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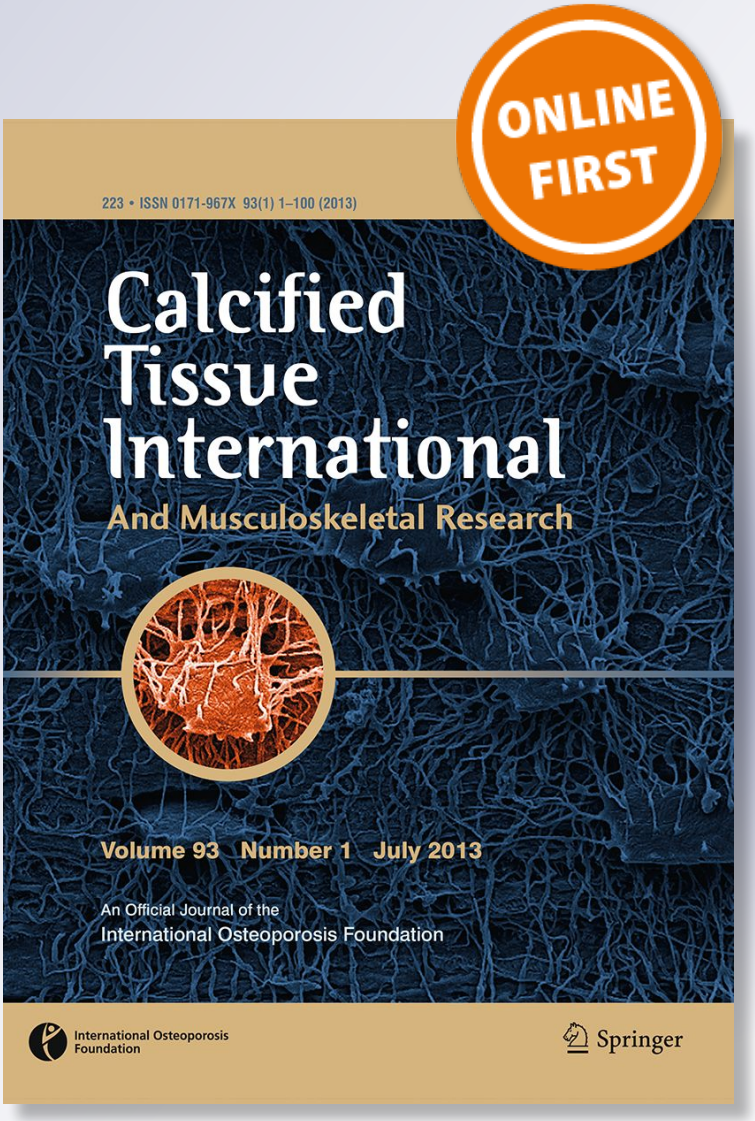

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ABSTRACTS

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Keywords: Kinome profiling; osteoblasts; extracellular matrix; titanium; cell adhesion; peptide array

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Histomorphometrical comparison of three different bone grafts: deproteinized bovine bone, bioglass and, synthetic hydroxyapatite

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Bone graft implantation is required to guide bone repair. Deproteinized bovine bone putty (BB), bioglass (BG) and, synthetic hydroxyapatite (SH) are frequently indicated as bone grafting materials due to their osteoconductive properties. We compared the bone healing response of BB, BG and SH (Synergy, Odontit Implant Systems, Argentina) in a critical sized bone defect. We created a bone defect of 4 mm diameter in rat tibiae for implantation with each biomaterial (N = 30 rats). Samples were collected at 2 and 4 weeks for histological and histomorphometrical analysis of new bone formation (NBF) and remaining particles of each device (RP).

Results: Percentage of NBF (mean ± SD): 2 weeks: Control group: 6.60 ± 3.71; BB group: 23.23 ± 3.89*; BG group: 18.35 ± 5.23*; SH group: 26.27 ± 9.30*; 4 weeks: Control group: 6.69 ± 2.38; BB group: 24.37 ± 3.66*; BG group: 17.45 ± 6.64*; SH group: 32.25 ± 3.80*. Percentage of RP: 2 weeks: Control group: 0 ± 0; BB group: 5.04 ± 1.39*; BG group: 3.03 ± 2.31*; SH group: 4.46 ± 2.87*; 4 weeks: Control group: 0 ± 0; BB group: 4.45 ± 2.35*; BG group: 2.87 ± 1.14*; SH group: 3.78 ± 1.68* (*$p < 0.05$ vs. control group; p = NS between BB, BG and SH groups). Although SH exhibited a trend towards increased NBF we did not find statistical significance among the three biomaterials. Bone healing at the implanted sites, was accompanied by a progressive inflammatory response consistent with the expected histological stages of bone repairing. All biomaterials were associated with trabecular bone formation. To date, there are no studies comparing the effect of these biomaterials in bone healing. While further studies need to be done, our results indicate that BB, BG and SH exhibit similar characteristics in terms of osteoconduction. Furthermore, the three biomaterials were histologically substantially equivalent.

Keywords: Bone healing; biomaterials; critical sized bone defect; bovine bone; bioglass; synthetic hydroxyapatite

P117

Bone regenerative potential of adipose-derived stromal vascular fraction on a xenohybrid bone scaffold

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Adipose tissue-derived stem cells (ASCs) are a promising tool for treatment of bone diseases or skeletal lesions, thanks to their multilineage differentiating ability. Osteoarthritis, a disease characterized by articular cartilage degeneration and subchondral bone sclerosis, may benefit from non-surgical treatments based on intra-articular infusions of ASCs. One of the major limitations of ASCs is represented by the necessity to be isolated and expanded through in vitro culture, thus a strong interest was generated by the adipose stromal vascular fraction (SVF), the non-cultured fraction of ASCs.

We investigated and compared the bone regenerative potential of SVF and ASCs, taking advantage of their ability to grow on SmartBone® (SB), a xenohybrid bone scaffold. Both ASCs and SVF colonized and formed new tissue on SB, filling its periphery and bone lacunae over time. At 15, 30 and 60 days, we monitored the tissue growth through immunoistochemical staining: collagen I, osteocalcin and TGFb markedly stained the new tissue on SB. MicroCT analysis showed a progressive increase in mineralised tissue apposition by newly formed trabeculae. Indeed, their quantification analysis demonstrated that SVFs were significantly more efficient than ASCs (3391 ± 270.5 vs. 1825 ± 133.4, $p < 0.001$) in inducing bone formation, when cultured on SB with osteogenic medium. In SVF cultures, we observed an increased secretion of soluble factors stimulating osteoblasts over time: VEGF (153.5–1278.1 pg/ml) and endothelin 1 (0.43–1.47 pg/ml).

In conclusion, the absence of manipulation of SVF in an in vitro culture could definitively represent a benefit for a larger use in clinical applications. Moreover, our data strongly support an innovative idea for a regenerative medicine based on solid scaffold functionalised with SVF to improve the precision of stem cells implant and the quality of new bone formation.

Keywords: Adipose tissue-derived stromal vascular fraction, bone scaffold, bone regeneration

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Investigation of the relationship between stem taper topography and the degree of corrosion and fretting in total hip arthroplasty

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Modularity in total hip arthroplasty (THA) is highly valued as it allows adaption to patient-specific anatomy and inter-operative flexibility. Primary THA belong to the most successful medical procedures, yet a certain percentage of revisions is inevitable. Besides more common causes, wear at the modular interface between stem and head taper is a potential cause of THA failure. This is predominately expressed in the form of mechanical fretting and chemical corrosion, and might depend on variations in surface topography of the stem tapers.

Forty-nine stem tapers of four different models (Alloclassic, CLS Spotorno, Aesculap Bicontact, SL-PLUS) were characterized regarding their surface topography using high-resolution 3D microscopy. Wear was defined as corrosion and fretting and quantified using an established scoring scheme.

Statistical tests employed ANOVA with Bonferroni correction, Mann-Whitney-U test for not normally distributed data, and Spearman´s rank correlation as test of correlation.

Profile height and effective surface enlargement were significantly higher in the Alloclassic and CLS compared to the Bicontact and SL-