Healing at mandibular block-grafted sites. An experimental study in dogs

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Abstract
Aim: The aim of this study was to evaluate the healing of autologous bone block grafts or deproteinized bovine bone mineral (DBBM) block grafts applied concomitantly with collagen membranes for horizontal alveolar ridge augmentation.

Material and methods: In six Labrador dogs, molars were extracted bilaterally, the buccal bony wall was removed, and a buccal box-shaped defect created. After 3 months, a bony block graft was harvested from the right ascending ramus of the mandible and reduced to a standardized size. A DBBM block was tailored to similar dimensions. The two blocks were secured with screws onto the buccal wall of the defects in the right and left sides of the mandible, respectively. Resorbable membranes were applied at both sides, and the flaps sutured. After 3 months, one implant was installed in each side of the mandible, in the interface between grafts and parent bone. After 3 months, biopsies were harvested and ground sections prepared to reveal a 6-month healing period of the grafts.

Results: 77.6% and 5.9% of vital mineralized bone were found at the autologous bone and DBBM block graft sites, respectively. Moreover, at the DBBM site, 63.1% of connective tissue and 31.1% of DBBM occupied the area analyzed. Only 0.2% of DBBM was found in contact with newly formed bone. The horizontal loss was in a mean range of 0.9–1.8 mm, and 0.3–0.8 mm, at the autologous bone and DBBM block graft sites, respectively.

Conclusions: Autologous bone grafts were vital and integrated to the parent bone after 6 months of healing. In contrast, DBBM grafts were embedded into connective tissue, and only a limited amount of bone was found inside the scaffold of the biomaterial.

Several clinical (e.g., Nyström et al. 1993, Raghoebar et al. 1996, Widmark et al. 1997, Cordaro et al. 2002, Maiorana et al. 2005) and animal studies (e.g., Ozaki & Buchman 1998, Araújo et al. 2002) have shown that autologous bone blocks used for alveolar ridge augmentation undergo various degrees of resorption. In a clinical study (Widmark et al.1997), a bucco-lingual resorption of about 60% was documented while, in a rabbit study (Ozaki & Buchman 1998), about 50% of resorption was observed at bone grafts harvested from the mandible or from the ilium and placed on the cranium.

Despite the resorption that bone grafts encounter during healing, they may provide sufficient increased volume of the alveolar ridge to promote successful implant treatment (Chiapasco et al. 2009, Clementini et al. 2012, De Santis et al. 2012, Zakhary et al. 2012). The healing of autologous bone grafts has been histologically documented in clinical (e.g., Zerbo et al. 2003, Acocella et al. 2010, Spin-Neto et al. 2014) as well as in animal studies (e.g., Perri de Carvalho et al. 2000, Araújo et al. 2002, Faria et al. 2008, De Santis et al. 2012, Yeo et al. 2012). In some of these, (Zerbo et al. 2003, Acocella et al. 2010, Spin-Neto et al. 2013), the presence of various amounts of residual no-vital bone after different periods of healing was reported.

Moreover, some clinical studies reported successful use of deproteinized bovine bone mineral (DBBM) block grafts for alveolar ridge augmentation (Hämmerle et al. 2008, Felice et al. 2013). However, animal experiments have shown that only a limited...