Healing complications in guided bone regeneration (GBR) can be frequent when nonresorbable membranes are used. Exposure of dense polytetrafluoroethylene (d-PTFE) membranes to the oral cavity are usually located close to the incision line due to a lack of tension-free flap closure. This case report presents a safe, novel technique that uses d-PTFE membranes placed on the missing buccal and palatal bone walls without covering the coronal aspect of the regeneration. Therefore, these membranes can be kept away from the incision line to minimize the risk of exposure. The coronal part is then covered with a resorbable membrane. A clinical case is presented, using this novel technique to three-dimensionally reconstruct noncontained defects in the maxilla. This technique is safe and effective in regenerating these defects; after 8 months of healing, three implants could be placed with proper primary stability. Further, histologic and histomorphometric analyses revealed functional bone with areas of new bone formation. However, more long-term studies are required to validate this technique. Int J Periodontics Restorative Dent 2021;41:857–862. doi: 10.11607/prd.5143

Guided bone regeneration (GBR) has been demonstrated to be a safe and predictable treatment therapy for reconstructing horizontal and vertical bone defects. Although GBR procedures have lower complication rates than other bone regeneration techniques, the complication percentages can vary from 5.8% to 31.8%. These complications are higher when expanded polytetrafluoroethylene (e-PTFE) membranes are used due to early or late exposure of the barrier to the oral cavity.

High-density PTFE (d-PTFE) membranes offer an alternative to e-PTFE, as their nonporous configuration makes them more resistant to trespassing bacteria colonizing the underlying regenerating tissue once exposed to the oral environment. The use of d-PTFE membranes in GBR procedures has been proved successfully in clinical studies. However, assessment of the incidence of membrane exposure and d-PTFE membrane complications are scarce in the literature.

Gallo and Díaz-Báez reported the management of 80 complications using d-PTFE membranes in horizontal and vertical defects. In that study, 55 out of 80 membranes were exposed to the oral cavity, most of them located in the maxilla and coronal areas of the defect and < 3 mm away from the alveolar crest.
Moreover, 55% of these complications were accompanied by suppurative exudate. The incidence of such complications indicates that the cause of exposure was probably due to improper tension-free wound closure, especially in the maxillary defect sites.

A novel GBR technique is presented that uses d-PTFE membranes to three-dimensionally reconstruct noncontained alveolar defects. These membranes are placed at the missing buccal and palatal bone walls and away from the incision line of the flap in order to reduce the possible membrane exposure.

**Case Presentation**

A healthy 65-year-old woman presented with maxillary partial edentulism localized in the first quadrant (Fig 1). Tooth extractions were performed 4 months prior due to extensive periapical lesions in teeth 14, 15, and 16 (FDI tooth-numbering system). CBCT exploration revealed extensive periapical lesions with a through-and-through bone defect in the area of tooth 16, in which the buccal and palatal walls were missing. In the area of teeth 14 and 15, a three-wall defect was detected, missing the buccal wall. GBR in combination with d-PTFE membranes was selected to reconstruct the residual ridge.

A midcrestal incision was made to reflect full-thickness buccal and palatal flaps (Fig 2a). The clinical measurements of the defects on the vertical and horizontal dimensions were 7 mm and 10 mm, respectively (Figs 2b and 2c). Then, nonreinforced d-PTFE membranes (Cytoplast TXT-200 Singles, Osteogenics Biomedical) were fixed using pins on the buccal and palatal areas in order to create an artificial screen (the missing bony walls), aimed at containing the bone substitute material. The membranes leave the coronal aspect of the reconstruction uncovered, avoiding close proximity of the membranes to the incision line of the flap (Figs 3 and 4a). Autogenous bone chips were harvested from the surrounding areas with a bone scraper (Safescraper, Osteogenics Biomedical) and mixed with xenograft particles (NuOss,
Ace Surgical Supply) with a 60:40 ratio. The composite graft was placed between the nonresorbable membranes to fill the defects (Fig 4b). Then, a cross-linked resorbable collagen membrane (ConFORM, Ace Surgical Supply) was placed on top to cover the crestal portion of the grafted site and was fixed with simple sutures (Fig 4c). Tension-free flap closure was achieved by performing periosteal releasing incisions, and the flap was closed using interrupted simple sutures (Fig 4d). Sutures were removed after 2 weeks. One week later, soft tissue healing was evaluated (Fig 4e).

Results

The site was allowed to heal for 8 months to achieve bone maturation. Healing was uneventful, and no membrane exposure was found (Fig 5a). A new CBCT scan revealed enough bone formation to allow implant placement. At the reentry surgery, after full-thickness flap elevation, nonresorbable membranes were removed (Fig 5b). With the use of a surgical guide, bone biopsy samples were taken from the regenerated sites of teeth 15 (bone biopsy A) and 16 (bone biopsy B) with a trephine bur (3-mm external diameter) that was used as the initial drill for implant placement. Bone samples were sent for histologic

Fig 4  (a) d-PTFE membranes were placed as a screen to contain the defect, and (b) composite biomaterial was placed inside the defect. (c) A cross-linked resorbable membrane was placed to protect the coronal part of the particulate graft. (d) Interrupted simple sutures were used to close the flaps. (e) The clinical appearance at 3 weeks postoperative shows good soft tissue healing.
Clinically, bone density was found to be adequate, with consistent bone formation into the defects that allowed correct primary stability (> 50 Ncm) of the implants. Three 4.1 × 10–mm Bone Level Implants (Straumann) were placed in tooth sites 14, 15, and 16 (Fig 5c). After 4 months of osseointegration, a modified roll-on technique was performed to improve the quantity and quality of the peri-implant soft tissues (Figs 6a and 6b). After 2 months, the final screw retained bridge prosthesis was delivered (Figs 6c and 6d).

The histologic results revealed vital trabecular bone and connective tissue with vascular formations of different sizes in both biopsy samples. Acellular elements could also be recognized, corresponding to the residual graft material (Fig 7). Histomorphometric results from sample A showed 54.01% new bone formation, 43.98% connective tissue, and 2.01% residual bone. Results from sample B showed 29.97% new bone formation, 50.03% connective tissue, and 20% residual bone.

At the 1-year follow-up, periapical radiographs were taken to assess marginal bone maintenance around the implants in the regenerated sites. Marginal bone level was maintained in all implants (Fig 8).

The present novel technique proved to be effective in three-dimensionally regenerating the noncontained defect at tooth site 16 and the three-wall defect at tooth site 15. Implants could be placed in the regenerated bone with a high insertion torque (> 50 Ncm).

Not having any complications during the healing period encour-
The modified roll-on technique was used in order to increase the volume and band of keratinized tissue. The modified roll-on flap was sutured around the healing abutments. Clinical appearance after 2 months of soft tissue management and with the final prosthesis in place.

Figures

Fig 6
(a) The modified roll-on technique was used in order to increase the volume and band of keratinized tissue. (b) The modified roll-on flap was sutured around the healing abutments. (c) Clinical appearance after 2 months of soft tissue management and (d) with the final prosthesis in place.

Fig 7
Histologic views of (a) biopsy sample A and (b) biopsy sample B.

Fig 8
Periapical radiograph taken 1 year after final prosthesis delivery.

Histomorphometric analysis of the bone biopsy sample retrieved from tooth area 16 showed 29.97% of new bone formation, 50.03% of connective tissue, and 20% of residual graft. These percentages are similar to other studies where d-PTFE membranes were used to cover the entire vertical defects. However, these percentages differed from those obtained in the biopsy sample retrieved from tooth site 15, where 2.01% of residual graft and 54.01% of new bone were present. This could be explained by the fact that this biopsy sample was likely taken close to the remaining walls of the bone defect, where more native bone was present.

Conclusions

Within the limitations of the present case report, this technique can be a useful alternative in the positioning of d-PTFE membranes; it can avoid close contact with the incision line and can be positioned close to the crestal areas, where membrane exposures are frequently encountered. Further long-term and follow-up studies with higher case numbers are needed to validate this technique.
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References


