A Review of Membranes in Surgical Dental Practice

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Today guided tissue regeneration (GTR) and guided bone regeneration (GBR) are standard procedures in surgical practice. The first attempts at osseous regeneration of a bone defect, excluding influences from connective tissue, by using cellulose acetate filters were taking place at the end of the 1950s (Hurley et al. 1959).

Indications for Guided Tissue Regeneration

Today membranes are used in the following areas:
- Dental implantology — with pre-implantological preparation of the alveolar crest and all forms of implantation.
- Periodontology — to replace lost periodontal structures and for periimplantitis treatment.
- Defect surgery — to reconstruct smaller bone defects (Becker et al. 1995). There are two biologically degradable product classes:
  1. Synthetic polymers such as polyactic acid, polyglycolic acid (Vicryl®) and their chemical modifications (Gore Resolut®, Artisorb®), and
  2. Xenologous collagens (Biodentine®, BioMend™, bovine origin).

Membranes are intended to prevent the proliferation of connective tissue cells into a bony defect, create and maintain an artificial antrum in which the bony regeneration can take place, be biocompatible and cell occlusive, and provide some protection against infections. Clinical manageability needs to be ensured with their use.

Classification of Membranes

Today a range of membranes is available for which a classification into resorbable and non-resorbable membranes appears logical. There are two classes:
- Barriers from calcium sulfate (Captor® or titanium in net, lattice or wire form (Frios® Bone Shield, Tiomesh) have their uses (Paulus 1996, Eistickerhandbuch 2000). Today two types are favored: the resorbable collagen membranes and the non-resorbable e-PTFE membranes (Watzek 1999). The advantage of resorbable membranes is the low degree of stress on patients due to the absence of an exposure operation, which allows protection of soft and hard tissue structures. It is important to note that not only resorbable materials must be biocompatible during the implantation phase, but also waste products from decomposing membranes. Moreover, re-osification of the defect region at the time of disintegration of the membrane should have occurred. A period of three months is thought to be ideal for this (Schlegel 1996).
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- Xenologous collagens (Biodentine®, BioMend™, bovine origin).

Membranes & Bone Replacement Materials

Membranes are often used in combination with bone transplants as spacers or fillers. Different antrum fillers are used:
- autologous bone,
- bone mineral structures (calcium phosphate ceramics [Cerasorb®] and xenogenic materials [Bio-Oss®]),
- homologous bone products (FDBA freeze-dried bone allograft) or
- collagens (in liquid, paste, sponge or membrane form).

When selecting, consideration needs to be given to what extent the bone regeneration is positively influenced by the spacer (Schlegel 1996). Complications with the application of membranes are, for example, membrane expositions caused by dehiscence (depending on the author, this is between 4% and 80%). With non-resorbable membranes removal is necessary due to the therapy resistant bacteria colonization of the surfaces and the resulting osteolysis. The TefGen® membrane is an exception as it can remain in situ for three to four weeks in case of accidental exposure.

Clinical Case Examples

Following is documentation of the use of different augmentation systems and membranes using case examples. As some operations were performed abroad, materials that aren't yet approved in Germany were used.

Case 1: Front tooth trauma, upper jaw
The 41-year-old female patient lost her incisors (11, 21, 22) in an accident approximately 25 years ago. When she came to the practice she had had implants two years ago that had to be removed three months later. After explantation, no measures were taken to rehabilitate the lost bone. The missing teeth have since been replaced by a provisional bridge (Fig. 1).

The extent of the jaw bone loss through atrophy and as a consequence of the lack of augmentation can be clearly seen on the palatal view (Fig. 2). The pillar teeth had root treatments and were provisioned with pins (Fig. 3). After checking the retention worthiness and doing an appropriate root canal treatment of the remaining teeth, an augmentation to create an alveolar crest in which implants can be inserted later was planned. The procedure had to be performed in two phases in this instance as the primary stability with an immediate implantation could not be guaranteed.

The missing bone parts were replaced with Cerasorb® after surgical exposure involving a slightly palatinally positioned pararectal incision (Fig. 4).