

Injectable Bone Cements in the Treatment of Spinal Fractures, Osteopromotive Capacity and Surgical Considerations

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INTRODUCTION: Recent developments focus on injectable calcium – phosphate – cements for different indications in orthopaedics and traumatology including spinal fractures and osteoporosis. We performed a study and compared 4 different injectable bone cements regarding toxicity, cell growth and cell differentiation. Furthermore we used 2 of them (Calcibon, KyphOs) in the treatment of vertebral fractures on patients and summarize clinical and technical considerations.

METHODS: 4 injectable bone cements, three CP cements (ChronOS inject – Synthes, Calcibon - Biomet Merck, KyphOs – Kyphon) and one non resorbable glass – ceramic (Cortoss - Orthovita) were compared. Mesenchymal stem cells from sheep were seeded for the cytotoxic test on 6-well plates (50.000 cells /well). After 3 days of cultivation, a toxicity test (trypanblue), cellproliferationtest (MTT, Absorption 550 nm) and histology was performed. After 16 days of cultivation cell growth/differentiation (2 mio cells seeded onto the sample) was performed by histology, AP synthesis, protein absorption and histology.

Between 2002 and 2005 we performed 315 conventional kyphoplasties on 180 patients. 15 patients were under the age of 40 and showed traumatic fractures and were treated with resorbable bone substances. Maximum follow-up 2.5 years.

RESULTS: No significant toxic influences were found in Calcibon and ChronOS inject. KyphOs showed a 16.7% increased toxicity if compared to control. No viable cells were found after seeding on Cortoss. The same results were seen on cell growth, best growth in the Calcibon and ChronOS inject groups followed by 50% less growth in the KyphOs groups and virtually no cell growth in the Cortoss group. After 16 days all surviving cells produced similar AP levels with again the ChronOS group showing the highest levels. No

performed on ChronOS inject, as the other materials were too hard to cut and broke in pieces.

No vertebra treated with resorbable bone substance refractured during the follow-up period. The resorption of the bone substance varied largely and all patients had still visible artificial substance within the bone after 2 years. However, CT and MRI follow-up showed no resorption zone or osteonecrosis around the cements, all were in the state of remodelling.

DISCUSSION & CONCLUSIONS: All three CP – cements stimulate mesenchymal stem cell proliferation into osteoblasts and osteoblast growth; however Calcibon and ChronOS inject are superior to KyphOs. Astonishingly Cortoss was toxic for MSC and subsequently no growth occurred. We conclude that under lab conditions it is difficult to simulate the actual ingrowth and remodelling of bone cements. All cements are in clinical use; however we prefer the use of resorbable bone cements in young patients. Technically all used cements need a cavity to be injected in which we realise with a kyphoplasty balloon. The indication of treating traumatic fractures is clinically most important, in our experience within a clinical research group using these cements in different centers, only A1 and A3.1 fractures may yield good results in the future.

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protein absorption was found in the Calcibon and Cortoss groups. Histological studies could only be