



Minimally Invasive Alveolar Ridge Preservation/Augmentation Procedure (Open Barrier Membrane Technique)

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INTRODUCTION

Conventionally, expanded polytetrafluoroethylene (e-PTFE) has been widely used for guided bone regeneration (GBR). In implant dentistry, e-PTFE membrane became a standard for GBR in 1980s and early 1990s. However, several disadvantages of the membranes has been recognized. A major complication with e-PTFE membranes is wound dehiscence and membrane exposure. Early membrane exposure causes infection and results in severely compromised amount of bone regeneration.

In 2005, Funakoshi introduced "Open Barrier Membrane Technique" as novel minimally invasive GBR technique using non-expanded, high-density PTFE (d-PTFE) membrane. A significant advantage of d-PTFE membranes is impenetrable for bacteria because of its surface characteristics (0.2µm low porosity). Because of this smooth surface, this membrane can be left intentionally exposed and primary closure is not required. Because no primary coverage is necessary, there is no need for periosteal releasing incisions causes swelling and pain.

The aim of this retrospective study was to evaluate the clinical regeneration of alveolar ridge preservation/augmentation using d-PTFE membranes with the use of bone graft materials.^{1,2}

MATERIALS & METHODS

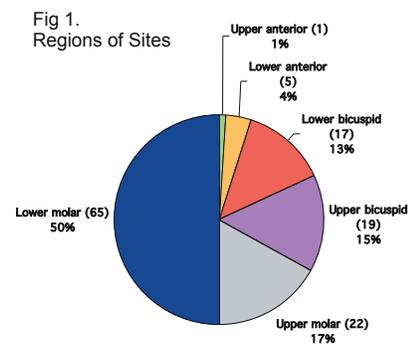
A total of 129 extraction sockets and alveolar ridges post extraction were evaluated in 111 subjects (49 males and 62 females; mean age, 58 years; age range: 31 to 83 years). Complete patients description is shown in Table 1 and Fig 1. The extraction sites

(socket type : 86 sites) and deficient alveolar ridges (ridge type : 43 sites) were treated with open barrier membrane technique for the placement of implants during 2002~2009.

Surgery After reflection of the mucoperiosteal flaps, autogenous bone or bone substitute and combined with enamel matrix derivative (EMD) and/or platelet rich plasma (PRP), was placed into the extraction socket or onto the deficient ridge where a d-PTFE membrane (Cytoplast® GBR-200, TXT-200, Osteogenics) was then placed over the site. The flaps were repositioned and sutured without periosteal releasing incisions. Intentional primary closure was not attempted, i.e., the membrane was left exposed. The membrane was removed at 4 to 6 weeks after surgery without anesthesia (not surgical procedure). The grafted sites had dental implants placed 4 to 6 months after membrane removal.

Table 1. Patients Description

| | n | % |
|------------|-------|-----|
| Patients | | |
| Sex | | |
| Male | 49 | 44% |
| Female | 62 | 56% |
| Age | | |
| Mean | 58 | |
| Range | 31-83 | |
| Smoking | | |
| Nonsmoking | 101 | 91% |
| Smoking | 10 | 9% |



Radiographic analysis Radiographic evaluation was performed for the treated sites. Vertical ridge changes were evaluated during the healing stage retrospectively. Following radiographic measurements were performed on the panoramic x-lay (Fig 2) : (1) depth of the defect (2) grafted (filled) bone height at surgery (3) bone loss at removal of membrane and (4) bone loss at implant placement. The

results were classified as either socket or ridge type according to the defect morphology and the mean values were calculated.

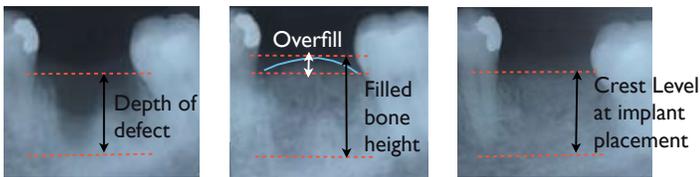
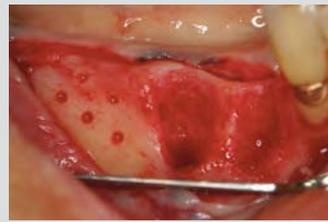


Fig 2.

Case 2: Ridge type | Female | Age-68Y | Non-smoker



a) Vertical and horizontal deficient alveolar ridge.



b) Bonegraft was performed to reconstruct the ridge.



c)



d)

c) At 6 weeks after surgery, the membrane was removed easily with cotton pliers. Smooth premature bone tissue could be seen.

d) 6 months later, four implants were successfully inserted into the regenerated alveolar bone. The deficient ridge was completely restored to sufficient volume of ridge width and height.



e)

e) 6 months after final restoration. Osseointegration was obtained clinically.

Case 1: Socket type | Female | Age-64Y | Non-smoker



a) Radiograph after extraction.



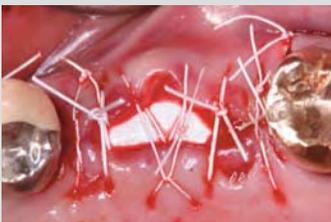
b) Both the buccal and lingual walls were lost. Note that the original ridge was curved.



c) Bone graft was performed and the membrane was placed



d) Bone was filled to horizontal level.



e) The membrane was intentionally exposed without periosteal releasing incision.



f) After 4 weeks, the membrane was removed without surgery. No evidence of inflammation.



g) 6 months after surgery, before implant placement. Missing walls were restored to full contour.



h) Radiograph before implant placement. The bone level was maintained.



i) Radiograph at definitive restoration.



j) Keratinized gingiva was preserved.

RESULTS & DISCUSSION

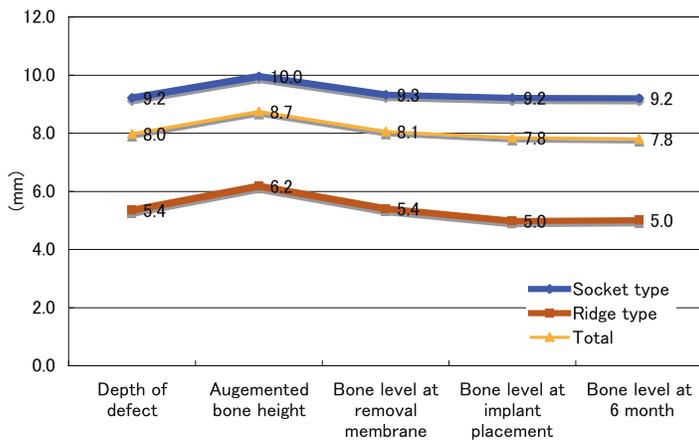
Clinical findings None of the patients reported any unusual pain, swelling or discomfort during the treatment. No infection or inflammation was present, although the membranes were exposed partially and plaque adhered on surfaces of the membranes at almost cases. After membrane removal, premature bone covered by smooth red non-epithelialized soft tissue was observed. The tissue re-epithelialized completely within 1 month. Keratinized gingiva was preserved at all sites, and furthermore, some cases showed enhancement. All sites had successfully placed implants and osseointegration was clinically obtained.

Alveolar crest change measurement Complete results are shown in Table 2 and Fig 3. Both socket and ridge type sites showed excellent bone gain as 100.9% and 95.8% respectively, with no significant differences between the types ($P = .12$). A little amount of bone loss (0.8 mm total) was found at implant placement. A total of 60 sites (47%) were overfilled.

Table 2. Vertical Alveolar Ridge Crest Changes (Mean±SD)

| | Depth of defect | Filled bone height at surgery | Bone level at removal membrane | Bone level at implant placement | Bone level at 6months after placement | Augmented bone gain rate at implant placement |
|--------------------|-----------------|-------------------------------|--------------------------------|---------------------------------|---------------------------------------|---|
| Socket type (n=86) | 9.2±1.9 | 10.0±1.6 | 9.3±2.3 | 9.2±1.8 | 9.2±2.2 | 100.9% |
| Ridge type (n=43) | 5.4±3.4 | 6.2±3.6 | 5.4±3.8 | 5.0±2.8 | 5.0±3.5 | 95.8% |
| Total (n=129) | 8.0±2.9 | 8.7±2.8 | 8.1±3.4 | 7.8±2.7 | 7.8±3.3 | 99.6% |

Fig 3. Alveolar Ridge Crest Changes



These results indicated that this technique using d-PTFE membrane predictably provided stable regenerated bone volume. To achieve reconstruct complete alveolar ridge is often required three dimensional bone overfilling. This technique facilitates the overfilling because primary coverage is not required. The advantages of the technique are reported in Table 3. Interestingly, the volume of bone loss corresponded approximately to the volume of overfill (0.9mm total).

Table 3. Advantages of Open Barrier Membrane Technique

- Minimally invasive and simple procedure
 - No need for primary closure
 - No periosteal releasing incision
 - Preserve/enhance keratinized gingiva
 - Without surgery at membrane removal
- Easy to achieve overfilling to reconstruct complete ridge

CONCLUSION

Non-expanded dense PTFE membranes predictably provided sufficient regenerated ridge suitable for implant placement. Open barrier membrane technique can be a new standard for alveolar ridge preservation and augmentation.

REFERENCES

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