Healing of dehiscence-type defects in implants placed together with different barrier membranes: a comparative clinical study

Ofer Moses
Sandu Pitaru
Zvi Artzi
Carlos E. Nemcovsky

Authors’ affiliations:
Ofer Moses, Zvi Artzi, Private Practice, Tel-Aviv, Israel
Sandu Pitaru, ColBar Research and Development, Ramat Hasharon, Israel
Carlos E. Nemcovsky, Dental and Maxillofacial Center, Tel-Aviv Medical Center, Tel-Aviv, Israel

Correspondence to:
Dr Carlos E. Nemcovsky
Department of Periodontology
The Maurice and Gabriela Goldschleger School of Dental Medicine
Tel Aviv University
Tel Aviv
Israel
Tel.: 972-3-6409350
Fax: 972-3-6409350
e-mail: carlos@post.tau.ac.il

Key words: collagen, dental implants, endosseous dental implantation, guided bone regeneration, membrane

Abstract

Objective: Premature exposure of membranes used in guided bone regeneration (GBR) results in decreased bone formation. The effect of an expanded polytetrafluoroethylene (e-PTFE) and two collagen membrane on bone healing of buccal dehiscence defects around implants in cases with and without premature membrane exposure was clinically evaluated.

Methods: Three groups were established: Group OS (Ossix™, n = 73 implants, 41 patients), Group BG (Bio-Gide®, n = 53 implants, 28 patients) and Group GT (e-PTFE, Gore-Tex®, n = 34 implants, 17 patients). Defect height and width were measured at the time of implant placement and at second stage surgery. Surface area was calculated as half ellipses. When several implants were placed simultaneously, a mean of their defect width and height was calculated.

Results: Mean percentage reduction of defect area (92.2 ± 13.78% Group OS, 94.6 ± 6.69% Group BG, and 97.3 ± 4.91% Group GT) and height (81.6 ± 23.19%, 85.4 ± 12.26%, and 93.4 ± 9.39% respectively) did not show statistically significant differences between groups. Differences between groups were not statistically significant for all parameters when cases without spontaneous membrane exposure were compared. However, differences were significant when spontaneous membrane exposure occurred. Mean percentage reduction of defect area among cases where membrane exposure occurred was 91.5 ± 10.86% Group OS, 71.5 ± 8.61% Group BG, and 73.7 ± 13.97% Group GT. Mean percentage reduction of defect height among cases with membrane exposure was 76.4 ± 18.28%, 53.4 ± 9.86%, and 49.4 ± 11.05%, respectively.

Conclusions: Premature exposure of membranes and subsequent and consequent exposure of implants results in impaired bone healing. Certain barrier membranes, as used in group OS, are apparently capable of supporting gingival healing even when prematurely exposed that could be advantageous in GBR procedures.

Following tooth loss, a natural process of alveolar bone resorption occurs (Atwood 1962; Pietrokovski & Massler 1971; Becker et al. 1994; Lekovic et al. 1997; Jahangiri et al. 1998). An insufficient amount of supporting bone can restrict adequate placement of endosseous oral implants. The use of barrier membranes, according to the technique of guided bone regeneration (GBR), allows for growth of bone tissue around implants placed in sites showing insufficient bone volume. Significant more bone formation has been shown around defects protected with a barrier membrane compared with controls [Dahlin et al. 1991; Jovanovic et al. 1992; Cordaro
Non-resorbable barriers, mostly made of expanded polytetrafluoroethylene (e-PTFE), are highly successful for guided tissue and bone regeneration procedures [Nyman et al. 1982; Dahlin et al. 1991; Jovanovic et al. 1992; Karring et al. 1993]. However, a second surgical procedure for their removal is needed. Their early spontaneous exposure to the oral environment is accompanied by bacterial colonization that demands premature retrieval, which causes less favorable results [Selvig et al. 1992; Tempor & Nalbandian 1993; Simion et al. 1994, 1994b; De Sanctis et al. 1996]. Biodegradable membranes composed of dura-mater, poly-lactic acid, polyglycolic acid, polyurethane and mostly collagen were introduced to overcome these shortcomings [Pitaru et al. 1987; Magnusson et al. 1988; Greensein & Caton 1993; Hutmacher et al. 1996].


Structural integrity of implanted bioabsorbable barrier membranes should be preserved for a sufficient time to allow maturation of newly formed bone under the membrane-protected space [Chung et al. 1990]. Early exposure of barrier membranes to the oral environment has a detrimental effect on bone regeneration around implants [Jovanovic et al. 1992; LeKholm et al. 1993; Simion et al. 1994; Melloni & Nevins 1995; Zitzmann et al. 1997; Machtel 2001; Nemcovsky & Artzi 2002; Nemcovsky et al. 2001].

A high incidence of spontaneous e-PTFE membranes exposure has been reported [Becker et al. 1994; Zitzmann et al. 1997]. Once exposed, non-resorbable membranes should be retrieved because of bacterial colonization [Nowzari & Slots 1995] and subsequent infection. When collagen membranes are applied, wound dehiscence usually does not lead to infection. However, there is premature degradation of the collagen structure in the exposed area, leading to a shortened barrier function with reduced bone fill [Zitzmann et al. 1997]. Collagen membrane degradation can be altered by increasing their structural integrity through cross linking [Speer et al. 1980; Weadock et al. 1983; Petite et al. 1990, 1994; Brunel et al. 1995]. A new collagen barrier that is apparently more resistant to animal and bacterial collagenase even when prematurely exposed to the oral environment has recently been introduced. This barrier consists of purified bovine type I collagen cross-linked by a non-toxic metabolite, which enables longer degradation time [Friedman et al. 2001, 2003].

The purpose of this study was to evaluate the effect of three types of barrier membranes on the clinical soft tissue and bone healing in buccal dehiscence type defects around implants placed simultaneously with the barrier membrane, in general, and with premature membrane exposure, in particular.

Material and methods

Patients were in good general health and were not heavy smokers. Implants were placed at least 6 months after tooth extraction. Only one implant surgery was performed in each patient. In all patients, one to three proximal implants were placed in the same clinical session together with bone augmentation procedures because of large defects. This study comprised of all 86 patients in whom 160 implants were placed and who matched these criteria. Four clinicians (O. M., S. P., Z. A., C. E. N.) performed all procedures in their private practice during 4 consecutive months.

Implants were threaded and manufactured by Sulzer Dental (Calcitek-Spline, Carlbad, CA, USA), Steri-Oss (Yorba Linda, CA, USA), and 3i Implant Innovations (Palm Beach Gardens, FL, USA). Implant surface was either microtextured, Osseotite or titanium plasma sprayed coated. Implant length ranged from 10 to 16 mm. Implant diameters were 3.75-3.8, 4.5, or 5 mm. Different implant types and manufacturers were not compared because of the small sub-groups. Either one of two types of collagen resorbable membranes (Ossix™ CollBar R&D Ltd., Ramat Hasharon, Israel, or Bio-Gide®, Geistlich Sohne AG, Wolhusen, Switzerland), or an e-PTFE non-resorbable membrane (Gore-Tex® augmentation material, W. L. Gore & Associates, Flagstaff, AZ, USA) and bone grafting with autogenous bone chips mixed with either bovine bone mineral (BioOss®, Geistlich Sohne AG) or pure phase β-tri calcium phosphate (Cerasorb®, Curasan AG, Kleinostheim, Germany). Bone graft, membrane and implant type to be used was decided prior to each procedure by the treating clinician.

Data for each patient were classified into one of three groups according to the applied barrier membrane:

- **Group OS** – Ossix® collagen membrane. In 41 patients [mean age 53.5 ± 10.22 years], 73 implants were placed: one implant in 19 patients [46.3% within group], two implants in 12 patients [29.3% within group], and three implants in 10 patients [24.4% within group].

- **Group BG** – Bio-Gide® collagen barrier. In 28 patients [mean age 50.5 ± 13.16 years], 53 implants were placed: one implant in 10 patients [35.7% within group], two implants in 11 patients [39.3% within group], and three implants in seven patients [25% within group].

- **Group GT** – Gore-Tex® e-PTFE membrane. In 17 patients [mean age 55.4 ± 10.76 years], 34 implants were placed: one implant in five patients [29.4% within group], two implants in 7 patients [41.2% within group], and three implants in five patients [29.4% within group].

Surgical procedure and follow-up

Implant osteotomy sites were prepared by sequential cutting burs according to a surgical stent with reduced low speed and internally and/or externally irrigated drills. Implants were placed into the prepared sites (Fig. 1) between 3 and 5 mm apical to the buccal gingival margin of approximal teeth [Salama & Salama 1993]. Primary stabilization was achieved for all implants. Bone graft was applied over the exposed implant surfaces and covered with a membrane. The barrier always covered the implant body cover screw and was tucked under the buccal and lingual flaps. Membranes were applied with no fixation to underlying bone (Fig. 2).

Primary soft tissue closure over the membranes was always achieved through a full partial thickness buccal flap coronally displaced and sutured without tension.
At the time of suture removal and during subsequent monthly post-operative follow-ups, soft tissue dehiscence over the membrane (Figs 4 and 5) and/or spontaneous exposure of implant cover screw were recorded. Spontaneously exposed membranes in group GT were surgically retrieved no later than 4 weeks after diagnosis and during which time the second stage implant surgery for implant uncovering was carried out.

Morphometric measurements
At the time of implant placement and after 6–8 months, at second stage surgery, the defect height – the distance from the most apical aspect of the buccal crestal bone to the implant platform margin, and the defect width – the widest mesio-distal dimension of the buccal bony defect, were measured (Fig. 1) (Jovanovic et al. 1992). A millimetric periodontal probe placed parallel and perpendicular, respectively, to the long axis of the implant, was used. Measurements were recorded to the nearest 1-mm mark. Distance was considered to be zero, even when at second stage surgery new bone partially covered the implant body cover screw. When several implants were placed simultaneously, a mean of their defect width and depth was calculated and this value was represented as the data for the respective patient.

Calculations
The surface area of the bony defects was calculated as half ellipses by multiplying the defect width by defect height by \( \frac{1}{4\pi} \approx 0.79 \).

The percentage of area defect fill at second stage implant surgery [Fig. 6] was calculated according to previous studies (Jovanovic et al. 1992; Zitzmann et al. 1997, 1999; Nemcovsky et al. 2000, 2002; Nemcovsky & Artzi 2002):

\[
\frac{\text{Area at baseline}}{\text{Area at second stage surgery}} \times 100.
\]

The percentage of reduction of the defect height, meaning relative crestal bone gain, at second stage implant surgery was calculated as:

\[
\frac{\text{Defect height at baseline} - \text{Defect height at second stage surgery}}{\text{Defect height at baseline}} \times 100.
\]

Statistical analysis consisted of \( t \)-test, Fisher’s exact test, Pearson’s chi-squared test, one- and two-way ANOVA according to treatment group and occurrence of spontaneous membrane exposure. Unit for statistical analysis was within patient mean and not single implants.

Differences between groups for implant numbers were not significant using Pearson’s chi-squared test.

Results
Generally, after implant placement, postsurgical inconveniences were minimal except for swelling and slight post-operative pain. At the time of implant uncovering, all implants appeared clinically integrated except one in Group BG, which was spontaneously exposed during the early healing process. Data from this patient were
excluded from the clinical analysis. Data for all groups are summarized in Table 1.

Premature membrane exposure and soft tissue healing

Group OS

Within this group, there was premature membrane exposure (Fig. 4) in 16 patients (39% of all patients in group OS) (five patients with one implant and 11 patients with two to three implants). However, soft tissue healing over the exposed barriers was noticed in only one patient (12.5% of patients with exposed OS membranes) of the exposed implants. Spontaneous early exposure of the implant body cover screw was noticed in eight of those treated patients (88.6% of patients with exposed OS membranes).

Group BG

Wound dehiscence with premature membrane exposure occurred in nine patients (32.1% of all patients in group BG) (one patient with one implant and eight patients with two to three implants). Soft tissue healing over the exposed barriers was noticed in only one patient (12.5% of patients with exposed BG membranes) of the exposed implants. Spontaneous early exposure of the implant body cover screw was noticed in eight of those treated patients (88.6% of patients with exposed BG membranes).

Group GT

Wound dehiscence with premature membrane exposure occurred in seven patients (41.2% of all patients in group GT) (one patient with one implant and eight patients with two to three implants). These membranes were prematurely retrieved before second stage implant surgery leading to early exposure of the implant in 41.2% of the treated patients in group GT.

Pearson’s chi-squared test showed no difference between groups for incidence of spontaneous membrane exposure. However, differences were statistically significant ($P = 0.043$) for early implant exposure. There was significant interaction between premature membrane exposure and early implant cover screw exposure within each group ($P = 0.006$ in Group OS, $P < 0.001$ in Groups BG and GT).

Pearson’s chi-squared test showed significant interaction between single and multiple implants simultaneously placed and incidence of spontaneous membrane exposure ($P = 0.042$). When all groups were considered together, the incidence was higher in multiple implant patients. However, this association only approached significance ($P = 0.066$) for early implant cover screw exposure. There was no significant interaction between the number of implants simultaneously placed and spontaneous membrane exposure within groups.

Bone augmentation

Morphometric data for crestal bone healing and percentage reduction of bony defect in the three groups is presented in Figs 7 and 8. The comparative effect of the barrier type on bone augmentation was determined by assessing the pre- and postoperative measurements and calculated dimensions of the defects in each group and comparing the results between the groups according to the following:
1. data obtained from all patients in each group,
2. data obtained only from patients with uneventful wound healing of the soft tissue (no premature membrane exposure),
3. data obtained only from patients who exhibited premature exposure of the membrane in each group,
4. data obtained from patients with premature exposure of the membrane and subsequent implant body cover screw,
5. number of placed implants per patient.

All patients (Table 1)
The pre-operative depth, width, and area of the defects in the three groups ranged between 4.9–5.3 mm, 3.3–3.8 mm, and 13.74–14.81 mm², respectively. There was no significant statistical difference between pre-operative dimensions of the defects between groups. The post-operative height, width, and area of the defects in the three groups ranged between 1–1.2 mm, 0.8–1.1 mm and 1.01–1.6 mm², respectively. There was no significant statistical difference between pre-operative dimensions of the defects between groups. The average reduction in defect height, width, and area was similar between groups. Approximately 75–79% reduction in defect height was found in the three groups, which was statistically significant for all groups (P<0.001).

Unexposed implants only (Figs 7 and 8)
Mean reduction of defect height and area in the three groups ranged between 81.6–93.4% and 91.2–97.3%, respectively. Even though two-way ANOVA indicated no significant statistical difference between groups, the reduction in defect dimensions was best for group GT compared with OS and BG.

Prematurely exposed membranes (Fig. 7)
Premature exposure of membranes within groups BG and GT resulted in a significant decrease in the amount of defect reduction in the exposed implant as compared with the unexposed ones (two-way ANOVA, P<0.001). However, such a decrease was not observed in OS group patients; in this group reduction in the defect dimensions was similar to the unexposed membranes cases. Reduction in defect dimensions among patients with wound dehiscence over the membranes was greater in the OS group compared with BG and GT. Although patients in group GT that presented prematurely exposed membranes exhibited the lowest reduction in defect height, there was no significant statistical difference between these patients and those in group BG with spontaneously early exposed membranes.

Prematurely exposed membrane and subsequent implant body cover screw (Fig. 8)
Early implant uncovering for patients with spontaneous membrane exposure was always performed in the GT group, therefore, results for early membrane and implant cover screw exposure are identical in this group. Premature exposure of the implant...
body cover screw within the BG group did not further affect the level of defect reduction, which was significantly lower than in patients without early membrane exposure ($P < 0.001$). In the OS group, exposure of the implant body cover screw resulted in decrease in the amount of defect reduction compared with patients with only membrane exposure, this difference was significant for percentage reduction of defect height ($P = 0.002$), however, only approaching significance for percentage of defect area reduction ($P = 0.065$). Although patients with exposed body implant cover screw in group OS showed higher levels of defect reduction than the other two groups, it only approached statistical significance ($P = 0.089$).

### Discussion

Successful regeneration of the alveolar bone is based on two main principles: exclusion of gingival tissue from the regenerating site during the process of new bone formation and maturation, and maintenance of a bacterial free closed compartment under the barrier membranes. Thus, primary soft tissue closure and maintenance throughout the healing and regeneration phases and membrane functional integrity are prerequisites for successful bone augmentation both with and without simultaneous implant placement. Space maintenance and primary soft tissue closure over the membrane are the most important factors affecting GBR with use of collagen barriers (Oh et al. 2003). Previous studies indicate that only partial bone regeneration is achieved if membranes are prematurely exposed to the oral environment (Mellonig & Nevins 1995; Zitzmann et al. 1997; Nemcovsky et al. 2002; Nemcovsky & Artzi 2002).

Non-resorbable e-PTFE membranes and resorbable collagen membranes are the most prevalent types of barriers used nowadays for GBR. Once exposed to the oral environment, e-PTFE membranes become rapidly contaminated because of their layered architecture and must be retrieved because of bacterial colonization and subsequent infection (Nowzari & Slots 1995). Reduced newly formed bone was found in patients where e-PTFE membranes were prematurely exposed during the first three

---

**Table 1. Mean values for treatment groups for the different measurements in mm (area in mm²)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative height</td>
<td>OS</td>
<td>5.3</td>
<td>2.07</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>5.1</td>
<td>1.90</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>4.9</td>
<td>1.07</td>
</tr>
<tr>
<td>Pre-operative width</td>
<td>OS</td>
<td>3.3</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>3.6</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>3.8</td>
<td>0.56</td>
</tr>
<tr>
<td>Post-operative height</td>
<td>OS</td>
<td>1</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>1.2</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>1.1</td>
<td>0.99</td>
</tr>
<tr>
<td>Post-operative width</td>
<td>OS</td>
<td>0.8</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>1.1</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>1.1</td>
<td>0.82</td>
</tr>
<tr>
<td>Pre-operative area</td>
<td>OS</td>
<td>13.74</td>
<td>7.06</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>14.97</td>
<td>9.32</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>14.81</td>
<td>3.81</td>
</tr>
<tr>
<td>Post-operative area</td>
<td>OS</td>
<td>1.01</td>
<td>1.27</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>1.48</td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>1.60</td>
<td>1.75</td>
</tr>
<tr>
<td>Percentage reduction defect height</td>
<td>OS</td>
<td>79.56</td>
<td>21.32</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>75.11</td>
<td>18.99</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>75.26</td>
<td>24.36</td>
</tr>
<tr>
<td>Percentage reduction defect area</td>
<td>OS</td>
<td>91.92</td>
<td>12.58</td>
</tr>
<tr>
<td></td>
<td>BG</td>
<td>88.44</td>
<td>11.59</td>
</tr>
<tr>
<td></td>
<td>GT</td>
<td>87.59</td>
<td>15.14</td>
</tr>
</tbody>
</table>

No statistically significant difference between groups (one-way ANOVA).

OS, Ossix® collagen membrane; BG, Bio-Gide® collagen barrier; GT, Gore-Tex® e-PTFE membrane; SD, standard deviation.
months after implantation compared with those exposed after 3–6 months or of those that remained unexposed until second stage implant surgery (Mattout & Mattout 2000b). Prematurely exposed collagen barriers are degraded by bacterial collagenases when exposed to the oral cavity, a process that jeopardizes GBR. Premature exposure of non-resorbable and resorbable membranes leads to extensive resorption of bone graft and lack of continuity between the graft and the recipient bed (Donos et al. 2002a, 2002b). Implants placed simultaneously with prematurely exposed barrier membranes show significantly higher crestal bone loss up to 24 months after placement compared with those with non-exposed membranes (Lorenzoni et al. 2002).

Non-resorbable and most resorbable barriers used for GBR do not support soft tissue healing after prematurely exposed. Recently, a new collagen membrane barrier, applied in group OS, was reported to have the capacity to support gingival healing even after premature exposure to the oral cavity (Friedman et al. 2001). According to the manufacturer, this membrane consists of collagen cross-linked with a native metabolite that ensures functional integrity for 6 months in unexposed membranes. This cross-linking technology renders the membrane with the capacity to withstand bacterial collagenolytic degradation even when prematurely exposed, thus, enabling soft tissue healing over the exposed membranes. In the present retrospective study, the capacity of this cross-linked collagen barrier membrane (OS) to support newly formed bone in dehiscence defects around implants in closed and prematurely exposed membranes was compared with the non-cross-linked collagen membrane (BG) and to the non-resorbable e-PTFE membrane (GT).

When all patients within each group and especially patients with uneventful gingival tissue healing were compared, the three types of membrane were similarly effective in supporting significant reduction of the bony defects. Although no significant statistical difference was observed between groups among patients with unexposed membranes, GT membranes were slightly more effective than the other two.

e-PTFE membranes exhibited a higher incidence of premature membrane exposures. However, there were no significant statistical differences between the three groups, which suggest that the premature membrane exposure could be related more to the patient wound healing capacity and the surgical procedure than to the type of membrane. The capacity of the three membrane types to support soft tissue healing and closure subsequent to premature exposure differed between the groups. While premature exposure of the BG membranes resulted in exposure of the implant cover screw in all patients except one, soft tissue healing and closing were observed in 68.7% of patients with prematurely exposed OS membranes. This significantly higher capacity of the OS to support soft tissue healing compared with the other two membranes can be explained by the fact that OS membranes are cross-linked (Hynder et al. 1992; Al Arrayed et al. 1995; Hutmacher et al. 1996). Friedman et al. (2001) reported complete gingival wound healing in 100% of prematurely exposed OS membranes compared with 0% healing of prematurely exposed e-PTFE membranes, however, in that study implants were not placed together with the bone augmentation procedures.

Among patients with prematurely exposed membranes, a significantly higher bony defect healing was shown in the OS than in the other two groups. Furthermore, defect reduction in the prematurely exposed patients within OS was statistically similar to that of unexposed membranes. Exposure of implant cover screw resulted in less defect reduction in all groups, which further substantiates the importance of soft tissue healing over prematurely exposed membrane barriers.

Present results agree with previous animal and human studies, (Lekholm et al. 1993; Simion et al. 1994; Dahlen et al. 1995; Melloni & Nevins 1995; Zitzmann et al. 1997; Fugazotto 1998; Machtei 2001; Donos et al. 2002a, 2002b; Nemcovsky et al. 2002), indicating that expo-
primary soft tissue closure and maintenance over e-PTFE and collagen resorbable membranes are crucial for successful GBR. Premature membrane exposure used in GBR and subsequent and consequent implant exposure result in decreased bone formation and bony defect reduction. Although, results have to be interpreted within the limits of this explanatory analysis, certain barrier membranes, such as OS appear to be capable of supporting gingival healing even when prematurely exposed, thus, being advantageous in GBR procedures.

Acknowledgements: The study is based on work done in the authors’ private offices and unrelated to their university affiliation. The authors wish to thank Rita Lazar for editorial assistance and preparation of the manuscript, and Ilana Gelerenter for statistical analysis. One of the authors, Sandu Pitaru, serves as a Chief Scientific Consultant for ColBar and holds options equities in the company.

Resumen


Methoden: Es wurden drei Gruppen gebildet. Gruppe OS (Ossix®, n=73 Implantate, 41 Patienten), Gruppe BG (Bio-Gide®, n=53 Implantate, 28 Patienten) und Gruppe GT (ePTFE, Gore-Tex®, n=34 Implantate, 17 Patienten). Die Höhe und die Breite der Defekte wurden zum Zeitpunkt der Implantation und bei der Wiederöffnung gemessen. Das Oberflächenareal wurde als Halbellipse berechnet. Wenn mehrere Implantate gleichzeitig gesetzt wurden, so berechnete man den Mittelwert der Defekttbreiten und -höhen.

Resultate: Die mittlere prozentuale Reduktion des Defekkareals (92.2 ± 13.7% Gruppe OS, 94.6 ± 6.9% Gruppe BG und 93.3 ± 4.9% Gruppe GT) und der Defekthöhe (81.6 ± 23.1%, 85.4 ± 12.2% und 93.4 ± 9.3%) zeigten keine statistisch signifikanten Unterschiede zwischen den Gruppen. Wenn die Fälle ohne Membranexposition verglichen wurden, bestanden zwischen den Gruppen bei keinem der untersuchten Parametern signifikante Unterschiede. Jedoch waren signifikante Unterschiede zu sehen, wenn eine spontane Membranexposition aufgetreten war. Die mittlere prozentuale Reduktion des Defekkareals bei Fällen mit Membranexposition betrug 91.5 ± 10.86% in Gruppe OS, 71.5 ± 8.6% in Gruppe BG und 73.7 ± 13.97% bei Gruppe GT. Die mittlere prozentuale Reduktion der Defekthöhe in Fällen mit Membranexposition betrug 79.4 ± 18.28%, 53.4 ± 9.86% (bzw. 49.4 ± 11.05%).


Resumen

Objetivo: La exposición prematura de las membranas usadas en regeneración ósea guiada resulta en una formación ósea disminuida. Se evaluó clínicamente el efecto de una membrana de ePTFE y dos de colágeno sobre la cicatrización ósea de defectos de dehiscencias bucales alrededor de implantes en casos con y sin exposición prematura de la membrana.

Métodos: Se establecieron tres grupos. Grupo OS (Ossix®, n=73 implantes, 41 pacientes), Grupo BG (Bio-Guide®, n=53 implantes, 28 pacientes) y Grupo GT (e-PTFE, Gore-Tex®, n=34 implantes, 17 pacientes). Se midió la altura y la anchura del defecto al colocar el implante y en la cirugía de la segunda fase. Se calculó el área de la superficie como medias elípticas. Al colocar varios implantes simultáneamente, se calculó una media de las alturas y anchuras de los defectos.

Resultados: La reducción porcentual media del área del defecto (92.2 ± 13.78% Grupo OS, 94.6 ± 6.69% Grupo BG, y 97.3 ± 4.91% Grupo GT) y de la altura (81.6 ± 23.1%, 85.4 ± 12.2% y 93.4 ± 9.3% respectivamente) no mostraron diferencias estadísticamente significativas entre los grupos. Las diferencias entre los grupos no fueron estadísticamente significativas para todos los parámetros cuando se compararon los casos sin exposición espontánea de la membrana. De todos modos, las diferencias fueron significativas cuando la membrana se expuso espontáneamente. La reducción porcentual media del área de los defectos con exposición de la membrana fue de 91.5 ± 10.86% Grupo OS, 71.5 ± 8.76% Grupo BG, y 73.7 ± 13.97% Grupo GT. La reducción porcentual media de la altura del defecto entre los casos con exposición de la membrana fue de 76.4 ± 18.28%, 53.4 ± 9.86%, y 49.4 ± 11.05%, respectivamente.

Conclusiones: La exposición prematura de las membranas y subsecuente y consecuente exposición de los implantes resulta en una cicatrización ósea mermada. Algunas membranas de barrera, como las usadas en el grupo OS, son capaces aparentemente de soportar la cicatrización gingival incluso cuando se exponen prematuramente lo cual puede ser ventajoso en procedimientos de regeneración ósea guiada.


