

Degree of Carbon-Carbon Double Bond Conversion, and Chemical Composition of Retrieved Bone Cement from Revised Total Hip Arthroplasties

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AIM

The purpose of this study was to characterize the surface properties and degree of cure of retrieved bone cement from revised total hip arthroplasties (THA).

MATERIALS AND METHODS

Bone cement was collected from 29 revisions. PMMA pieces were handled and sterilized according to ISO specifications and was subjected to multitechnique analysis involving SEM and X-ray microtomography for the investigation of the surface morphology and structure of the cement, micro MIR FTIR spectroscopy for the characterization of the molecular synthesis and degree of conversion, and X-ray fluorescence spectroscopy or the elemental analysis. Control bone cement samples served as controls for the determination of the degree of cure of as-received materials. The statistical analysis for the quantitative data was performed with an one-way ANOVA and the Tukey test at $\alpha=0.05$ level of significance.

RESULTS

Analysis of retrieved samples showed evidence of extreme porosity, and adsorption of a proteinaceous film composed of alcohols, amides and carbonates which shows evidence of adsorption of K, Na during the early stages of maturation; at later stages, this film is subjected to calcification through the precipitation of calcium and phosphorus and formation of calcium phosphate complexes. The degree of cure of retrieved samples indicated that the conversion is in the range of 60-70%, much lower than water-polymerized controls, assigned to the lower availability of monomer *in vivo*, due to its release to the surrounding tissues.

CONCLUSIONS

The results of this study emphasize the necessity for adopting *in vivo* analyses including retrieval studies for the investigation of the properties of bone cements. Based on the vastly irrelevant structure of retrieved bone cement with the cement formulated for *in vitro* tests as presented in this study, the clinical significance of *in vitro* research protocols may be doubtful.