology at the University of Mainz

2001 Dr. med. dent., Department of Operative Dentistry and Periodontology, University of Mainz

2002-2005 Postgraduate Education in Periodontology at the Department of Operative Dentistry and Periodontology at the University of Mainz

2006 Specialist in Periodontology of the German Society of Periodontology (DGP/EFP)

2007 Specialist in Periodontology of the European Dental Association (EDA)

2009 Habilitation (PD) at the Department of Operative Dentistry and Periodontology, University of Mainz

2009 Docent (Associate Professor) degree at the Department of Operative Dentistry and Periodontology at the University of Mainz
mucoderm® is a 3D collagen tissue matrix derived from porcine dermis that passes through a multi-step cleaning process which removes all potential tissue rejection components from the dermis. This results into a three-dimensional stable matrix consisting of collagen and elastin. mucoderm® supports revascularization, fast soft tissue integration, and is a valid alternative for the patient’s own soft or connective tissue grafts.

After placement, the patient’s blood infiltrates the mucoderm® graft through the three-dimensional soft tissue network, bringing host cells to the soft tissue graft surface and starting the revascularization process. Significant revascularization can begin after implantation, depending on the health condition of the patient as well as other biological and non-biological factors.

Natural 3D collagen tissue structure

mucoderm® matrix is made of pure porcine collagen without artificial cross-linking or additional chemical treatment. SEM pictures of mucoderm® show its rough and open-porous collagen structure that guide soft tissue cells and blood vessels.

Properties & Advantages
- Native collagen matrix
- Guided vascularization and integration
- Soft tissue graft without the need for autograft harvesting
- Complete remodeling into patient’s own tissue in ~6-9 months
- Thickness ~1.2 - 1.7 mm
- Rapid rehydration
- Easy handling, application and fixation

Product Specifications

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mucoderm® available sizes
Scientific Results

Biocompatibility proved by MTT in vitro viability assay testing*

The viability assay proved high biocompatibility of the mucoderm® 3D collagen matrix.

Beginning with day 6, the MTT viability assay demonstrated a significantly higher viability of gingival fibroblasts, endothelial cells and osteoblasts on mucoderm® in comparison with the control group (p<0.05).

Subcutaneous implantation into mice demonstrated good tissue integration and revascularization of mucoderm®*

Microvessel staining revealed good revascularization with many in-sprouting blood vessels (lower left image). In addition, specific staining of cells undergoing mitosis, indicated a high proliferation and migration of cells within the matrix (lower middle and right image). Ingrowth of blood vessel and cells is a prerequisite for incorporation and remodelling of mucoderm®.

SEM examination of mucoderm® shows the monolayered matrix and its homogenous and open porous collagen structure that facilitate flow of nutrients and migration of cells, and subsequent integration of the mucoderm®.

In vitro testing

<table>
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<td>MTT assay endothelial cells</td>
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<td>800</td>
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<td>MTT assay osteoblasts</td>
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Gingival fibroblasts on mucoderm®
HLEVC cells on mucoderm®
Osteoblasts on mucoderm®

Gingival recession defects are not only an aesthetic problem, but can also lead to clinical problems such as root hypersensitivity, cervical root caries and root abrasion. Today, autologous connective tissue transplants are considered the “gold standard” for treatment of periodontal recessions, although harvesting is often painful for the patient. The application of a regenerative tissue graft saves the patient from autologous connective tissue harvesting, thereby enhancing patient acceptance of the surgical procedure.

The correct application and handling of the graft material is a prerequisite to obtain predictable and optimal aesthetic and clinical results. The following application guidelines are based on clinical results and were developed together with 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 the coverage of recession defects, especially when patients don’t agree with palatal autograft harvesting. Nevertheless, expectations concerning the clinical and aesthetic outcome of the surgery should be considered carefully and discussed with the patient. The patient compliance with the post-operative treatment plan, as well as an unimpaired or controlled state of health, is indispensable for the success of the treatment.

Product Specifications
Independent of the applied technique, the clinical success of the treatment of Miller class I and II defects is more predictable than for class III and IV defects. In principle, a complete recession coverage could only be obtained for Miller class I and II defects. Likewise, predictability and success is better for the treatment of defects in the maxilla as compared to mandibular defects. mucoderm® can be used in combination with all mucogingival surgery techniques including coronally advanced flap and envelope technique.

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 4 weeks following surgery. Plaque prevention can be achieved by mouth rinsing with a 0.2% chlorhexidine solution. Post-operatively, the patient should be seen every week for plaque control and to evaluate healing.
Handling of the mucoderm® matrix

General product handling

Rehydration
A sufficiently long rehydration of the mucoderm® prior to application is necessary. Rehydration should be performed in sterile saline solution or blood for 5-20 minutes maximum, depending on the desired flexibility of the matrix (the flexibility of the mucoderm® graft increase with prolonged rehydration time) and the technique used.

Trimming
The size and shape of the matrix should be adapted to the defect size. After rehydration mucoderm® can easily be trimmed to the desired size with a scalpel or scissors. Cutting or rounding the edges of a mucoderm matrix that has been rehydrated shortly prevent perforations of the gingival tissue during flap closure.

For the coverage of multi-recession defects, an extension of the mucoderm® is possible by cutting the matrix on alternating sides (mesh-graft-technique) and pulling to extend it.

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

Fixation
When a split-thickness flap is used, a close contact between the periosteal wound bed and the immobilized mucoderm matrix should be ensured by suturing the matrix to the intact periosteum using single-interrupted- or crossed sutures.

Suturing
Flaps should always be sutured tension free.

Handling Tips

Rehydration
- from 5 to 20 minutes

Trimming
- use of scalpel or scissors to cut the desired shape

Exposure
- for recession coverage exposure of the mucoderm® graft should always be avoided

Fixation
- try to suture the mucoderm® to avoid micro movements
Special Handling

Application of mucoderm® by the Mesh-Graft Technique

For multiple recessions where the length of the graft is not sufficient, the mucoderm® matrix can be extended by the mesh-graft-technique. The technique involves cutting the mucoderm® matrix on alternating sides and pulling to elongate it.

Indications

**Periodontology**
mucoderm® is indicated for use in guided tissue regeneration procedures, in periodontal and soft tissue recession defects. The graft can be applied in combination with:
- Coronal advanced flap
- Laterally advanced flap
- Envelope technique
- Tunnel technique

**Implantology, Oral Surgery & CMF**
Further fields of application for mucoderm® are:
- Soft tissue augmentation/ thickening
- Augmentation of attached gingiva (substitute for free gingival graft)
- Covering of implants placed in immediate or delayed extraction sockets
- Localized ridge augmentation for later implantation
- Alveolar ridge reconstruction for prosthetic treatment
Clinical Cases mucoderm®

Recession Coverage with the Coronally Advanced Flap Technique

Schematic drawing of the application of mucoderm® by Coronally Advanced Flap Technique

Clinical view of root recession before mucoderm® placement
Preparation of a split flap by a sulcular and two vertical releasing incisions
mucoderm® cut-to-shape and placed over the root
Gingival tissue coronally repositioned, fully covering the mucoderm®, and sutured in place

Treatment of a single recession with mucoderm® by Coronally Advanced Flap Technique

Gingival recession at tooth 43 before the treatment with mucoderm® matrix
Preparation of a split flap with two vertical releasing incisions and placement of the mucoderm® over the denuded root
The flap is coronally repositioned and sutured over the mucoderm and the underlying tooth root
Clinical situation 6 weeks post-op showing significant root coverage and thickening of the marginal tissue

Treatment of multiple recessions and soft tissue thickening with mucoderm® by Coronally Advanced Flap Technique

Gingival recessions at teeth 23, 24 and 25 before treatment with mucoderm®
Preparation of a coronally advanced flap
Placement of mucoderm® over the denuded roots
Situation 12 weeks post-op: coverage of roots and clear thickening of the marginal tissue
Recession Coverage with the modified Coronally Advanced Flap Technique (Zucchelli technique)

Schematic drawing of the application of mucoderm® by a modified Coronally Advanced Flap Technique

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 all-crossed sutures

- Cutting the edges of a shortly rehydrated matrix prevent damage of the gingival tissue during flap closure
Recession coverage with mucoderm® by tunneling techniques

Recession Coverage with the Envelope Technique

Clinical situation 3 months after mucoderm® treatment showing significant root coverage and increased thickness of the marginal tissue

The flap is repositioned over the mucoderm® matrix and sutured

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

Handling Tips
- For the tunnel technique a prolonged, 10-20 min, rehydration time of the mucoderm® is recommended.
- Fixation of the matrix by single-interrupted- or all-crossed sutures is required

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 2 min

Sulcular incisions around teeth 22 to 25 are made and a partial-thickness dissection is performed by undermining the papillae using tunneling instruments

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

The flap is repositioned over the mucoderm® matrix and sutured

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

Clinical situation 12 months post-op
Innovation.
Regeneration.
Aesthetics.

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