**Effect of Addition of high Dose Antibiotics on the Mechanical Properties of Bone Cement: A Preliminary Study**

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**INTRODUCTION**

Several authors have examined the elution characteristics of antibiotic loaded bone cement (ALBC) and corresponding changes in its biomechanical properties [1-9]. Although ALBC are being increasingly used to treat infected total joints, little information is available regarding the release of multiple antibiotics and its long term effects on the biomechanical properties of the bone cement. To address this gap in our knowledge, the overall goal of this project was to investigate the progressive change in the compressive properties of ALBC due to release of Tobramycin (T) and Gentamycin (G) at different doses (alone or combination) from bone cement for up to 3 months.

**METHODS:**

Simplex P® and the antibiotics were acquired from Stryker and Sigma (# T1783-500MG for T and # G3632-10G for G) respectively. Four batches of ALBC were prepared as follows: a) 0.5g G and 0.5g T to 40g of PMMA; b) 5g G and 5g T to 40g of PMMA; c) 10g G to 40g of PMMA and d) 10g T to 40g of PMMA. Samples of 6.0 mm diameter and height of 12.0 mm were fabricated in accordance with ASTM. Samples were radiographed using a Faxitron X-ray System and specimens with bubbles >1mm were rejected. Three good samples were identified for each group. Specimens were immersed in 4ml PBS in capped polypropylene vials and placed in a shaking incubator (Belly Button®). At the designated sampling times (mentioned before), specimens were recovered and air dried for compression testing and the elution solutions were stored at 4°C for later analysis. Compression testing was performed using a materials testing machine (Instron model 5566; Instron Corp, Canton, Mass) fitted with a 20kN load cell. A deformation rate of 1.3mm/min was used. The surfaces of the fractured and intact specimens were examined using a JOEL Scanning Electron Microscope (SEM) at varying magnifications after coating with gold-palladium.

**RESULTS**

Figure 1 shows typical load deformation behavior of various bone cement groups indicating an initial elastic behavior followed by large plastic deformation. There was a significant decrease in the compressive strength of the samples having the higher doses of antibiotics as compared to the control and the ones having the lowest dose. This may be due to compromised structural integrity of the samples having higher doses as a result of elution of significant quantity of antibiotics. Duration of elution did not significantly change the compressive properties of the ALBC. SEM revealed formation of larger and widely distributed voids/channels on the surface of the cement matrix rendering the scaffolds porous for samples having larger doses of antibiotics (particularly T) as compared to other samples. SEM micrographs showed presence of extensive pores and channels, particularly for the cement specimen containing 10 g T. This observation may have implications in the uniform drug release profile observed from these samples. The v/v ratio for drug:cement was highest for samples containing 10 g T. This may have contributed to the creation of the pores/channels rendering the scaffolds porous with significantly diminished mechanical properties.

**CONCLUSIONS/FUTURE STUDIES**

Amount of antibiotic incorporated to ALBC has a significant effect on their compressive properties and is more important than the duration of drug elution from the specimens. We plan to continue our study adding more samples in each group and conducting additional tensile and fatigue tests with those samples.

**SIGNIFICANCE**

Further work will optimize the maximum dose of antibiotics that may be safely incorporated into PMMA without compromising its mechanical properties below a clinically acceptable value. Solubility of the drug in the media, homogeneity of its distribution in the matrix and its density seem to be important attributes that may determine its elution from a non-biodegradable/non-bioresorbable matrix, post elution.

**REFERENCES**