Technical Guidelines for Use of Geistlich Mucograft® / Geistlich Mucograft® Seal

Based on several, independent clinical publications [1-17], discussions with pilot surgeons, and the consensus of more than 20 Geistlich Mucograft® Round Tables (2009–2013), the following technical guidelines should be considered when using Geistlich Mucograft®:

1. In general:

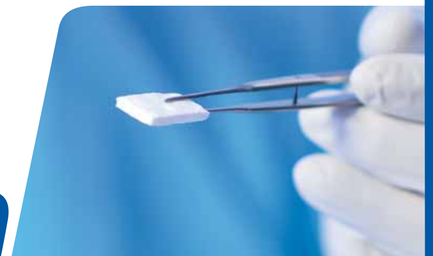
- Geistlich Mucograft® is an alternative to autogenous grafts: The 3D-matrix can be used in recession coverage and in gain of keratinised tissue procedures in which either connective tissue grafts or free gingival grafts show predictability today. Geistlich Mucograft® Seal can be used for socket seal in Ridge Preservation procedures. Patient selection criteria, patient compliance and surgical requirements, as with autogenous soft-tissue grafts, should be fulfilled.
- Patient selection and compliance are of crucial importance for optimal clinical outcome. Patient expectations should be considered.
- Geistlich Mucograft® / Geistlich Mucograft® Seal is ready to use without need of pre-hydration or washing treatments.
- Geistlich Mucograft® should be trimmed dry and precisely to the required size to avoid tension. For accurate trimming of Geistlich Mucograft®, the use of a template might be helpful.
- Geistlich Mucograft® / Geistlich Mucograft® Seal should be manipulated and applied in a dry state.
- Orientation of Geistlich Mucograft® / Geistlich Mucograft® Seal: The compact structure should face outwards and the spongy structure towards the bone and/or periosteum.
- No compression of Geistlich Mucograft® / Geistlich Mucograft® Seal: The 3D-matrix should remain uncompressed before, during and after surgery.
- Immobilisation of Geistlich Mucograft® /Geistlich Mucograft® Seal: After surgery the matrix should be immobile, since stabilisation of the blood clot is important for wound healing.
- No tension around Geistlich Mucograft®: Any tension of the soft tissues around Geistlich Mucograft® should be avoided. If possible, wider than normal flaps are recommended.
- Post-surgical management: As with any regenerative site, caution must be exercised in post-operative care and during hygiene practices at or near the surgical site. For the first 4 weeks, no brushing or flossing at the gingival margin and no chewing of hard foods. For the first 6 months, do not probe or allow scaling and root planning of sites.

2. Gain of Keratinised Tissue

- The maximum width of the band of keratinised tissue that can be obtained is genetically predetermined.
- Pre-surgical situation: At the coronal margin and/or surrounding teeth or implant, a small band of keratinised tissue should be present that can provide the biological information to the regenerated soft tissue. With Geistlich Mucograft®, comparable results to autogenous graft are obtained if a band of at least 1 mm keratinised tissue is left.
- Good access: A minimum vestibule depth should be available in posterior sites to allow surgery and tension free healing of the treated site.
- Split-thickness flap: Geistlich Mucograft® should be applied on a periosteal bed since blood supply is important.
- Open healing (onlay technique): When preparing the surgical bed, part of the remaining keratinised band should be moved apically with the flap. The elevated flap should be sutured at its base if necessary.
- Geistlich Mucograft® should be sutured tension-free to the surrounding tissue and may be left exposed, without wound dressing. If suturing the apical part of Geistlich Mucograft® is required, sufficient vestibule depth should be available to allow tension free healing.
- After gain of keratinised tissue with Geistlich Mucograft®, a minimum waiting period of 3 months is recommended if reopening of the site is necessary for further treatment.

3. Recession Coverage

- In general, recession treatments of Miller Class I and II defects show much higher predictability and success rates than Miller Class III and IV defects.
- Recession treatments of the maxilla often show better results than in the mandible due to the reduced muscular tension and adequate vestibulum depth of the maxilla.



swiss made

Geistlich Biomaterials

Geistlich Mucograft®

Treatment concepts for soft-tissue regeneration

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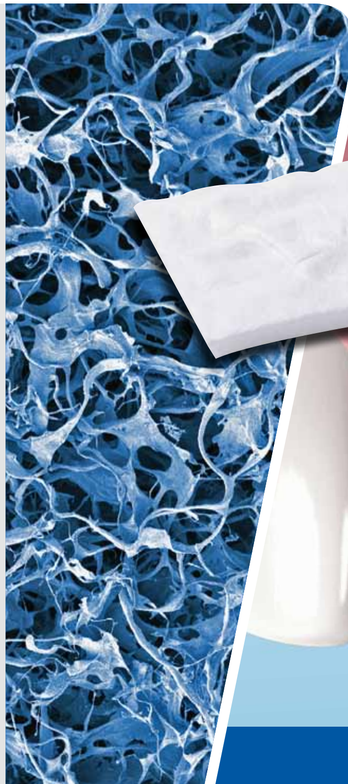


LEADING REGENERATION

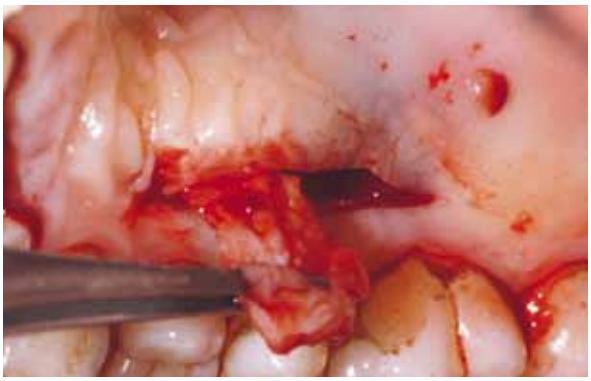
Why are soft-tissue graft alternatives needed?

In recent years there has been a change in the direction of the therapy concept for partially edentulous patients towards an increasing awareness of the significance of dental aesthetics. Although bone remains the soft-tissue scaffold, the quantity and quality of the soft tissue around teeth and implants gains progressively in importance.

What would you choose?

Autogenous soft-tissue graft...

Harvest of autogenous free gingival graft
(courtesy of Dr. Thoma).



Harvest of autogenous connective tissue graft
(courtesy of PD Dr. Jung).

... or Geistlich Mucograft®?

Geistlich Mucograft® provides an alternative to autogenous soft-tissue grafts, while avoiding harvest-site morbidity.

Geistlich Mucograft®, the autogenous soft-tissue graft alternative, benefits patients and physicians alike. This off-the-shelf soft-tissue graft eliminates the need for harvesting tissue from the patient, in turn, shortening surgical time,[1] reducing the probability of complications,[2] and minimising pain.[1] Geistlich Mucograft® is a 3D-matrix with high biocompatibility. It interfaces naturally and harmoniously with the patient's own tissue for optimal recession coverage[3-5] or efficient regeneration of keratinised tissue.[1, 6-8]

[1] Sanz M, et al. J Clin Periodontol. 2009 Oct;36(10):868-76
[2] Griffin TJ, et al. J Periodontol. 2006 Dec;77(12):2070-9
[3] McGuire MK & Scheyer ET. J Periodontol. 2010 Aug;81(8):1108-17
[4] Cardaropoli D, et al. J Periodontol. 2012 Mar;83(3):321-8
[5] Aroca S, et al. J Clin Periodontol. 2013 Jul;40(7):713-20
[6] Nevins M, et al. Int J Periodontics Restorative Dent. 2011 Jul-Aug;31(4):367-73
[7] Lorenzo R, et al. Clin Oral Implants Res. 2012 Mar;23(3):316-24
[8] McGuire MK, et al., *manuscript in preparation*

Geistlich Mucograft® – Evidence based

Clinical and scientific evidence, proving the effectiveness of Geistlich Mucograft® is continually gathered by Geistlich Pharma AG. To date, hundreds of soft-tissue treatments with Geistlich Mucograft® have been documented by more than 150 experienced surgeons.* This clinical data, together with the findings of several independent pre-clinical and clinical publications[1-16] and the consensus of more than twenty Geistlich Mucograft® Round Tables has resulted in accurate technical guidelines for the use of Geistlich Mucograft®.

Scientific evidence pillars of Geistlich Mucograft®

More than 150 surgeons involved from 13 countries	More than 300 long-term* documented cases	Several independent scientific publications[1–16]	More than 20 national and international Geistlich Mucograft® Round Tables**

Evidence

Technical Guidelines for Use of Geistlich Mucograft®

Technical Guidelines reference **PULL OUT** on last page

* 6-months or longer follow-up . Data on file, Geistlich Pharma AG, Wolhusen, Switzerland
** Monaco, USA, Poland, Italy, Belgium, UK/Ireland/Nordics, Rumania, Spain/Portugal, Switzerland, Germany, France, Brazil, Finland, Chile, Greece, Thailand, Israel, Australia, South Korea, Turkey, Russia...

[1] Sanz M, et al. J Clin Periodontol. 2009 Oct;36(10):868-76
[2] Herford AS, et al. J Oral Maxillofac Surg. 2010 Jul;68(7):1463-70
[3] McGuire MK & Scheyer ET. J Periodontol. 2010 Aug;81(8):1108-17
[4] Ghanaati S, et al. Biomed Mater. 2011 Feb;6(1):015010
[5] Nevins M, et al. Int J Periodontics Restorative Dent. 2011 Jul-Aug;31(4):367-73
[6] Vignoletti F, et al. J Clin Periodontol. 2011 Sep;38(9):847-55
[7] Rocchietta I, et al. Int J Periodontics Restorative Dent. 2012 Feb;32(1):E34-40
[8] Thoma DS, et al. J Clin Periodontol. 2012 Feb;39(2):157-65
[9] Cardaropoli D, et al. J Periodontol. 2012 Mar;83(3):321-8
[10] Lorenzo R, et al. Clin Oral Implants Res. 2012 Mar;23(3):316-24
[11] Rotundo R & Pini-Prato G. Int J Periodontics Restorative Dent. 2012 Aug;32(4):413-9
[12] Jepsen K, et al. J Clin Periodontol. 2013 Jan;40(1):82-9
[13] Jung RE, et al. J Clin Periodontol. 2013 Jan;40(1):90-8
[14] Molnar B, et al. Quintessence Int. 2013 Jan;44(1):17-24
[15] Aroca S, et al. J Clin Periodontol. 2013 Jul;40(7):713-20
[16] Schmitt CM, et al. J Periodontol. 2013 Jul;84(7):914-23

Geistlich Mucograft® – Biologics

Geistlich Mucograft® is a unique 3D-collagen matrix designed specifically for soft-tissue regeneration as an alternative for autogenous soft-tissue grafts.The 3D-matrix was developed taking the free gingival graft as a model (figure 1).

The collagen of Geistlich Mucograft® is specially processed to favour immediate blood clot stabilisation (figure 2). This leads to early vascularisation,[1,2] facilitates soft-tissue cell ingrowth[1] and excellent integration of the 3D-matrix with surrounding tissues (figures 3, 4 and 5).[1,2]

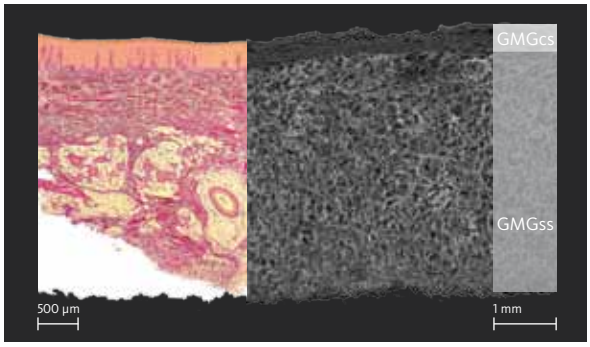


Figure 1
Natural model free gingival graft (histology; courtesy of Dr. Thoma).

Geistlich Mucograft® 3D-collagen matrix (scanning electronic microscopy; data on file , Geistlich Pharma AG, Wolhusen, Switzerland).

Compact structure (GMGcs):

› Protection in open healing situations
› Ability to be sutured

Spongy structure (GMGss):

› Blood clot stabilisation
› Ingrowth of soft-tissue cells

Specially processed collagen to favour blood clot stabilisation → Early vascularisation[1,2] → Good soft-tissue cell ingrowth[1] → Good integration and soft-tissue regeneration[1,2]

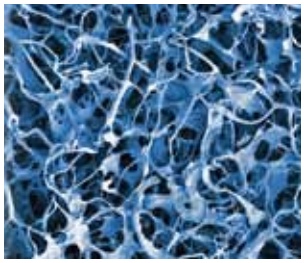


Figure 2
Geistlich Mucograft®, the 3D-matrix consists of specially processed collagen (scanning electronic microscopy).

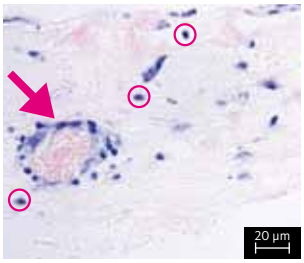


Figure 3
Histology showing early vascularisation of Geistlich Mucograft® 15 days after implantation (mouse model). Arrow indicates the formation of blood vessel. Circles show soft-tissue cells in the 3D-matrix (courtesy of Prof. Dr. mult. Sader, Dr. Ghanaati).[1]

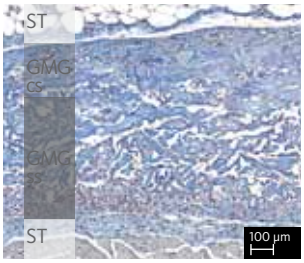


Figure 4
Soft-tissue cell ingrowth into Geistlich Mucograft®. Histology 30 days after implantation (mouse model). ST: soft tissue; GMGcs: Geistlich Mucograft® compact structure; GMGss: Geistlich Mucograft® spongy structure (courtesy of Prof. Dr. mult. Sader, Dr. Ghanaati).[1]

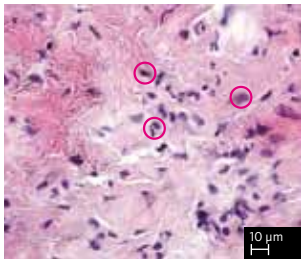


Figure 5
Complete soft-tissue integration of Geistlich Mucograft® within human connective tissue 6 weeks after clinical implantation, without any signs of foreign body reaction. Circles show soft-tissue cells in the 3D-matrix. (courtesy of Prof. Dr. mult. Sader, Dr. Ghanaati).[1]

[1] Ghanaati S, et al. Biomed Mater. 2011 Feb;6(1):015010
[2] Rocchietta I, et al. Int J Periodontics Restorative Dent. 2012 Feb;32(1):E34-40

A New Dimension for you ...

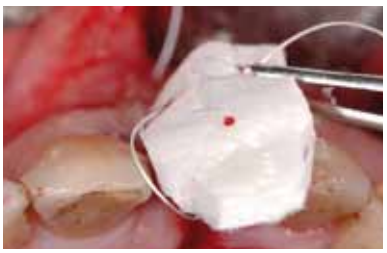
Easy Handling

Geistlich Mucograft® offers all the benefits of an off-the-shelf product and is easy to handle compared to autogenous soft-tissue grafts.[1]

Ready to use: Direct from the blister to the defect without pre-treatment or pre-hydration.

Trimming to defect shape: After measuring the defect, the 3D-matrix is trimmed to the desired size while dry.

Easy to suture: The outer compact structure provides optimal suture pull-out strength.



Dry application to the defect: The 3D-matrix moistens rapidly as a result of its marked hydrophilicity (courtesy of Dr. Zabalegui).

Good adherence: The soaked Geistlich Mucograft® adapts spontaneously to contours and adheres well to the defect (courtesy of Dr. McGuire).[2]

Unlimited availability and consistent, constant quality: The likelihood of unexpected events during surgery is reduced and gives freedom to choose a more gentle surgical procedure for the surrounding tissues (e.g. flaps without releasing incisions; courtesy of Dr. Abundo).[3]

[1] Sanz M, et al. J Clin Periodontol. 2009 Oct;36(10):868-76
[2] McGuire MK & Scheyer ET. J Periodontol. 2010 Aug;81(8):1108-17
[3] Abundo R & Corrente G. „Chirurgia plastica parodontale – Trattamento estetico delle recessioni gengivali". ACME Edizioni, 2010

... and for your Patient

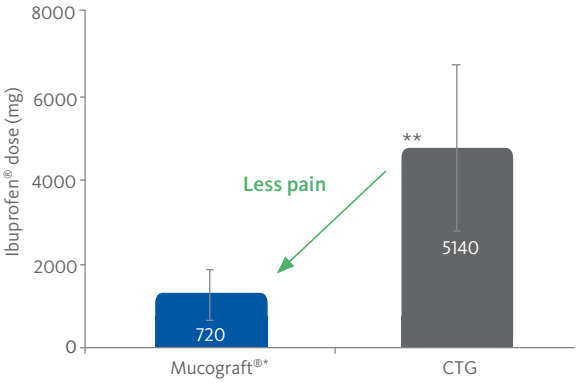
Less pain and morbidity: The absence of the donor site significantly reduces post-operative pain (graph 1).[1] Additionally it avoids post-operative complications such as numbness, which often perseveres for several weeks.[2,3]

Less surgical chair time: Without harvest of autogenous grafts, surgery time is reduced by 30 % (statistically significant) when using the off-the-shelf 3D-matrix compared to connective tissue grafts (graph 2).[1,4]

Faster soft-tissue healing: Early healing of a surgical wound in open healing situations is significantly faster when covered with Geistlich Mucograft® than in spontaneous healing.[5]

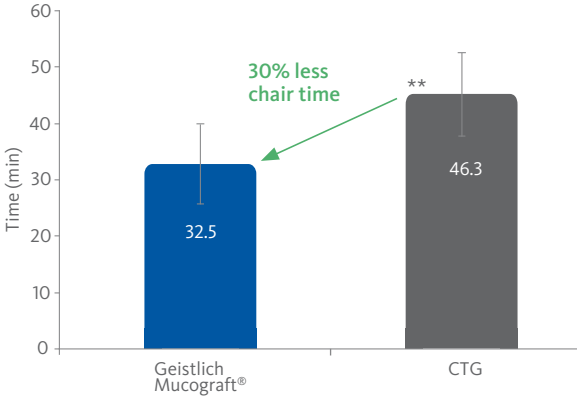
Natural soft-tissue colour and structure: Natural texture and colour match to surrounding native tissues are obtained after treatment with Geistlich Mucograft®.[6,7]

Total Ibuprofen® dose 10 days post-operative



Graph 1
Significantly less patient pain with Mucograft® (prototype)* as compared to connective tissue graft (CTG).[1]

Total surgery time



Graph 2
Significantly less surgical chair time with Geistlich Mucograft® when compared to connective tissue graft (CTG).[4]

[1] Sanz M, et al. J Clin Periodontol. 2009 Oct;36(10):868-76
[2] Del Pizzo M, et al. J Clin Periodontol. 2002 Sep;29(9):848-54
[3] Soileau KM & Brannon RB. J Periodontol. 2006 Jul;77(7):1267-73
[4] Lorenzo R, et al. Clin. Oral Impl. Res, 2012 Mar;23(3):316-24
[5] Thoma DS, et al. J Clin Periodontol. 2012 Feb;39(2):157-65
[6] McGuire MK & Scheyer ET. J Periodontol. 2010 Aug;81(8):1108-17
[7] Nevins M, et al. Int J Periodontics Restorative Dent. 2011 Jul-Aug;31(4):367-73

* Mucograft® (prototype) exhibited highly similar physical, mechanical and biological properties to the final product Geistlich Mucograft® differing only in the porcine collagen source used.

Indication: Gain of Keratinised Tissue

Investigators still cannot agree on the importance of the presence of keratinised tissue. Various studies have shown, however, that lack of keratinised soft-tissue around implants and teeth can have negative consequences in both function and aesthetics.[1,2]

Soft-tissue recession

A recent study has shown that lack of keratinised buccal soft-tissue around implants caused gingival recession over a period of five years.[1]

Inflammation and attachment loss

There is scientific evidence that the presence of keratinised mucosa has a significant effect on the health and stability of the soft tissue,[3,4] while lack of keratinised soft tissue around implants is associated with inflammation and attachment loss.[2]

Increased plaque accumulation

Patients with a low width of keratinised tissue showed increased plaque lingually and more frequent bleeding at the implant.[1]

Lack of keratinised tissue around implants is associated with

- Gingival recession over a period of five years[1]
- Soft-tissue attachment loss[2]
- Increased plaque accumulation lingually[1]
- Inflammation of the soft tissue[2]
- More frequent bleeding[1]

Presence of keratinised tissue around implants is associated with

- Significant effect on the health and stability of the soft tissue[3,4]

Proven Efficacy

Therapy with Geistlich Mucograft® yields a similar amount of keratinised tissue gain as with either the connective tissue graft[5] (CTG) or free gingival graft (FGG).[6] In addition, Geistlich Mucograft® provides higher therapy safety for gaining keratinised tissue around implants compared to connective tissue grafting while eliminating the morbidity of a harvest site.[5]

Therapy with Geistlich Mucograft® yields

- gain of keratinised tissue comparable to CTG[5] or FGG[6]
- higher therapy safety than CTG[5]
- no harvest-site morbidity[5]

[1] Schrott AR, et al. Clin Oral implants Res. 2009;20(10):1170–7
[2] Chung DMT, et al. J Periodontol. 2006;77(8):1410–20
[3] Block MS & Kent JN. J Oral Maxillofac Surg. 1990;48(11):1153–60
[4] Bragger U, et al. Clin Oral implants Res. 1997;8(5):412–21
[5] Lorenzo R, et al. Clin Oral Implants Res. 2012 Mar;23(3):316-24
[6] Nevins M, et al. Int J Periodontics Restorative Dent. 2011 Jul-Aug;31(4):367-73

Gain of keratinised tissue around teeth

Surgery by Dr. Adrián Guerrero (Málaga)

Aim: Gain of keratinised tissue in the anterior-inferior region.

Jaw	Region	Restorative Status	Gingival Biotype
☐ Upper Jaw	☒ Anterior	☒ Tooth	☐ Thick
☒ Lower Jaw	☐ Posterior	☐ Implant	☒ Thin

Material	› Geistlich Mucograft®
Technique	› Split-thickness flap and open healing

1 Pre-operative situation with absence of buccal keratinised tissue on teeth 31 and 41. The patient indicated pain during brushing.

2 Preparation of the surgical bed: a split-thickness flap is elevated and sutured apically.

3 After trimming to the defect size, Geistlich Mucograft® is sutured to the surgical bed with 5.0 resorbable sutures.

4 Post-operative situation after 1 week (suture removal).

5 Nice uneventful re-epithelialisation 2 weeks after surgery.

6 Situation 6 months after surgery. Note the 2–3 mm gain of keratinised tissue in the buccal aspect of 31 and 41.

Conclusion: In some cases the absence of attached gingiva is related to discomfort during brushing, persistent gingival inflammation and muscle pulling. In this case, Geistlich Mucograft® was used with the aim of gaining keratinised tissue in the buccal aspect of two lower central incisors, avoiding the harvesting of a free gingival graft from the palate. The final outcome, 6 months after surgery, shows a nice band of keratinised tissue with good colour and texture match. The result of the procedure met the patient's expectations as brushing can now be properly executed without any discomfort. No attempt was performed to cover the exposed roots at this stage; however, the current clinical situation is now favourable, if a second surgery for root coverage is desired.

Augmentation of width of keratinised tissue around prosthetic restoration

Surgery by Prof. Dr. Mariano Sanz and Dr. Ramón Lorenzo (Madrid)[1]

Aim: Augmentation of the width of keratinised tissue around prosthetic restoration, avoiding the patient morbidity caused by autogenous soft-tissue grafts.

Jaw	Region	Restorative Status	Gingival Biotype
☐ Upper Jaw	☐ Anterior	☐ Tooth	☒ Thick
☒ Lower Jaw	☒ Posterior	☒ Implant	☐ Thin

Material	› Mucograft®*
Technique	› Split-thickness flap and open healing

1 Pre-operative image. Note the minimal amount of keratinised tissue around the premolar and molar sites.

2 Split-thickness flap elevated to prepare the surgical bed for the soft-tissue device.

3 Mucograft® (prototype)* is trimmed in dry state to the defect size.

4 The 3D-collagen matrix, Mucograft® (prototype)*, is sutured to the prepared surgical bed and left exposed for healing.

5 Healing of the soft tissue, 10 days after surgery before suture removal.

6 View immediately after suture removal. Note the rapid re-epithelialisation of the treated site.

7 Post-operative view after 1 month.

8 Situation after 3 months.

9 Presence of a band of keratinised tissue (4 mm) 6 months after treatment.

Conclusion: Mucograft® (prototype)* is as effective and predictable as connective tissue graft (CTG) to gain an adequate width of keratinised tissue. The 3D-matrix shows excellent handling properties and can be used successfully in an open healing situation, reducing significantly patient morbidity and surgery time compared to CTG.

[1] Sanz M, et al. J Clin Periodontol. 2009 Oct;36(10):868-76

* Mucograft® (prototype) exhibited highly similar physical, mechanical and biological properties to the final product Geistlich Mucograft® differing only in the porcine collagen source used.

Increase of width of keratinised tissue around implants

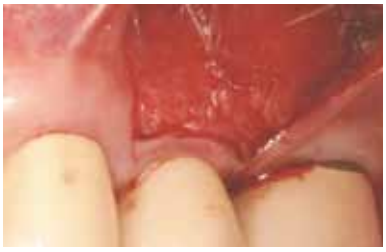
Surgery by Dr. Doina Panaite and Dr. Allan Charles (Pasadena)[1]

Aim: Increasing the width of keratinised tissue around implants with Geistlich Mucograft®, while also achieving vestibule creation and oral hygiene access improvement.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☐ Anterior	☐ Tooth	☒ Thick
☐ Lower Jaw	☒ Posterior	☒ Implant	☐ Thin

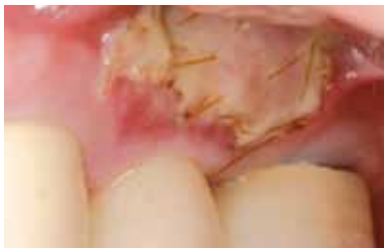
Material	› Geistlich Mucograft®
Technique	› Split-thickness flap and open healing

1 Pre-operative view. A small band of keratinised gingiva is present.



2 The band of keratinised gingiva is split and a split-thickness flap is elevated exposing connective tissue and periosteum.

3 Geistlich Mucograft® is sutured to the recipient bed and left exposed.



4 Underneath the fibrin clot, the area appears to granulate 1 week post-operative.

5 Excellent wound healing 4 weeks after surgery.

6 Post-operative follow-up after 2 months.

7 Surgery site view 3 months post-operative.

8 Lugol's iodine staining delineating keratinized tissue at 6 months.

9 Mucogingival appearance (4 mm of keratinised tissue) 6 months after surgery.

Conclusion: Geistlich Mucograft® can be used as an alternative to significantly increase the zone of keratinised and attached tissue around existing implants. In addition, good texture and colour match to surrounding native tissues was observed on the mucogingival tissues regenerated with the 3D-collagen matrix.

[1] Charles A, *submitted for publication*

Gain of keratinised tissue around teeth

Surgery by Dr. Enzo Vaia (Naples)

Aim: Increasing the width of keratinised tissue without harvest of autogenous soft-tissue graft.

Jaw	Region	Restorative Status	Gingival Biotype
☐ Upper Jaw	☐ Anterior	☒ Tooth	☐ Thick
☒ Lower Jaw	☒ Posterior	☐ Implant	☒ Thin

Material	› Geistlich Mucograft®
Technique	› Split-thickness flap and open healing

1 Lack of keratinised tissue in a patient with thin biotype, abrasion in 33, inexact filling on 34 and provisional crowns on 35 and 36.

2 The surgical bed is prepared. After stripping (split-thickness flap) the muscular fibres in the apical region are sutured to the periosteum.

3 Trimming, positioning, stabilisation and immobilisation of Geistlich Mucograft® with sutures 5.0.

4 The surgical site is protected with a periodontal dressing fixed in the interproximal spaces.

5 Clinical situation 10 days after surgery. Note the rapid granulation (healing) of the treated site.

6 Clinical situation 3 weeks after surgery. The treated site has re-epithelialised rapidly and the width of keratinised tissue is increased.

7 Follow-up 2 months post-operative. Note the gain of the gingival margin at the treated site.

8 Follow-up 6 months after surgery. Note the increase of keratinised tissue and its perfect integration to surrounding tissues.

9 Clinical situation 1 year post-operative. The obtained outcome remains stable.

Conclusion: The 3D-matrix Geistlich Mucograft® may be used successfully to increase keratinised tissue around teeth without the need of harvesting free gingival graft from the palate. The aesthetic outcome is optimal and stable over time (1 year).

Widening of attached gingiva prior to implant placement

Surgery by Dr. Ulrich Konter (Hamburg)

Aim: Widening of the attached gingiva using Geistlich Mucograft® for complex implant rehabilitation prior to augmentation and implant placement.

Jaw	Region	Restorative Status	Gingival Biotype
☐ Upper Jaw	☐ Anterior	☐ Tooth	☐ Thick
☒ Lower Jaw	☒ Posterior	☒ Pre-implant	☒ Thin

Material	› Geistlich Mucograft®
Technique	› Split-thickness flap and open healing

1 Initial situation: partially edentulous lower jaw with inserting muscle fibres, ligaments and reduced width of attached gingiva prior to bone augmentation procedure.

2 Vestibuloplasty with split flap preparation and apically fixed flap. After removal of muscle, scar fibres and ligaments, Geistlich Mucograft® is fixed with single and cross-over sutures.

3 Migration of small blood vessels into the Geistlich Mucograft® collagen matrix 2 days after surgery.

4 Harmonic integration of Geistlich Mucograft® collagen matrix after 2-week healing period.

5 Situation 2 weeks post-operative after suture removal.

6 Completely incorporated Geistlich Mucograft® collagen matrix 3 months post-operative. The width of attached gingiva has increased.

7 Follow-up picture 3 months post-operative, occlusal view. Insertion of muscular fibres is situated apically of the intended bone augmentation.

8 View on the inside of the elevated flap during augmentation procedure demonstrating the gain of thickness with Geistlich Mucograft®.

9 Uneventful healing 6 months after extensive bone augmentation.

Conclusion: The use of Geistlich Mucograft® for widening of the attached gingiva shows a good increase of width around teeth and implants comparable with autologous grafts – with significantly reduced morbidity by avoiding the palate wound. The shrinkage of the xenogeneic collagen matrix is higher than that of a free gingival graft (FGG), so an overextension of the preparation and matrix is mandatory. The colour match is excellent and much better than with a FGG.

Socket seal of posterior alveole in late implant placement

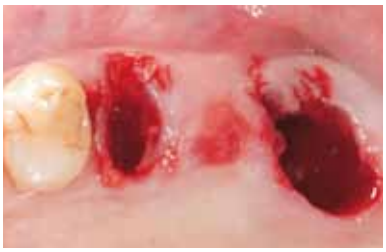
Surgery by Dr. Hadi Antoun (Paris)

Aim: Conservation of hard and soft-tissue volume after teeth extraction for late implant placement without sinus floor augmentation.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☐ Anterior	☐ Tooth	☒ Thick
☐ Lower Jaw	☒ Posterior	☒ Pre-implant	☐ Thin

Material	› Geistlich Bio-Oss® (0,25 – 1,0 mm) fines particles/Geistlich Mucograft® (15 x 20 mm)
Technique	› Socket seal

1 Examination of an unstable bridge between 25 and 27 revealed deep pockets as well as bleeding due to periodontal infection (terminal phase).



2 Extractions are performed atraumatically and without raising a flap. The alveolar sockets have been curetted with precision and prepared for receiving a biomaterial.

3 Occlusal clinical image: the alveolar sockets are filled and packed gently without excess of pressure.

4 Instead of using a tissue punch, alveolar sockets are sealed using Geistlich Mucograft®, which is fitted to the defect and held in place with cross-suturing (3.0 non-resorbable).

5 Healing after 1 week, just before suture removal. The gum shows a nice pink colour, indicating perfect tolerance of the biomaterial.

6 Healing after 2 weeks showing incomplete closure of the sockets but no exposed biomaterial. The collagen matrix effectively protected the site as the blood clot formed.

7 Healing after 4 months with soft-tissue maturation and maintenance of the horizontal volume of the crest.

8 Maturation and maintenance of tissue volume around the integrated implants 2 months after implant placement (or 8 months after extraction).

9 Clinical image 1 year after prosthetic restoration. Note the quality of the soft-tissue as well as the maintenance of the vestibular shaping.

Conclusion: Extraction with late implant placement is an extremely reliable procedure, which has been proven repeatedly in the international literature. The alveolar socket seal technique used in this clinical case, however, is relatively new. The time intervals between the healing of the alveolar socket and implant placement are the same as for the „tissue punch" technique. The technique of this clinical case has the following advantages: ridge volume preservation, lack of a second operation site, less surgical time, simplification of the procedure, soft-tissue volume preservation due to a socket sealing with Geistlich Mucograft®, and finally a sinus lift procedure is spared thanks to the hard-tissue preservation with Geistlich Bio-Oss®.

Socket seal of anterior alveole in late implant placement

Surgery by Dr. Ronald E. Jung (Zurich)

Aim: Preservation of hard and soft-tissue volume after extraction in the anterior region for late implant placement.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☐ Tooth	☐ Thick
☐ Lower Jaw	☐ Posterior	☒ Pre-implant	☒ Thin

Material	› Geistlich Bio-Oss® Collagen (100 mg)/Geistlich Mucograft® (20 x 30 mm) punch (ø 8 mm)
Technique	› Socket seal

1 Extraction of tooth 21 due to a trauma with concomitant external resorptions. Care was taken in preserving the alveolar bone.

2 Crestal view of the socket after tooth extraction. No flaps are raised around the affected area. A slight buccal bone defect was observed.

3 The socket is gently curetted for removal of granulation tissue. Subsequently, the wound margins were de-epithelialised with a diamond in a counter piece with water cooling.

4 Filling of the extraction socket with Geistlich Bio-Oss® Collagen to the level of the palatal bone.

5 After measuring the alveole, Geistlich Mucograft® is punched (8 mm diameter).

6 The Geistlich Mucograft® punch is placed on top of Geistlich Bio-Oss® Collagen to seal the filled alveole.

7 Suturing of the Geistlich Mucograft® with 6-0 single interrupted sutures.

8 Nice healing of the soft tissues 1 week after extraction.

9 Situation 7.5 months after extraction revealing nice soft-tissue situation with a slight dip at the buccal aspect.

Conclusion: Volume preservation of hard and soft tissue after tooth extraction is important to prevent extensive guided bone regeneration procedures at implant placement. With this minimally invasive procedure, the volume of hard and soft tissue can be better preserved with Geistlich Bio-Oss® Collagen and Geistlich Mucograft®, respectively, compared to spontaneous healing.[1]

[1] Jung RE, et al. J Clin Periodontol. 2013 Jan;40(1):90-8

Indication: Recession Coverage

Gingival recession occurs both in populations with high standards of oral hygiene[1] and in populations with periodontal disease resulting from poor oral hygiene.[2] Although a large variety of etiologic factors have been associated with gingival recession, its treatment is mainly motivated by aesthetic concerns and/or buccal cervical dentine hypersensitivity.[3,4]

Motivation for recession coverage treatment

- Aesthetics concerns[3,4]
- Buccal cervical dentine hypersensitivity[3,4]

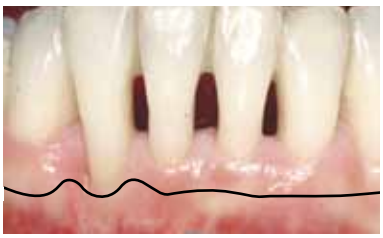
Classification

Several classifications of recession defects have been suggested in the literature based on the morphological properties,[5] distance from the cemento-enamel junction to the soft-tissue margin,[6] etc. Currently, Miller's Classification is probably the most widely used for describing marginal tissue recession.[7] This classification helps the clinician to assess whether a recession defect can be predictably treated.[7]

Miller Class I: Recession does not extend to the mucogingival junction. No periodontal loss of bone or soft tissue in the interdental area (courtesy of Dr. Abundo[8]).

Miller Class II: Recession extends to or beyond the mucogingival junction. No periodontal loss of bone or soft tissue in the interdental area (courtesy of Dr. Abundo[8]).

Miller Class III: Recession extends to or beyond the mucogingival junction. Bone or soft tissue loss in the interdental area or malpositioning of the teeth (extrusion, vestibularisation, rotation; courtesy of Dr. Abundo[8]).



Miller Class IV: Recession extends to or beyond the mucogingival junction. Severe bone or soft tissue loss in the interdental area and/or severe malposition of the teeth (courtesy of Dr. Abundo[8]).

Therapy Safety

Based on Miller's classification, treatment of Miller Class I and II type defects show high predictability and complete recession coverage can be achieved.[7] In defects with Miller Class III, partial root coverage can be anticipated whereas in Miller Class IV type defects, recession coverage is unpredictable [7] and may require adjunctive treatment (e.g. orthodontics). In addition, it is commonly accepted that recession treatments in the maxilla show higher predictability than in mandible.[9]

	Higher treatment predictability	Lower treatment predictability
Type of recession defects	Miller Class I and II[7]	Miller Class III and IV[7]
Localisation of recession defects	Maxilla[9]	Mandible[9]

Proven Efficacy

Geistlich Mucograft® in combination with a coronally advanced flap (CAF) presents a viable alternative to connective tissue graft (GTC) in recession coverage, without the morbidity of the soft-tissue harvest.[9,10] Also in combination with a coronally advanced modified tunnel, Geistlich Mucograft® may represent an alternative to CTG by reducing surgical time and patient morbidity.[11]

Geistlich Mucograft® with coronally advanced flap yields

- mean recession coverage comparable to CTG[10]
- gain of keratinised tissue comparable to CTG[9,10]
- lower patient morbidity than CTG[9,10]

[1] Serino G, et al. J Clin Periodontol. 1994 Jan;21(1):57-63
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[5] Sullivan HC & Atkins JH. Periodontics. 1968 Aug;6(4):152-60
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[7] Miller PD Jr. Int J Periodontics Restorative Dent. 1985;5(2):8-13
[8] Abundo R & Corrente G. „Chirurgia plastica parodontale – Trattamento estetico delle recessioni gengivali". ACME Edizioni, 2010
[9] McGuire MK & Scheyer ET. J Periodontol. 2010 Aug;81(8):1108-17
[10] Cardaropoli D, et al. J Periodontol. 2012 Mar;83(3):321-8
[11] Aroca S, et al. J Clin Periodontol. 2013 Jul;40(7):713-20

Single recession coverage with coronally advanced flap in thick biotype

Surgery by Dr. Daniele Cardaropoli (Turin)[1]

Aim: Restoration of the gingiva around the dental enamel junction, while avoiding an autogenous donor site.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☒ Tooth	☒ Thick
☐ Lower Jaw	☐ Posterior	☐ Implant	☐ Thin

Material	› Geistlich Mucograft®
Technique	› Split-full-split thickness flap (coronally advanced) and submerged healing

1 Before preparation of the flap the exposed root portion is cleaned with a scraper and is wiped with EDTA (or similar).

2 After measuring the dimension of the recession defect using a periodontal probe, the incisions for raising the flap are cut.

3 A split-full-split thickness flap is elevated and coronally mobilised.

4 The area of the papillae is de-epithelialised to allow anchorage of the flap coronal to the cemento-enamel junction.

5 Geistlich Mucograft® is applied dry to the defect and is fixed with 4 single sutures.

6 The coronally advanced flap is sutured over Geistlich Mucograft®.

7 Nice, uneventful healing 15 days post-operatively at suture removal.

8 Soft-tissue situation immediately after suture removal.

9 Complete root coverage 7 months after surgery. Note the excellent colour match.

Conclusion: The 3D-matrix, Geistlich Mucograft®, may be used successfully for recession coverage in combination with CAF. The device shows good, uneventful wound healing and excellent colour match, while avoiding harvest of autogenous soft-tissue grafts. Additionally, a gain in gingival thickness has been achieved with Geistlich Mucograft® at the end of the treatment.

[1] Cardaropoli D, et al. J Periodontol. 2012 Mar;83(3):321-8

Single recession coverage with coronally advanced flap in thin biotype

Surgery by Prof. Dr. Giovanni Zucchelli (Bologna)

Aim: Root coverage and increase in buccal soft-tissue thickness.

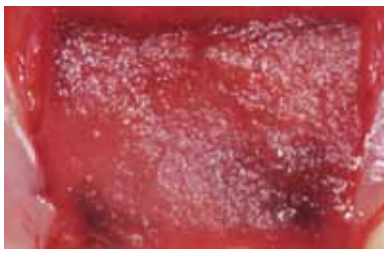
Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☒ Tooth	☐ Thick
☐ Lower Jaw	☐ Posterior	☐ Implant	☒ Thin

Material	› Geistlich Mucograft®
Technique	› Split-full-split thickness flap (coronally advanced) and submerged healing

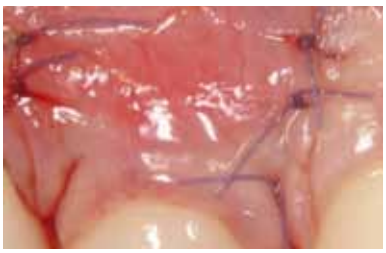
1 Pre-operative lateral smile showing the recession defect of tooth 14.

2 Pre-operative image of recession defect (tooth 14).

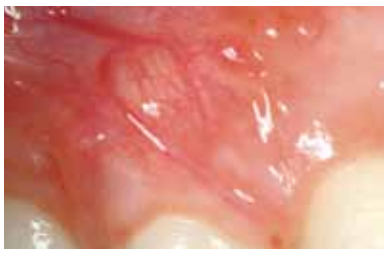
3 After elevation of split-full-split flap the interdental papillae are de-epithelialised.



4 Geistlich Mucograft® is placed over the root and sutured to the papillae.



5 The flap is mobilised, coronally advanced and sutured completely covering the Geistlich Mucograft®.



6 Healing of the surgical site 2 weeks after surgery.

7 Surgical site 6 months after surgery.

8 Outcome 1 year after treatment.

9 Lateral smile 1 year after surgery showing the optimal aesthetic outcome.

Conclusion: Aesthetic root coverage with CAF and Geistlich Mucograft® might be an alternative option to connective tissue graft and CAF. An increase of keratinised tissue and gingival thickness was observed during the healing of the treated site. In this case, 100% of root coverage and an excellent aesthetic outcome were achieved.

Single recession coverage with coronally advanced flap in thin biotype

Surgery by Dr. Michael K. McGuire and Dr. E. Todd Scheyer (Houston)[1]

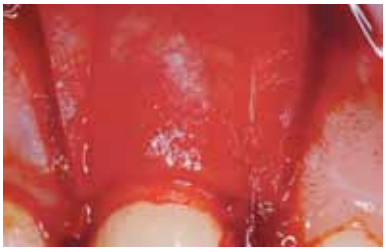
Aim: Root coverage combining Geistlich Mucograft® with coronally advanced flap (CAF) without the morbidity of soft-tissue graft harvest.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☒ Tooth	☐ Thick
☐ Lower Jaw	☐ Posterior	☐ Implant	☒ Thin

Material	› Geistlich Mucograft®
Technique	› Split-thickness flap (coronally advanced) and submerged healing

1 Pre-operative image showing the recession defect (tooth 13).

2 After elevation of a partial thickness flap, the interdental papillae are de-epithelialised.



3 Geistlich Mucograft® is placed over the defect and sutured to the papillae.

4 The flap is coronally advanced and sutured completely covering the 3D-matrix.

5 Healing of the surgical site 1 week after treatment.

6 Post-operative situation after 4 weeks.

7 Surgical site 3 months post-operative.

8 Optimal outcome 6 months post-operative. Note the natural appearance of the soft tissue achieved with Geistlich Mucograft®.

9 Outcome 1 year after treatment.

Conclusion: Recession coverage with Geistlich Mucograft® and CAF provides an acceptable option to connective tissue graft and CAF. A notable creeping attachment of the gingiva is observed in this case with Geistlich Mucograft® during the healing of the surgical site and optimal outcomes after 6 months appear to have further improved at 1 year follow-up.

[1] McGuire MK & Scheyer ET. J Periodontol. 2010 Aug;81(8):1108-17

Single recession coverage with modified flap design

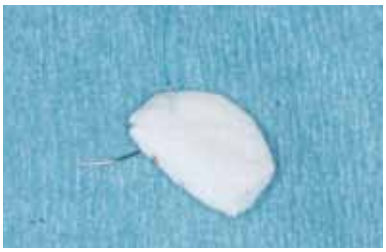
Surgery by Dr. Peter Lindkvist (Copenhagen)

Aim: Restoration of the marginal gingiva around the dental enamel junction on tooth 11, avoiding an autogenous donor site, and reducing scar formation with the modified incisions design.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☒ Tooth	☒ Thick
☐ Lower Jaw	☐ Posterior	☐ Implant	☐ Thin

Material	› Geistlich Mucograft®
Technique	› Coronally advanced flap with modified incisions design

1 Before preparation of the split flap, the exposed root is polished and scaled with a curette.



2 The size of the needed Geistlich Mucograft® is measured, and the graft material is contoured. For an easy fixation of the matrix it is penetrated with the 7.0 suture.

3 A split-thickness flap with a distal releasing incision is raised. The graft material is placed dry and fixed with a single U-suture.

4 The distal area of the papilla is de-epithelialised and the flap is rotated. The flap is sutured with a 7.0 monofilament suture.

5 Nice uneventful healing 10 days post-operative at suture removal.

6 Soft-tissue condition immediately after suture removal.

7 Soft-tissue condition after 3 months.

8 Healing after 7 months, with the wanted restoration of the gingival line. Note the excellent colour and only limited scar formation.

9 Post-operative result after 9 months with excellent colour and texture match and even less signs of scar-formation.

Conclusion: The Geistlich Mucograft® matrix can be used for coverage of Miller Class I recessions in combination with the coronally advanced split-thickness flap. An incisions design with a distal releasing incision will allow a tension free rotation and minimises the risk of scar formation.

Single recession coverage with laterally moved coronally advanced flap

Surgery by Dr. Hilde De Vree & Prof. Dr. Hugo De Bruyn (Gent)

Aim: Root coverage combining Geistlich Mucograft® with laterally moved, coronally advanced flap.

Jaw	Region	Restorative Status	Gingival Biotype
☐ Upper Jaw	☒ Anterior	☒ Tooth	☒ Thick
☒ Lower Jaw	☐ Posterior	☐ Implant	☐ Thin

Material	› Geistlich Mucograft®
Technique	› Split-thickness flap (laterally moved, coronally advanced) and submerged healing

1 Pre-operative clinical view of recession defect (tooth 41).

2 The root surface is planed and a split-thickness flap prepared (as described by Zucchelli et al 2004).

3 After de-epithelialisation of the papillae, the trimmed Geistlich Mucograft® is placed on the defect.

4 Geistlich Mucograft® is stabilised with 4 single sutures on the surgical bed.

5 The flap is moved laterally, advanced coronally and sutured completely covering the Geistlich Mucograft®.

6 Uneventful healing after 14 days.

7 Soft-tissue situation 3 months post-operative.

8 Occlusal view 3 months post-operative. Gain in gingival thickness can be observed.

9 Complete root coverage 6 months post-operative. Increased gingival height on tooth 41.

Conclusion: The laterally moved, coronally advanced surgical technique was combined successfully with Geistlich Mucograft® to treat an isolated gingival recession. Gain in gingival thickness and keratinised tissue could be observed. A nice blending of colour and thickness of the surgically treated area with respect to adjacent soft tissues was seen.

Multiple recession coverage with flap without releasing incisions

Surgery by Dr. Christine Romagna (Auxerre)

Aim: Covering of multiple recessions with minimal invasive treatment.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☒ Tooth	☐ Thick
☐ Lower Jaw	☐ Posterior	☐ Implant	☒ Thin

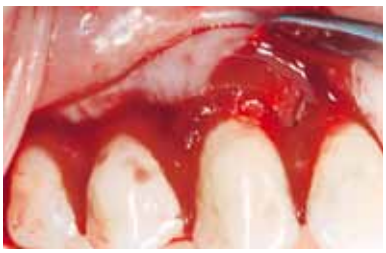
Material	› Geistlich Mucograft®
Technique	› Coronally advanced flap without releasing incisions and submerged healing

1 Pre-operative picture of the area intended to treat. Note the thin biotype.

2 Initial situation showing Miller Class I defects on region 13 (3 mm) and 14 (2 mm).

3 A split-full-split thickness flap without releasing incisions is elevated.

4 The anatomical papillae are de-epithelialised.



5 The collagen matrix Geistlich Mucograft® is placed under the flap.

6 Immediate post-operative situation after suture of the flap covering Geistlich Mucograft® completely.

7 Follow-up picture 2 weeks after surgery.

8 Nice healing of the site 1.5 months post-operative.

9 Pleasant aesthetic outcome 7 months after surgery.

Conclusion: Multiple recession coverage is achieved with a coronally advanced flap (split-full-split thickness) and Geistlich Mucograft®. The absence of releasing incisions allows nice healing of the soft tissue without scars. In addition, the use of Geistlich Mucograft® avoids harvest of autogenous connective tissue graft. This minimally invasive treatment offers a pleasant aesthetic outcome.

Multiple recessions with coronally advanced tunneling

Surgery by Dr. Oliver Brendel (Sindelfingen)

Aim: Complete coverage of exposed root surface due to functional and aesthetic demands.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☒ Tooth	☐ Thick
☐ Lower Jaw	☐ Posterior	☐ Implant	☒ Thin

Material	› Geistlich Mucograft®
Technique	› Tunnel technique (coronally advanced) and submerged healing

1 Multiple Miller Class I recession defects in the maxilla.

2 Intensive cleaning of the tooth crowns as well as curettage and smoothing of the tooth necks (e.g. with ultrasonic scaler and preparation diamond).

3 The mucosa pockets are prepared starting with sulcular incisions (envelope technique).

4 Connection of the envelopes with interdental undermining of the tissue.

5 Conservative mobilisation of the papillae. Consecutively, the exposed root surfaces are conditioned with EDTA 24%.

6 Analogous to the connective tissue graft, Geistlich Mucograft® is placed pulling through the tunnel.

7 Coronal positioning of the tunnel and fixation with the appropriate suture technique.

8 Two months after recession coverage, a natural appearance.

9 Clinical situation after 1 year: The papillae have readapted in a creeping effect. The recession coverage appears biologically stable.

Conclusion: Given a correct indication and taking aetiological and patient-related factors into consideration, Geistlich Mucograft® in combination with the tunnel technique can lead to reproducible and full recession coverage. It represents a good alternative to connective tissue grafting and obviates harvesting from the palate. Experience has shown that thickening of the tissue is somewhat lower than with connective tissue grafts, but the tissue appears more natural and shows outstanding colour and texture matching with the neighbouring tissue. The healing course is normal and free of complications, given the correct indication.

Multiple recessions with coronally advanced modified tunnel

Surgery by Dr. Sofia Aroca (Paris) & Prof. Dr. Anton Sculean (Berne)

Aim: Treatment of multiple recessions in the anterior region of the maxilla.

Jaw	Region	Restorative Status	Gingival Biotype
☒ Upper Jaw	☒ Anterior	☒ Tooth	☐ Thick
☐ Lower Jaw	☐ Posterior	☐ Implant	☒ Thin

Material	› Geistlich Mucograft®
Technique	› Coronally advanced modified tunnel (CAMT) and submerged healing

1 View at baseline of multiple recession-type defects. The contact points are splinted with composite for suspended sutures.

2 Tunnel preparation with tunneling instruments. The full-thickness dissection is made from the sulcular area to beyond the mucogingival line.

3 The papillae are tunnelised.

4 Geistlich Mucograft® is placed with the help of sutures on the right side.

5 Geistlich Mucograft® being placed under the tunnel in the same manner on the left side.

6 Geistlich Mucograft® is placed slightly above the cemento-enamel junction.

7 Geistlich Mucograft® on the left side.

8 The tunnel and the matrix placed and fixed in the coronal position with separated sutures suspended around the contact point.

9 Clinical view at 6 months.

Conclusion: The recessions were covered successfully with Geistlich Mucograft®. The gingival margin is stable. The tissue blending is excellent.

Benefits of Geistlich Mucograft®

- 3D-Matrix specifically designed for soft-tissue regeneration
- Ready to use
- Easy handling[1] and application in dry state
- Unlimited availability and constant quality[2,3]
- No harvest-site morbidity[1-5]
- Reduced surgical chair time[1,2,4,5]
- Early vascularisation and good tissue integration[6,7]
- Excellent wound healing also in open healing situations[1]
- Good colour and texture match[4,8,9]
- Optimal alternative to soft-tissue grafts for gain of keratinised tissue[1,2,10] and root coverage[5]

Higher patient satisfaction

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Geistlich Mucograft®
Collagen matrix
15 mm × 20 mm
Therapeutic areas: gain of keratinised tissue and recession coverage

Geistlich Mucograft®
Collagen matrix
30 mm × 20 mm
Therapeutic areas: gain of keratinised tissue and recession coverage

Geistlich Mucograft® Seal
Collagen matrix
8 mm diameter
Therapeutic area: extraction socket management

Geistlich Mucograft® / Geistlich Mucograft® Seal

The matrix consists of porcine collagen and is specifically designed for soft-tissue regeneration. Geistlich Mucograft® / Geistlich Mucograft® Seal is built up of a compact structure that gives stability while allowing open healing, and a spongy structure that supports blood clot stabilisation and ingrowth of soft-tissue cells.

- The maximum recession coverage that can be achieved is biologically determined by the cemento-enamel junction.
- Geistlich Mucograft® should remain completely submerged under the flap to avoid premature resorption of the collagen since blood supply is important.
- The flap should be sutured tension-free.
- Geistlich Mucograft® should not be compressed during or after surgery. Therefore avoid: suturing of Geistlich Mucograft® together with the flap, over-suturing of the flap, or post-surgical compression of the wound.
- When using Geistlich Mucograft® in recession coverage, outcomes often improve for at least 6 months post-operative by a creeping effect. Frequently this positive creeping effect lasts to one year.
- The application of Geistlich Mucograft® should be combined with coronally advanced flap (CAF) or coronally advanced tunnel technique.
- When using the coronally advanced tunnel technique besides the general guidelines for recession coverage, following should be considered:
  - Cutting, suturing and application in the dry state. During application, the matrix will rapidly be fully soaked with blood. Manipulation in wet state should be kept to a minimum.
  - Pulling, not pushing of Geistlich Mucograft® into the tunnel.

4. Socket Seal*

- Use of Geistlich Mucograft® Seal with Geistlich Bio-Oss® Collagen is recommended following atraumatic tooth extraction when the alveolar buccal walls are preserved. Definition of preserved extraction socket varies and may include minor bony defects from 0 to 50 % of buccal bone wall.
- Geistlich Mucograft® Seal must be used with a socket fill material (e.g. Geistlich Bio-Oss® Collagen).
- Before applying Geistlich Mucograft® Seal, adjacent soft-tissue margins should be de-epithelialised. This allows soft-tissue cells to migrate from the soft-tissue border into the matrix.
- Orientation of Geistlich Mucograft® Seal: The compact structure of the matrix should face outwards and the spongy structure towards the extraction socket. Geistlich Mucograft® Seal spongeous structure is striped for easier differentiation of the two sides.
- Geistlich Mucograft® Seal should be sutured using non-resorbable sutures, not glued. The close adaptation of the device to tissue boarders can be accomplished by single interrupted sutures, double interrupted sutures or cross sutures.
- The finest possible suture material comfortably used by the surgeon should be selected: for single interrupted sutures, the 6.0 or 5.0 suture size is recommended; for cross-suturing, a 5.0 suture size is appropriate.

- When suturing Geistlich Mucograft® Seal, assure a tension-free close adaptation of the device edges to the de-epithelialised marginal soft-tissue borders of the extraction socket.
- A provisional restoration, either removable or fixed, should not place pressure on the graft or cause tissue impingement.
- The Geistlich Mucograft® Seal protocol may be followed with either thick or thin gingival biotypes.
- Treatment with Geistlich Mucograft® Seal and Geistlich Bio-Oss® Collagen allows for different therapeutic options: from early implant placement (8-10 weeks after tooth extraction) to late implant placement or bridge restoration.

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* Geistlich Mucograft® Seal Advisory Board Meeting Report 2013. Data on file, Geistlich Pharma AG, Wolhusen, Switzerland.