Porcine pericardium membrane around immediately placed implants: an experimental study in dogs

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Introduction

The regeneration and healing of large defects in bone is a gradual process and are constantly prone to soft tissue infiltration. In order to enhance the healing process and prevent the migration of unwanted cells, a barrier membrane can be used. Membranes also sustain blood clots in place and allow time for bone forming cells to reconstruct bone unobstructed. This characteristic of the membrane warrants the blood to preferentially contact the implant surface directly, when placed into a fresh defective site, such as implant placement in fresh extraction sockets. Immediate implant placement is less invasive and potentially more efficient than the classical approach, where multiple surgeries may be needed if using a graft material for the initial bone healing process. Today, a wide variety of membrane materials are commercially available. Porcine collagen membranes, obtained from dermis, peritoneum or pericardium, are resorbable and biocompatible. Pericardium membranes present multilayered, multidirectional arrangement of fibers, providing inherent mechanical strength, tear and stretch resistance.

In this study, the bone morphometry and/or morphology around implants placed in fresh extraction sockets and covered with pericardium derived collagen membrane was evaluated and compared to a group without a membrane, to investigate whether the unique feature of the membrane could provide enhanced bone regeneration.

Methods

First mandibular molars of six beagle dogs were bilaterally extracted and implants of 3.8 × 13 mm (DT Implants-Ossean Surface, Intra-Lock Intl, Boca Raton, FL) were placed in the mesial and distal sockets at the level of the buccal crest. On one side the implants were covered with a porcine peritoneum derived membrane (Vitafila™, Osteogenics, Lubbock, TX, USA); the contralateral implants served as controls. Six weeks post-surgery, the animals were sacrificed. Non-decalcified, histologic slides of ~30-μm were stained with toluidine blue. Bone-to-implant contact (BIC) and buccal-bone loss were calculated. Wilcoxon matched-pairs test at 95% was utilized for statistical evaluation.

At 6 weeks, the qualitative analysis of the histologic sections showed for both groups, regions of direct BIC and new woven bone bridging the gap between implant and the old bone of the socket walls (Figure 2). Apical migration of soft tissue resulting in a more apical position of the BIC was observed for the implants in the control group (Figure 3). In the experimental group an intimate contact between implant and bone was observed throughout the implant surface (Figure 4). Quantitative analysis rendered a significantly higher BIC for the test group in comparison to the control group, 75% versus 45% (p<0.02), respectively. The sites that were covered with the membrane presented a 0.7 mm buccal bone loss which was significantly lower than the control group that showed a 2.5 mm loss in buccal plate (p<0.02, Figure 5). The implantation site within arch (mesial or distal) did not influence BIC or BBL in either control or test groups (p>0.80).

Results

Conclusions

The findings of the present study showed that using a bioresorbable, pericardium membrane resulted in significantly higher BIC and a closer fit between the bone margin and the implant platform as compared to sites without membrane coverage. Although it has not been compared to other membrane materials in the present study, the outcomes of this study strongly suggests the bio-effectiveness of the biologically inspired design membrane in challenging cases such as implant placement in the fresh extraction sockets.

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