Novel Nanocoating Promotes Bone Growth and Apposition on Stainless Steel

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**Background:** Appositional bone growth to spine and orthopedic implants is a desirable quality especially if a surface treatment does not adversely affect implant size or biomechanics. It becomes even more important with motion-preserving implants of the spine. A novel chemically stable coating of self-assembled-monolayer of phosphonates (SAMP) that covalently bonds to metallic oxide surfaces, has been developed. In-vitro results have shown the SAMP coating to be osteoconductive, enhancing osteoblast attachment to and spreading on metallic surfaces. We report bone growth in a rabbit model comparing SAMP-treated stainless steel (SS) implants versus untreated controls.

**Methods:** Forty-four male, skeletally mature New Zealand White rabbits were implanted bilaterally in the femoral intramedullary canals where each animal received a treated and untreated cylindrical 316L SS implants. The rabbits were randomized to one of four time points (n = 11 animals): 4, 8, 12 and 16 weeks. In-vivo plain radiographs were performed immediately post-operatively and at all time points until sacrifice. Specimens designated either for histology (n=3 femurs) or mechanical evaluation (n = 8 femurs). In-vitro images of cancellous and cortical sections were taken using a scanning electron microscope (SEM) (FEI, Peabody, MA) to identify new bone around the implants. The sections were embedded in PMMA in order to prepare undecalcified slides for histomorphometry.

**Results:** Bone formation was observed in the epiphyseal cancellous bone in the area surrounding the distal end of the implant and the trabeculae in that area had grown thicker in treated than untreated implants. Moreover, newly formed bone was found in intimate contact with the surface of the proximal end of the treated implant that was not in contact with the femoral cortex as early as 4 weeks. Histological evaluation showed cell types associated with new bone formation in both the cortical and cancellous regions in higher numbers in treated than untreated implants.

**Conclusion:** We have shown that for early implant fixation, the SAMP treatment of SS rods in this rabbit model provides a promising improvement of bony integration onto metal components of orthopaedic implants.

Figure 1A:

![Figure 1A](image-url)

Figure 1B:
Figure 1: Backscatter SEM images of distal epiphyseal regions of two rabbit femurs.
A: implanted with an uncoated implant at 4 weeks.
B: implanted with SAMP-coated implant at 4 weeks.
The metal is indicated by higher density (white). Postoperatively formed trabeculae is more evident in the epiphyseal region surrounding the coated implant than that in surrounding the uncoated one.