

European Association for Osseointegration

17th Annual Scientific Meeting

September 18 to 20, 2008 · Warsaw, Poland

Immunohistochemical observations after sinus floor elevations with a reduced healing period

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Tenascin, an extra cellular matrix glycoprotein, is present in the matrix surrounding osteoblast precursors and osteoblasts during bone development, but is absent from mineralized bone matrix and connective tissues adjacent to bone. In this study, biopsies harvested 4 months after sinus floor elevations were stained immunohistochemically with Tenascin-specific antibodies and evaluated. Additionally, histomorphometric analyses were performed to quantify the amount of new bone.

Material and Methods

In his clinical study, 34 two-stage sinus floor elevations were performed in 24 patients in accordance with the method described by Tatum. The chosen augmentation material was a synthetic bone graft material based on Calcium phosphate (BONITmatrix®, DOT GmbH, Rostock, Germany), consisting of nano HA- and nano β -TCP-crystals (60:40) embedded in a bioactive Silicon dioxide matrix. No autologous bone was added. The material was mixed with blood taken from the operation site.

After 4 months of healing the patients received implants. During surgery ten cylindrical bone biopsy specimens were taken from the grafted posterior maxilla using a trephine bur. The bone cores were analysed immunohistochemically and histomorphometrically.

Results

All bone core cylinders showed high tenascin activity, indicating bone growth after 4 months of healing. The extracellular matrix molecule is substantially evident in newly formed bone material. In completely differentiated adult bone-, however, it is only detectable focally, especially in association with vascular structures. In fibrous marrow a trabecular tenascin matrix pattern is visible. The bone graft material gets enveloped and penetrated by tenascin.

Histomorphometry revealed that 35.47% of the tissue volume was bone tissue, 14.04% residual graft and 50.5% connective tissue.

After 4 months of healing, microscopic observations showed complete osseous integration of the residual graft material in a bone matrix. New bone formations could be seen throughout all graft surfaces. Signs of inflammation or foreign body reactions were not to be documented. The homogeneous stabilisation reached such a quality that all implants clinically proved a high primary stability on insertion.

Discussion

While normal histologic analysis can only show a bone remodelling process at a given moment in time, immunohistochemical analysis can help to investigate and measure bone growth and thus contribute to the assessment of the ongoing process itself. Using the highly specific glycoprotein tenascin, our study proved that the newly formed bone was actively growing. Through additional histomorphometric analysis the exact amount of newly formed bone and the rate of resorption of graft material could be quantified.

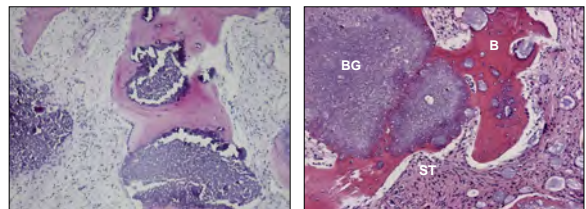


Fig. 1 + 2: Biopsy taken from the grafted site after 4 months of healing: good osseointegration of the grafted material (HE-staining) BG: bone graft, B: bone, ST: soft tissue

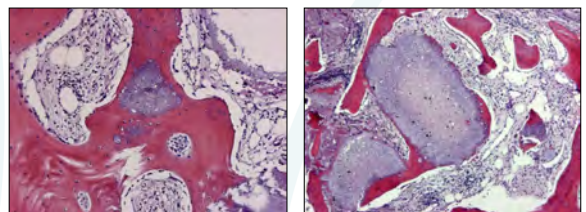


Fig. 2 + 3: the grafted material is completely covered with bone (HE-staining)

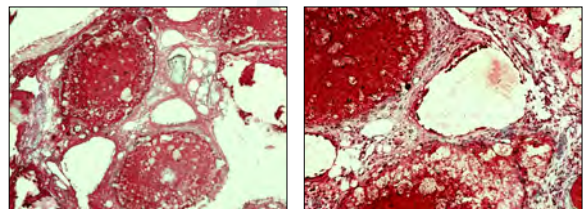


Fig. 5 + 6: Immunohistochemical staining shows high bone growth activity surrounding the grafting material (Fig. 5: Tenascin-C, Fig. 6: Osteocalcin)

