ARTICLES

CHARACTERIZATION OF LIGHT-CURED DENTAL COMPOSITES PREPARED FROM BIS-GMA/TEEGDMA AND BIS-GMA/ MPS MIXTURES

Y. VERANES[§], D. CORREA[§], J. M. MARTIN[†], R. KRAEL[§] and R. ALVAREZ[§]

[§] *Centre of Biomaterials, University of Havana, P.O. Box 6130, 10400, Havana, Cuba.*
yayma@biomat.uh.cu

[†] *Laboratory of Adhesion and Adhesives, Department of Inorganic, Fac. of Sciences, University of Alicante, P.O Box 99, 03080, Alicante, Spain*

Abstract— **The aim of this study was to prepare light-cured dental composites and to evaluate their physical, chemical and mechanical properties. Experimental composites were prepared from 2, 2 bis [4-(2-hidroxy 3-metacriloxypropoxi) phenyl] propane (Bis-GMA), tetraethyleneglycol dimethacrylate (TEEGDMA), 3-methacryloxypropyl trimethoxysilane (MPS) and a hybrid filler consisting of quartz and colloidal silica particles (Aerosil 90). The initiation system was based on the pair Camphorquinone (CQ)/N, N dimethylaminoethylmethacrylate (DMAEMA). The experimental composites and a commercial dental composite used as reference (Charisma®) were submitted to determinations of depth of cure, water absorption and solubility, compressive and diametral tensile strengths, and elastic modulus, according to the indications of the ISO standards. The experimental resins presented adequate values for most of the analyzed properties, except for compressive strengths. In the Bis-GMA/ MPS/quartz-aerosil composite a better integration between filler and matrix was observed. The Bis-GMA/TEEGDMA/ quartz-aerosil composite showed the best performance in regards to depth of cure, solubility in water, diametral tensile strength and elastic modulus. The properties of this composite were better than those of the commercial reference material, except for compressive strength.**

Keywords— **light-cured, dental composites, depth of cure, absorption, solubility, mechanical properties**

I. INTRODUCTION

During many years dental amalgam was the ideal restoring material for the damaged dental tissue, due to its high mechanical strength and durability, but it lacks of aesthetic and mimetic with the dental tissue. (López-Amo, 2001; Garro, 2001). The dental composites or compound resins appeared as an aesthetic and mimetic alternative to dental amalgam. They consist of two main components, the organic matrix and the inorganic filler. The organic matrix is formed by dimethacrylates, which are non-toxic and capable of a rapid free-radical polymerization, even in the presence of oxygen and water. The unfilled matrix has a poor wear resistance by itself, which can be improved by the inclusion of particulate fillers, which are harder than the polymeric matrix (Kalachandra *et al*., 1997; Sideridou *et al.*, 2002).

For dental restorative composites the monomeric mixture commonly consist of Bis-GMA and a viscosity modifier (diluent) as triethyleneglycol dimethacylate (TEGDMA), 3-hydroxypropyl methacrylate (HPMA), TEEGDMA and MPS (Vehoven *et al*., 1994; Habsuda *et al*., 2002).

The polymerization of dimethacrylates can be chemically or visible light-initiated, but light-initiation is preferred because it allows a better control of the entire polymerization process. Thus initiation can be started and stopped almost at will.

A basic mechanical property of a restorative material, such as light-cured resin composites, usually presented by manufacturers, is its strength. Data usually provided includes compressive, tensile, or flexural strengths. These strength values are usually related to filler content and composition or to different curing times (conversion degree of the matrix) and packing procedures (Brosh *et al.,* 1999).

Composites are classified according to their viscosity (flowable or condensable) and also according to the type and size of the fillers (macrofillers: 10-30 μm, microfillers: 0.01-0.04 μm and hybrid fillers: mixture of macrofillers and microfillers).

The use of inorganic fillers consisting of rational mixtures of fractions with different particle size increase packing density and filler content, improve the strength, ensures that the material can be easily polished and decrease the polymerization shrinkage of the resulting composite. Thus, these hybrid composites can be used for dental restorations in posterior teeth where masticatory forces are particularly intense (Leylanaz and Santerre, 1999; Davidenko *et al.*, 2001; Paik *et al*., 2001).

The water absorption of dental resins, either filled or unfilled, is important for dental applications. In filled dental resins the absorbed water decrease the life of the restorations by hydrolysis of the bonds developed between the filler surface and the coupling agent with results in cracks formation. The water ingress may have beneficial effects concerning the expansion of the composite, compensating thus the polymerization shrinkage with improved marginal sealing and relaxation of the stresses set up within the matrix during shrinkage (Mar-