**In vivo Evaluation of Premixed Calcium Phosphate Cement in a Vertebral Defect in Rat**

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**Introduction**

Calcium phosphate cements (CPC) have been used in many orthopaedic applications since their discovery in the 1980’s [1]. By mixing a precursor powder with water a paste is obtained, which can be injected and hardens in situ, thus allowing minimal invasive surgery. However, CPCs are difficult to handle. The mixing and transfer procedures are often technically difficult and the materials have a limited working time. One solution to the difficult handling properties is to exchange water for glycerol as mixing liquid [2]. This way the setting of the cement is postponed until the cement is inside the body, when glycerol is exchanged for water from body fluids. In clinical situation this makes the surgery less stressful and the risk of improper mixing and injection are eliminated. The beneficial handling properties of the material make it suitable for use in vertebral compression fractures. The setting time of the material is below 25 minutes and the compressive strength between 10 and 15 MPa, as evaluated in bench tests. The aim of this work is to evaluate the in vivo performance regarding bone formation of an acidic premixed CPC in a vertebral defect in rats.

**Materials and Methods**

*Cement preparation.* The premixed cement consisted of beta-Tri calcium phosphate 44 % (w/w), mono calcium phosphate monohydrate 36 %, ZrO₂ 20 % mixed with glycerol. The zirconia was added to obtain appropriate radio opacity of the material for the use in spinal indications. A powder to liquid ration of 4.5 g/ml was used. All components were sterilized before mixing and the mixing was performed under sterile conditions. Syringes were filled with the premixed cement 3 days before surgery. The syringes were stored in a fridge until the day of the surgery. *Surgery.* A 2.0 mm diameter and 3.5 mm deep hole was drilled into the center of a tail vertebra. A stainless steel K-wire was implanted into the hole to prevent self-regeneration. 12 weeks later the K-wire was removed. The hole was filled either with the premixed cement, commercial PMMA or left empty as control. *Osteoblast activity.* Osteoblast activity was measured with nanoSPECT/CT using Tc99-MDP isotope administrated through tail vein of the rats.

**Results**

The animals tolerated the implant well; there was no sign of wound infection, rejection or loss of animals in the study. The biocompatibility of the premixed CPC was thus confirmed in vivo. The osteoblast activity was monitored during 5 weeks after implantation. The activity was calculated as the percentage of the next healthy vertebra. In each case the values are higher than those of the normal bone. For the premixed CPC there is a trend of increasing activity at the 2nd week, while in case of the empty hole and the PMMA an opposite trend could be seen.

**Discussion and Conclusions**

The osteoblast activity was highest for the premixed CPC, which indicates that it stimulates new bone formation to a higher degree than the two controls. The resorbability and ease of use of the premixed CPC makes it an attractive alternative for minimal invasive surgery.

**References**


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