Ridge preservation/restoration using d-PTFE membranes

A protocol for using non-resorbable membranes immediately after extraction with creation of keratinised gingiva

Having attended several EAO congresses over the last 10 years, we noticed that very few to none of the presentations discussed the use of d-PTFE membranes immediately after an extraction. The role of this type of membrane in bone augmentations was only discussed during a couple of short oral presentations and in some posters. The goal of this article is to inform EAO members and other readers about the interesting indications for placing a d-PTFE membrane directly after extraction.

A variety of alveolar ridge preservation and augmentation techniques have been described in the scientific literature. Autologous bone or bone substitutes can be used to fill the alveolar process/dental alveolus. A resorbable membrane or collagen plug can be used as a cover. In addition, non-resorbable membranes have a role to play in the ridge preservation/restoration process.

The non-resorbable e-PTFE (Gore-Tex) membranes which were previously available were not suitable for this purpose. Instead, a d-PTFE (Teflon) membrane (Cytoplast) is required because unlike e-PTFE this remains in function if exposed to the oral cavity. This is because d-PTFE membranes are non-permeable to bacteria. A study by Hoffmann et al. (2008) reported minimal changes in the alveolar process when a d-PTFE membrane was placed following an extraction. An additional advantage is the increase in the width of the zone of keratinised gingiva when using this type of membrane (Barboza et al. 2014).

Application of d-PTFE membranes in practice

We have been applying d-PTFE membranes directly following extractions for a considerable period of time within our practice, and with good results. Their use means that after a healing period we can place implants surrounded by hard bone and keratinised tissues with sufficient dimensions in around 95% of all cases. The following case illustrates one example of the technique.

The case concerns a 50-year-old woman who had been referred for treatment of periodontitis. She underwent treatment in accordance with the Dutch periodontology protocol, resulting in a predominantly stable and healthy reduced periodontium. Endodontic retreatments were performed on teeth 36 and 37 (tooth 36 had had an apex resection in the past). However, in the 36 an endo-periodontal problem developed with the feeling of drilling into hard, natural bone. Some months later the crown was placed by the referring dentist (Figure 9).

Figure 8. X-ray image of molar 36.
Figure 9. CBCT image of the 36. The arrow indicates the considerable amount of bone loss on the vestibular side.

A potential complication can occur when using this technique if the edge of the membrane is not fully covered by the soft tissues during the healing period. This will create a portal of entry for bacteria, which has a negative impact on the process of bone augmentation. In such a case, early removal of the membrane is required. The amount of regeneration will then depend on the length of time the membrane has remained in position, well covered by soft tissues.
Conclusion

Using a d-PTFE membrane directly following an extraction is a valuable technique because it has been clinically demonstrated to lead to good results. The placement of implants becomes easier and more predictable when this technique is used. It also considerably increases the likelihood that at the time of implant placement no additional bone augmentation procedure will be needed (including sinus lifts). The d-PTFE membrane will preserve/restore the shape of the alveolar ridge and increase the amount of keratinised gingiva, even in compromised situations. Likewise, the presence of a wide zone of keratinised tissue will increase the chance of stable peri-implant tissues. However, this technique requires further studies to investigate its limitations. Furthermore, its success is linked to the skill and knowledge of the practitioner and it should only be undertaken by well trained and suitably experienced surgeons.
Question and answer with the authors

1. Do you have any experience of using this technique without any bone substitutes? No, we use bone substitutes because we want to provide as much support as possible to rebuild the alveolar process and to speed up the formation of the osteoid matrix. As the case shows, our aim is to regenerate bone horizontally and vertically outside the affected/reduced bony walls. Studies which report on vertical augmentations with e-PTFE membranes show an advantage when a bone substitute is used as a filler (Simion et al. 1998, Tinti et al. 1998), so we combine membrane placement after extraction with a bone substitute. Interestingly, the study by Hoffmann et al. (2008) describes the same technique as illustrated in our case using d-PTFE membranes but without titanium reinforcement and without bone fillers. The study excluded clinical situations where the lingual bony wall was affected and/or more than 50 % of the vestibular bony wall was missing. Hoffmann reported very small reductions in the shape of the alveolar process after 12 months. The largest changes of 2mm were found in the centre of the extraction site where the d-PTFE membrane had the least support. Histology 12 months after extraction showed newly formed tissues consisting mainly of new alveolar bone following the existing outline of the bone walls present at the time of extraction. So to improve the results and technique reported by Hoffmann, we use bone substitutes in combination with titanium reinforced membranes to regenerate as much bone as possible. The goal is to obtain the original size of the alveolar process.

2. Do you have any experience of using this technique with other bone substitutes? No we do not. However, in a review of animal studies by Nakajima et al. (2007) and Fiorellini et al. (2007) which investigated the regeneration and osseointegration of mandibular defects using e-PTFE membranes and various bone fillers, some indications can be found. It is important to stress that in these studies bone augmentation was carried out in a conservative way, so not directly after extraction and with wound closure. After a healing period of 8 months, the authors reported no significant differences between different bone fillers including autogenous bone, DFDBA, anorganic bovine bone, TCP granules, collagen sponge and no filler (control). We think this gives an indication that alternative bone fillers will also perform well with a d-PTFE membrane placed directly after extraction.

3. Could you describe in detail the surgical procedures (in particular the placement of the membrane and the suturing of the flap)? Following anaesthesia, the tooth or molar is extracted astraumatically as possible using instruments including periotomes, a Piezon and a root extraction system, separating roots if applicable. After the extraction, the alveolus is carefully cleaned and all granulation is removed. The tissue is then manually cut from the underlying bone all around the extraction site. We then place a titanium reinforced d-PTFE membrane underneath the tissue, without a flap if possible (if the amount of bone destruction is large, or the augmentation area is broadened to an adjacent edentulous area, a limited flap can be raised). In the case illustrated here a small flap on the vestibular side was raised as the vestibular bone wall was largely missing. The membrane is placed between the bone and the tissue on one side after which an allologenic bone graft material is put into the alveolus as a filler. Care must be taken to place the membrane with the textured surface (with small dimples) outwards, i.e. facing the oral cavity. The remaining edge of the membrane is then also placed between the bone and the tissue. Some bending of the titanium reinforced part of the membrane is required to make this possible. By doing this, the desired shape of the membrane can be achieved. A substantial part of the membrane will not be covered with tissue, thus creating a deliberate exposure. However, the edges of the membrane must be covered with tissue. The wound margins are sutured using a horizontal mattress suture, single or cross suture.

4. Do you recommend particular post-operative procedures to the patient? No, not really. We believe that post-operative procedures like chlorhexidine rinsing twice a day, antibiotics (Amoxicillin 500 mg 1 week, 3 x a day), and avoiding chewing or applying forces on the affected area are pretty standard after all augmentation procedures.

References