CLINICAL APPLICATION OF RESORBABLE POLYMERS IN GUIDED BONE REGENERATION

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Introduction

Long segmental diaphyseal bone loss often results from high energy trauma like blast injury, osteomyelitis or wide excision of malignant conditions. Treatment of this long segmental diaphyseal defects remain a difficult clinical problem. In the literature, many authors have reported that bone loss more than 2.5 cm always require bone grafting. This is probably the critical size defect in human. Non-vascularized bone graft frequently fails if the defect is longer than 6-7 cm. 2.5 cm is probably the critical size defect is human and 7 cm is likely the critical size for non-vascularized bone graft. Various treatment methods are adopted currently to address this problem, including vascularized bone graft, distraction osteogenesis and massive allograft. However, all these methods are associated with a lot of problems.

Successful guided bone regeneration has been achieved in skull bone and jaw bone using resorbable allograft. Bone regeneration in long segmental defect and relatively small defect in tumour excision has been achieved using resorbable polylactide scaffolds.

Methods and materials

10 patients with bone defect of sizes up to 6 cm due to various causes including benign tumour, osteomyelitis & fractures were treated with resorbable polylactide scaffold impregnated with marrow blood which contains stromal cells. In cases with infection, antibiotics was also loaded into the scaffold and in this situation, the scaffold also served as a drug delivery device. The patients have assessed regularly with X rays and clinical symptoms.

Results

Serial X ray evaluation and clinical evaluation revealed presence of bone regeneration. The limbs enjoyed satisfactory function and there was minimal donar site morbidity and major surgery can be avoided.

Discussion

Selected cases are treated with guided bone regeneration which would be treated otherwise by conventional technique. Vascularized bone transfer has limited supply and involves a major operation. There is always a chance of vascular complication and there is donor site morbidity. Distraction osteogenesis has a limitation of length that can be lengthened and requires a prolonged placement of external fixation. There is a high chance of traction injury to nerve and other soft tissues. Massive allograft requires a prolonged period, in terms of decades, for complete creep substitution. There is also a high incidence of disease transmission and infection. Therefore there is a constant demand for bone substitute which can bridge long segmental defect effectively with minimal morbidity and can heal in reasonable time frame. The affected limb can be rehabilitated and bear weight for functional restoration as early as possible. These early results are promising.

INJECTABLE POLYURETHANES FOR THE TREATMENT OF THE OSTEOPOROTIC SKELETON

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Introduction

Bone loss resulting from osteoporosis increases the risk of fractures. The "at risk" population is estimated to be 28 million in the US and 100 million worldwide. Among fractures of osteoporotic bones compression fractures of the vertebral body are the most demanding to treat. Common treatment involves injecting of methylmethacrylate (MMA) cement into the vertebral body to restore the height of a collapsed vertebra (vertebroplasty, kyphoplasty).

Both procedures have several drawbacks including leakage of MMA cement outside of the vertebra, soft tissue damage, pressure on nerve roots and/or the spinal cord resulting in pain, paralysis necessitating cement removal, migration of cement to the lungs, which may cause pulmonary embolism, respiratory and cardiac failure, and even death. Increased stiffness of the segments resulting from the presence of injected cement, often leads to fractures of the vertebrae adjacent to those treated. The MMA cements have high rigidity and, in consequence, there is a mismatch in Young's moduli between cement and osteoporotic bone. Tissue necrosis due to high polymerization temperature of MMA and high monomer toxicity can be yet another problem.

A possible solution to these problems could be the use of new injectable polymeric materials that set at lower temperatures, possibly based on nontoxic monomers and having lower moduli than those of poly(methylmethacrylate) (PMMA) cements. The latter property can be achieved, for example, by incorporating an elastic component in the polymer chain or by developing porous structure in the setting cement. In addition, such injectable materials could be loaded with antiresorptive drugs preventing further bone loss and osteogenic drugs promoting new bone formation.

If the osteoporotic bone of the vertebrae possesses potential to regenerate, it might be beneficial to use biodegradable cements, allowing new bone to fill the space formed by degrading cement.

Candidate materials for such injectable cements are seg-