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Abstract

The effect of substrate characteristics on primary human bone cell response to mechanical loading was investigated in this study. The substrates comprised organic and inorganic materials with a range of hydrophilic and hydrophobic features. Substrate surface topography varied from smooth to particulate to porous. It was found that hydrophilic substrates such as borosilicate glass facilitated bone cell adhesion, in contrast to hydrophobic substrates such as poly(L-lactic acid), in which clumps of cells grew unevenly across the substrate surface. All primary bone cells cultured in the various collagen-coated substrates were responsive to mechanical stimulation. The study showed that, at a low strain level of 1000µm train, mechanical stimulation enhanced bone cell differentiation rather than proliferation. Coating the substrates with collagen type I enhanced cell adhesion and promoted an elongated cell morphology, indicating that the presence of specific binding sites on a substrate may be more important than its hydrophilic properties, regardless of the substrate topography.

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Abstract

BACKGROUND: Polymethyl-methacrylate (PMMA) beads releasing antibiotics are used extensively to treat osteomyelitis, but require surgical removal afterwards because they do not degrade. **METHODS:** As an alternative option, this report compares the in vitro gentamicin release profile from clinically used, biodegradable carrier-materials: six injectable cements and six granule-types. Cement cylinders and coated granules containing 3% gentamicin were submerged in dH₂O and placed in a 48-sample parallel drug-release system. At regular intervals (30, 90, 180 min. and then every 24 h, for 21 days), the release fluid was exchanged and the gentamicin concentration was measured. The activity of released gentamicin was tested on *Staphylococcus aureus*. **RESULTS:** All combinations showed initial burst-release of active gentamicin, two cements had continuous-release (17 days). The relative release of all cements (36-85%) and granules (30-62%) was higher than previously reported for injectable PMMA-cements (up to 17%) and comparable to other biodegradable carriers. From the cements residual gentamicin could be extracted, whereas the granules released all gentamicin that had adhered to the surface. **CONCLUSION:** The high release achieved shows great promise for clinical application of these biodegradable drug-carriers. Using the appropriate combination, the required release profile (burst or sustained) may be achieved.

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Abstract

Calcium Sulfate Delivery System with Tobramycin for the Treatment of Chronic Calcaneal Osteomyelitis

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Introduction

Treatment of chronic calcaneal osteomyelitis is one of the most challenging problems encountered in orthopaedic surgery. The results usually are poor.

Material & methods

We present a 24-year-old woman with *Pseudomonas aeruginosa* and *Proteus mirabilis* chronic calcaneus osteomyelitis secondary to a decubitus ulcer of the left calcaneus after a motor vehicle accident. The patient had long-term intravenous antibiotics and plastic surgery and microsurgical operations including the use of cutaneous and vascularized musculocutaneous flaps without benefit.

Computed tomography and magnetic resonance imaging showed extensive destruction and sequestration of the bone, in addition to extension and sinus formation to the heel pad. Extensive debridement of the necrotic bone and application of tobramycin loaded PMMA beads was performed, in addition to postoperative intravenous administration of ciprofloxacin. Six months later, laboratory examination including complete blood cell count, ESR, and CRP were within normal limits. At this time, extensive surgical debridement and filling of the osseous defect with autologous iliac cancellous bone graft and tobramycin impregnated calcium sulfate pellets and paste (Stimulan) was done. Postoperatively, the patient had per os antibiotics for 3 months.

Results

Recovery was uneventful. At the latest follow-up, 2 years later, there was no recurrence of the infection. Standard radiographs and computed tomography scans showed filling of the calcaneal defect and complete incorporation of the calcium sulfate graft with the host bone.

Conclusion

Two stage surgical treatment with extensive debridement and antibiotic impregnated calcium sulfate was effective in treating chronic calcaneal osteomyelitis.

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