



CHAPTER I

INTRODUCTION

Acrylic polymer is commonly referred as a "bone cement", although it is used as a grouting agent to fill the canal space in a hollow tubula bone fitted with a prosthetic device and not as an adhesive. Charnley(1) introduced polymethylmethacrylate, PMMA into orthopaedic surgery in the early 1960s. The material consists of liquid and powder components. The liquid is mainly methyl methacrylate monomer with trace of hydroquinone to prevent premature polymerization, and N,N-dimethyl-p-toluidine to promote cold curing. The powder is made up of a fine granular (20-50 μm diameter) mixture of methyl methacrylate-styrene copolymer, polymethylmethacrylate and sometimes barium sulphate to make it radiopaque. Its usefulness results from its ability to cure to a rigid form in a short period of time (8-12 min after mixing) at room temperature, and in a presence of water or biological fluids. Against these advantages however should be balanced the poor mechanical properties of PMMA, together with the exothermic nature of polymerization.

Since the PMMA bone cement presents some mechanical and biological inconveniences, investigations into improvement of the properties of the cement, the cement-bone interface and the cement-implant interface would have far-reaching consequences. There are in fact two major research initiatives in progress: first, to eliminate cement completely by developing either bone ingrowth into a porous

metal stem or bone apposition at a bioactive surface and second, to improve the mechanical properties and/or to reduce the exotherm of existing acrylic bone cement by various methods of reinforcement.

While most investigators have tried to improve the mechanical properties of bone cement by various methods of reinforcement of the PMMA bone cement, Weightman *et al.*(2) have tried with a new bone cement, more ductile bone cement based on polyethylmethacrylate (PEMA) powder and n-butyl methacrylate monomer (n-BMA). It has been shown to have distinct advantages over conventional PMMA bone cements, not only mechanically but also physicochemically and biologically. Unlike PMMA, the new cement is not irritant to soft tissue and less toxic to dental pulp(3-5) and has been shown to have a higher fracture toughness and superior fatigue life(6) as well as a lower exotherm than the conventional PMMA bone cement. Unfortunately, the new bone cement was observed to have high creep. As a consequence of these findings further work has continued in this area to address this weakness and Behiri *et al.*(7) found that introduction of hydroxyapatite (HAP) powder with PEMA produced increases in the Young's modulus and yield stress and decreases in the elongation to fracture. Furthermore, introduction of a silane coupling agent (3-trimethoxysilyl propylmethacrylate) to the surface of hydroxyapatite enhanced the properties of the hydroxyapatite reinforced PEMA bone cement.

In the present study, mechanical property improvement of the bone cement has been attempted by using a new bone cement using PMMA-Co-PEMA powder and MMA monomer instead of n-BMA monomer and PEMA bone cement. Further mechanical property

improvement was investigated by reinforced with either BaSO_4 or hydroxyapatite, both untreated and silane treated one.



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย