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Use of a resorbable collagen membrane system in implant surgery

Today, the use of so-called „barrier membranes“ for guided tissue regeneration (GTR) and guided bone regeneration (GBR) has become an indispensable part of therapy within the scope of dento-alveolar and implantological procedures. Above all in implantology, the use of membranes makes it possible to achieve both a more efficient growth of bone-forming cells and optimal postoperative results.

Dr. Maximilian Jamil, Dr. Josephine Cordes, Dr. Mareike Jeromin/Brunswick, Germany

During the past few years, the use of membranes in dento-alveolar surgery has been further developed in various experimental approaches for influencing the new formation of bone. Membranes serve as mechanical barriers and control bone regeneration by preventing migration of rapidly migrating, fibroblastoid cells into the area of the bony defect. As a result, “slower” cells with osteogenic potential are used to fill the defective area with bone.[6,8,9]

As part of the further development of this controlled tissue regeneration, collagen membranes with the capability of being fully resorbed in the tissue were used.[1,2,3,4,5,10] This feature enables the practitioner to spare his/her patients a second procedure for removal of the membrane; this further increases the acceptance of such procedures on the part of the patients.

The resorbable membranes offer a versatile field of use. In the field of dento-alveolar surgery and implantology, membranes are used for covering of defects and for securing of augmentation material. Further indications within the scope of sinus-lift surgery include closure of perforations of the Schneiderian membrane as well as covering of the facial wall of the maxillary sinus.

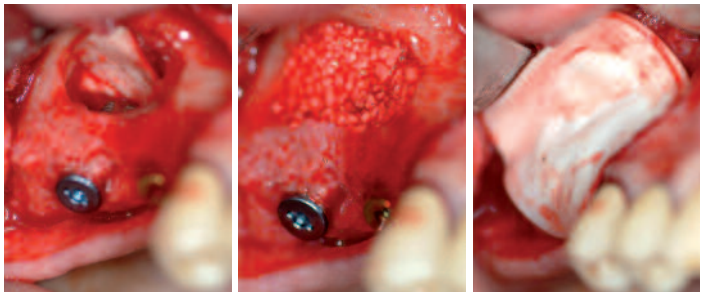

Fig. 1: Inserted collagen membrane (PARASORB RESODONT®, RESORBA Medical GmbH, Nuremberg) with perforation of the Schneiderian membrane in region 16 after insertion of implant. – **Fig. 2:** Mixture of autologous bone and alloplastic bone substitute (Cerasorb®, company curasan, Kleinostheim) inserted into the pre-formed cavity. – **Fig. 3:** Collagen membrane (PARASORB RESODONT®) inserted above the fenestration of the maxillary sinus for protection of the augmentation material.

Sinus-lift surgery

The sinus-lift surgery in the maxilla (maxillary sinus floor augmentation procedure) is one method of inserting implants in the maxillary lateral tooth area of the maxillary sinus, even with very low quantities of available bone. It is a safe and established treatment method.[11] After fenestration of the bone at the facial wall of the maxillary sinus, the Schneiderian membrane is dissected out in cranial direction and the implant is inserted so that it extends into the exposed maxillary sinus. Before inserting the implant, the membrane can be attached on top for protection of the mucosa of the maxillary sinus as well as in case of perfora-

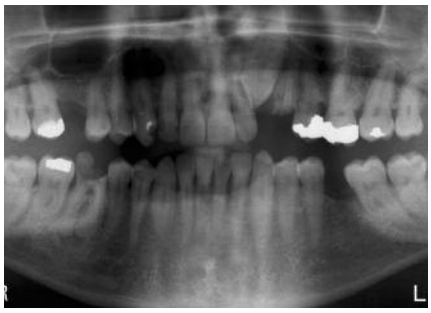
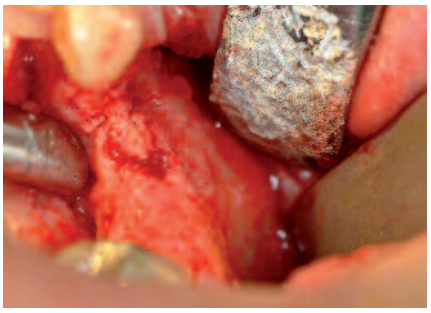
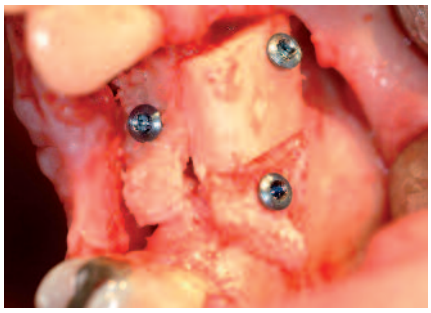

Fig. 4: Pre-operative panoramic tomography of case 1. – **Fig. 5:** Presentation of three-dimensional bone defect from occlusal view. – **Fig. 6:** Bone grafts fixed with micro-screws.

tion of the Schneiderian membrane (Fig. 1). The created cavity around the implant is then filled with a bone substitute (Fig. 2). A collagen membrane is placed above the fenestration of the maxillary sinus and the wound is closed to protect the inserted material against ingrowth of connective tissue (Fig. 3). When closing the wound, it should be ensured that the inserted membrane is not connected to the oral cavity at any place.

Bone augmentation

Depending on the degree of atrophy and the defect situation it may be necessary to augment bone near the implant site to achieve an aesthetically and functionally optimised result. For this, augmentation material from the oral cavity is seated and fixed in the defect. The remaining small areas without bone material are filled with particulated material. The area is covered with a collagen membrane to secure the augmented material in place and to keep resorption as low as possible. The use of a resorbable membrane system with two patients is described in the following.

Case 1

A 42-year old patient with a retained tooth 23 and a non-conservable tooth 25 (Fig. 4) came to our surgery. Despite minimally invasive surgical extraction of the teeth, the postoperative situation showed a combined horizontal and vertical bone defect. Treatment of the edentulous space by means of an implant-supported dental prosthesis should be performed primarily by augmentation with autologous bone.

Surgical procedure

After exposure of the bone defect (Fig. 5), the three bone grafts were taken from the mandible retromolarly on the left and fixed in region 23/24 by using titanium screws (system 1.5 mm, company: Martin, Tuttlingen) (Fig. 6). The remaining clearances were additionally filled with bone chips. A collagen membrane (PARASORB RESODONT®, RESORBA Medical GmbH, Nuremberg) of equine origin was used for covering the particulated bone material. This resorbable membrane consists of collagen fibrils and can be used on both sides. The membrane is available in three different sizes.

The collagen membrane was trimmed to the corresponding size in dry condition (Fig. 7) and then wetted with saline solution. The membrane is shaped so that the reconstructed area is covered completely and the membrane overlaps the edges of the defect by approx. 2 mm (Fig. 8). This enables form-fit positioning of the membrane on the bone, thus preventing lateral ingrowth of the rapidly growing fibroblastoid cells and the corresponding complementary inhibition of bone growth. The membrane was then fixed at the palatal mucosa by means of a transgingival suture to prevent dislocation.

After slitting of the periosteum, the mucoperiosteal flap is repositioned above the augmented area and the wound is closed by back-and-forth sutures. The mucosa fully covered the collagen membrane so that there was no connection to the oral cavity. Postoperatively, the patient was advised to adhere to soft food, physical rest and cooling of the area of surgical intervention.

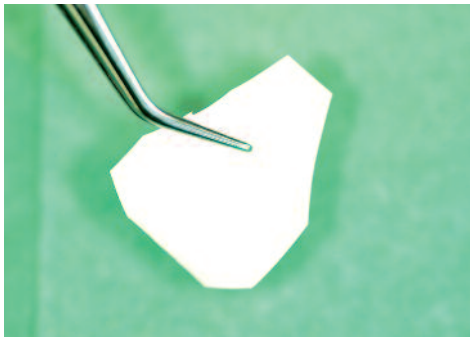
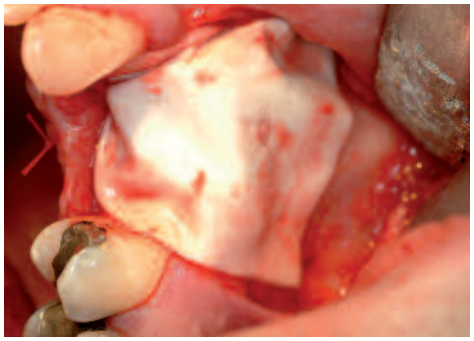
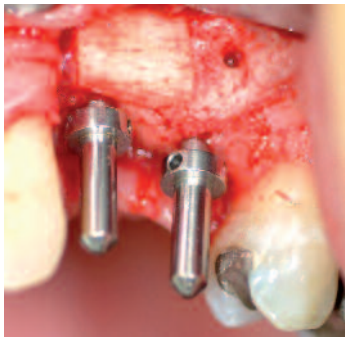

Fig. 7: Collagen membrane cut to the defect size. – **Fig. 8:** Augmented material fully covered by the collagen membrane. – **Fig. 9:** Inserted guide elements after removal of the osteosynthesis materials four months post operationem.

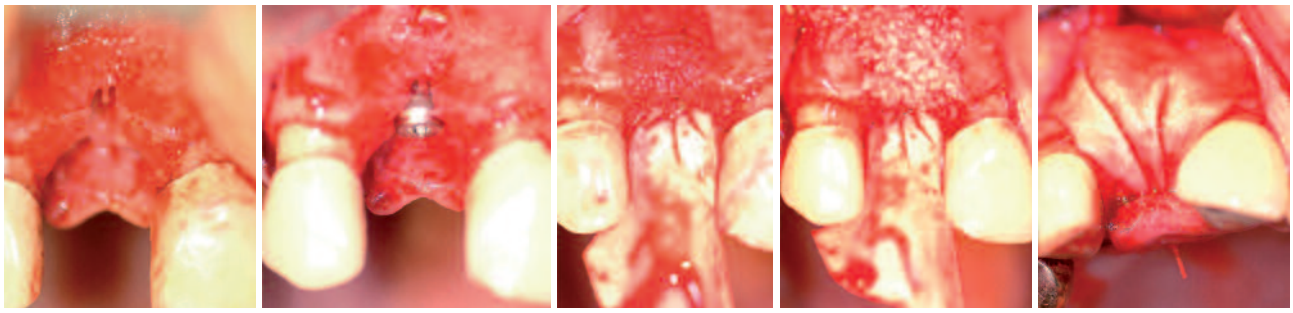

Fig. 10: Presentation of bone defect (above all horizontally) after implant drilling in region 12. – **Fig. 11:** Inserted implant with buccal bone defect at the level of the implant shoulder. – **Fig. 12:** Autologous bone material positioned on top of the defect; collagen membrane palatally fixed with suture. – **Fig. 13:** Bovine bone substitute serving as resorption protection. – **Fig. 14:** Collagen membrane positioned above the defect before wound closure.

The subsequent postoperative controls showed wound healing without complications, making it possible to insert two implants in region 23 and 24 four months post augmentationem after removal of the osteosynthesis screws (Fig. 9).

Case 2

A 63-year old patient came to our surgery with status post extraction of tooth 12 alio loco. The patient requested treatment of the single tooth gap in region 12 by means of an implant-supported dental prosthesis. Surgical procedure was correspondingly planned as insertion of implant with simultaneous augmentation and insertion of a xenogenous bone substitute for resorption protection of the augmented bone.

Surgical procedure
After exposure of the deficiently ossified alveolus (fig. 10) and preparation of the implant site, an implant (XiVE®, company Friadent, Mannheim) with a diameter of 3.4 mm and a length of 13 mm with a good primary stability (25 Ncm) was inserted (Fig. 11). As expected, there was a buccal bone defect in the area of the implant shoulder after insertion of the fixture.
Bone chips were taken from the area of the nasal spine and particulated by a bone mill (company: Aesculap, Tuttlingen) to cover the defect with autologous bone. The bone chips created in this way were applied to the exposed areas of the implant (Fig. 12), and a xenogenous bone substitute (Bio-Oss®, company Geistlich, Baden-Baden) was further implanted on top for resorption protection (Fig. 13). Then, a collagen membrane (PARASORB RESODONT®) was positioned above this area (Fig. 14), and tension-free wound closure was performed after slitting of the periosteum. Exposure of implant is planned after a period of four months.

Discussion

During the past few years, various experimental approaches for influencing the new formation of bone have been developed; implantation of mechanical barriers, the guided tissue regeneration (GTR) and the guided bone regeneration (GBR) are the methods that have particular importance in implantology. In case of bony defects, migration of rapidly migrating, fibroblastoid cells should be prevented. On the other hand, ingrowth of the "slower" osteogenic cells relevant for new formation of bone should be promoted. Consequently, the use of membranes is indicated in connection with the aforementioned indications based on present knowledge. The following features of the membrane were helpful in connection with these uses: the membrane should allow for diffusion and should be resorbable to spare the patient a second intervention for removal of the membrane. Further requirements include uncomplicated handling and sufficient dimensional stability after placement on the reconstructed area.
Except for dimensional stability (this is better achieved by non-resorbable systems), the collagen membrane presented in this document met these requirements and is correspondingly suited for use in dento-alveolar and periodontal surgery as well as in connection with augmentations and implant surgery. ■

References can be requested at the editorial office.

CONTACT

Dr. Maximilian Jamil
Wolfenbütteler Str. 22
38102 Brunswick, Germany
Tel.: +49 531 8861700
Fax: +49 531 8861701
E-Mail: praxis@kieferchirurg-braunschweig.de
Web: www.kieferchirurg-braunschweig.de

Dr. Josephine Cordes
Wolfenbütteler Str. 72
38102 Brunswick, Germany
Tel.: +49 531 2823320
E-Mail: Jo.cordes@gmx.de

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