Lumbar Spine Fusion with a Novel Tantalum-Coated Carbon Fibre Cage Loaded with Colloss®

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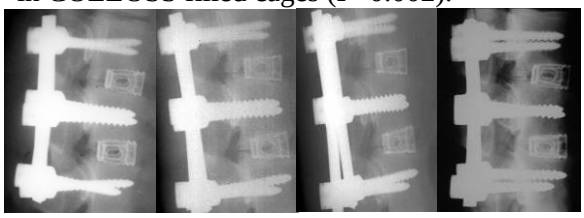
INTRODUCTION: Interbody spinal fusion has been performed increasingly in clinical practice, but failure to achieve a solid bony fusion occurs in 5% to 35% of the patients. Besides, implants of carbon fiber composite have been widely used in spinal applications. However, a series studies using carbon fiber reinforced cages showed a fibrous layer was constantly found interposing between the implant and the surrounding bone [1,2,3]. The aim of the present study was to tested whether the combination of a bovine bone protein extract-COLLOSS and a carbon fiber cage with a thin layer of biocompatible metal coating could improve the fusion results in a spinal fusion model

METHODS: 8 female Danish landrace pigs were operated, and lumbar spine interbody fusion of L3/4, L4/5 using tantalum coated C-C composite cages (Danfoss Bionics, Nordborg, Denmark) with pedicle screws fixation were performed on each pig. Cages packed with either autograft or a bovine bone collagen lyophylisate (COLLOSS®, OSSACUR AG, Oberstenfeld, Germany) were randomly assigned to the two levels anteriorly. Fusion was evaluated radiologically at 0, 4, 8, and 12 weeks post-op. All pigs were killed at 12 weeks and CT (after removal of pedicle screws), micro-CT and histology examinations were conducted

RESULTS: 7 pigs went through the observation without major complications.1 pig was excluded after 8 weeks due to implant related complications. Cages demonstrated good radio-transparency for serial evaluation of bone formation inside at follow-ups(Fig.1). With clinical CT evaluation, new bone formation could be clearly demonstrated inside the cage. Excellent biocompatibility was demonstrated by micro-CT images, in which bone in direct contact with the Ta-coated cages was abundant. Micro-CT evaluation showed that there were no differences of the bone volume fractions (BV/TV), surface densities (BS/BV) and trabecular thickness (Tb.Th) between the two graft materials. Only trabecular space (Tb.Sp) and trabecular number (Tb.N) had significant differences between them (P=0.02 and P=0.03 respectively). Histology sections demonstrated intimate contact of trabecular bone to the cage (Fig.2).Histomorphometrical comparison shown that only cartilage volume was slightly higher in COLLOSS filled cages (P=0.002).



0 week 4 weeks 8 weeks 12 weeks

Fig.1 Serial radiographic examinations of the same pig demonstrate the radiotransparent

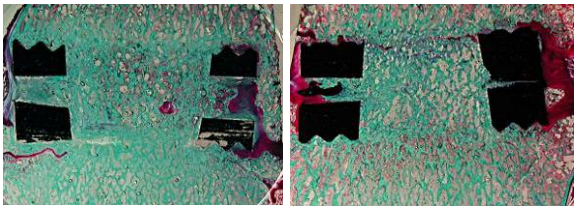


Fig. 2: Histological sections show the good bone-implant contacts and complete fusion with both Colloss(right) and autograft (left) .

DISCUSSION & CONCLUSIONS: The present study demonstrates when a thin layer of tantalum was coated on top of the carbon material; excellent interface binding was seen from both Micro-CT and histology. The bone formation can be followed with serial radiographs, while the thin Ta coating can serve as a marker and also an enhancement for bone anchorage. The bovine bone protein lyophilisate—COLLOSS achieved the same bone formation with that of autograft in this model after 12 weeks.

REFERENCES: **1**, Li H, Zou X, Xue Q, et al. Eur Spine J. 2004 Jan 17. **2**, Zou X, Li H, Bunger M, et al, Spine J. 2004 Jan-Feb; 4(1):99-105. **3**, Xue Q, Li H, Zou X, et al. Eur Spine J. 2004 Jul 10

ACKNOWLEDGEMENTS: This project was supported by the Danfoss Bionics A/S, Denmark; OSSACUR AG, Germany; and Nanoscience and Biocompatibility grant by Danish Research Agency