INTRODUCTION

The successful use of biodegradable materials in surgery has opened the perspective to the possible use of these as antibiotic carriers\(^1\). Non resorbable polymethylmethacrylate (PMMA) antibiotic beads are currently widely used for the treatment of osteomyelitis (bone infection) but have the disadvantage that they require operative removal after treatment\(^2\). An antibiotic carrier that releases the antibiotic in high concentrations and is subsequently remodelled by bone tissue would obviate the need for operative removal of antibiotic beads. Injectable calcium phosphate (CaP) cements can be mixed with antibiotics and adapt to the shape of the bone defect that needs to be filled allowing minimally invasive procedures. As the efficacy of the combination is determined largely by the release pattern and the total amount of antibiotic released, we investigated the in vitro release of gentamycin from six different surgical calcium phosphate bone cements.

METHODS

Gentamycin loaded CaP cylinders were produced by adding 1 gram of cement powder and 30 mg gentamycin (Biomet Merck, Darmstadt, Germany) to the cement mixing-solution (powder to liquid ratio according to manufacturer’s instructions). The cylinders hardened overnight in cylindrical molds of 6x5mm (diameter x height). This resulted in 3 % weight/weight gentamycin-CaP cylinders. Controls without gentamycin were made for all groups. All cylinders were weighed and immersed in 500 µl distilled water in 48-well microtitre plates and kept at room temperature, constantly shaking at 180 rpm. The water was replaced at regular intervals (30, 90 and 180 minutes on day 1 and then 24 hourly for 21 days). These samples were stored at -20°C until analysis. Gentamycin concentrations were measured using a Fluorescence Polarisation Immuno Assay (FPIA) (Abbott AxSym System, Abbott Laboratories, Irving, Texas, USA). The data were analysed using two sample T test, (significance at p<0.05).

We used two clinically approved biodegradable cements and four experimental cements. The approved cements were: Bonesource (Stryker-Leibinger, Freiburg, Germany ) and Norian SRS (Mathys, Bettlach, Switzerland). The experimental cements were: Biobon (Biomet Merck, Darmstadt, Germany), Bioceament D (Biomet Merck, Darmstadt, Germany), Biofil, experimental CaP bone substitute (DePuy CMW, Blackpool, UK) and Chronos Inject, new brushite cement (Mathys, Bettlach, Switzerland).

ESSENTIAL RESULTS

The total amount of gentamycin released from the different cements ranged from 34.4% to 82.0% of total gentamycin added, as shown in Table 1. All cements showed a burst release pattern in the first day. Thereafter only two cements, showed a continuous release that leveled off after 17 days (Biobon) or 14 days (Bonesource). The release profiles of the cements are shown in Figures 2A and 2B. Significant difference was observed on day 21 between Biobon and Bonesource (p=2.12E-6) and on day 3 between Norian, Chronos, Biofil and Bioceament D (p=0.05 between all groups).

DISCUSSION

Many in vitro studies report an initial burst-release which is probably determined by the release of drug located in the surface of the carrier material. The continuous release that may be seen subsequently has been linked to the porosity of the material, and originates mainly from the deeper parts of the carrier\(^3\). Two cements showed such a continuous release, which would allow prolonged local antibiotic treatment, but might also induce resistant bacteria.

Depending on its mechanical characteristics, the resorbable material, could be used either in isolated defects or in load-bearing applications.

Strong biodegradable cements for such applications are currently being developed. This study shows that six different gentamycin loaded biodegradable calcium phosphate cements released gentamycin in two different release patterns i.e. burst and continuous. The cements that showed the highest total values (released over 50% of the available gentamycin) were Chronos, Biofil and Bonesource. The minimum release limit for gentamycin containing cements of 2 mg/g is exceeded by all cements studied\(^2\). Concluding, all cements studied released gentamycin, the duration and the pattern of release differed markedly between cement types.

**REFERENCES**


** POSTER #0459 **

GENTAMYCIN RELEASE FROM RESORBABLE CALCIUM PHOSPHATE GRANULES

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*Fig. 2A, Cumulative gentamycin release from calcium phosphate cements showing burst release only. Values are means of n=5 ± SD*

*Fig. 2B, Cumulative gentamycin release from calcium phosphate cements showing continuous release, levelling off after 17 days (Biobon) or 14 days (Bonesource). Values are means of n=5 ± SD*