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Short communication

Making bone II: maxillary sinus augmentation with mononuclear cells—case report with a new clinical method

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Abstract

We report a simplified method of using bone marrow aspirate concentrate (BMAC™) to regenerate hard tissue.

The results suggest that BMAC™ combined with a suitable biomaterial can form sufficient bone within 3 months for further implants to be inserted, and at the same time minimise morbidity at the donor site.

Keywords: Biomaterials; Bone substitutes; Clinical research; Implants; Sinus floor elevation; Mesenchymal stem cells; Mononuclear cells; Bone marrow aspirate

Introduction

Raising the sinus floor is standard treatment for an atrophic maxilla.[1] Autologous bone is still the gold standard,[2] but morbidity must be taken into account.[3]

Osteoconductive biomaterials have been tested as an alternative but, to gain osteoinductivity, growth factors or cells are needed. In earlier *in vitro* studies, grown bone chips used to raise the sinus floor[4] yielded varying results.[5]

Transplantation of progenitor cells from bone marrow aspirate has been tested before.[6,7] Two tested methods, the FICOLL concentration and BMAC™ (bone marrow aspirate concentrate), showed comparable formation of new bone.[8] Here we describe a new method using BMAC™.

Material and methods

Both maxillary sinuses of a 46-year-old partially edentulous man were augmented (Fig. 1).

BMAC was obtained from the superior posterior iliac spine. The aspiration needle and 2×60 ml syringes were flushed with heparin 10 000 U/ml. Citric acid 8 ml was inserted and BMA 52 ml collected in each syringe. It was injected into two dual chamber disposables (BMAC™, Harvest Technologies Corporation, Plymouth, MA, USA), and placed into the SmartPReP2-centrifuge. Enucleated cells were separated and concentrated by centrifugation (Fig. 2). Most of the plasma was removed and the cells were resuspended. Before augmentation BMAC was mixed with autologous thrombin and BBM in a non-metal dish.

Under general anaesthesia a mucoperiostal flap was raised, an osteotomy made, and the sinus membrane detached. It was then augmented with BBM enriched with BMAC and autologous thrombin. Augmented areas were biopsied after 3 months.

Biopsy specimens of bone were taken, 100 μm slides prepared, and histomorphometric analysis made under light microscopy.

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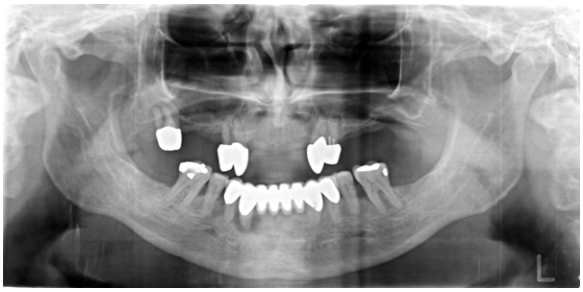

Fig. 1. Preoperative orthopantomogram showing the patient's atrophied maxilla before augmentation with bovine bone mineral and BMAC™.

Results

Histological analysis showed no signs of inflammation. The particles of BBM occupied 29.1% of the specimen and newly formed bone 26.9%. The newly formed bone connected the particles of biomaterial, and stabilised the grafted complex. It was integrated into the local bone with blood vessels running through it (Fig. 3).

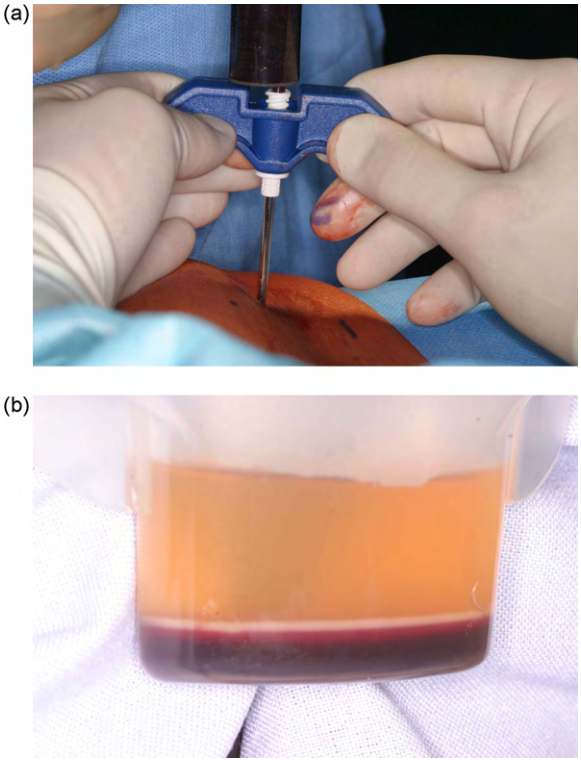

Fig. 2. (a) Aspiration of the bone marrow aspirate. The syringe is flushed with citrate to keep the aspirate from clotting. (b) Close up of the smaller of the two chambers of the BMAC™ kit. Most of the supernatant has been removed. The amber-coloured fluid is the supernatant. The white line is composed of mononuclear cells including progenitor cells and mesenchymal stem cells (data not shown). This layer floats on top of the thrombocytes.

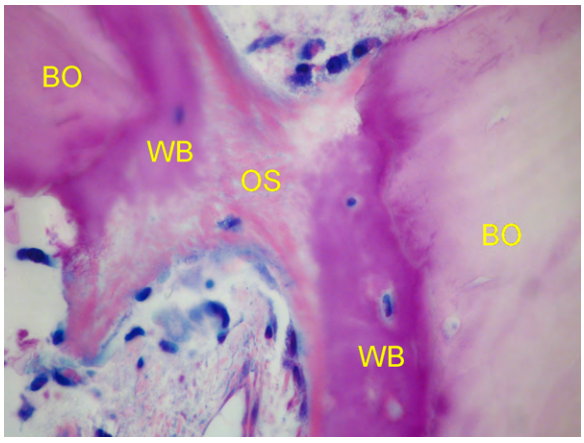

Fig. 3. Trephine biopsy specimen of the augmented area stained with azure II and pararosaniline. Particles of bovine bone mineral (BBM) are a slightly darker colour than newly formed bone. BBM particles are bridged by newly formed bone (original magnification ×600), BO = bovine bone mineral, WB = woven bone, OS = osteoid.

Discussion

The combination of BBM and BMAC seems to result in quicker formation of bone, as previously reported sinus augmentation with BBM and venous blood showed bony formation of 14.7% after a healing time of 6–8 months.[9]

Acknowledgements

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