REINFORCED AUTO POLYMERIZED RESIN AS A REPAIR MATERIAL FOR HEAT CURED DENTURE BASES

Thesis

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AIM OF THE STUDY

The present investigation was done to study the effect of addition of alumina and zirconia to the autopolymerized resin to repair heat cured acrylic resin. Some properties of repaired specimens were tested.

INTRODUCTION

The denture base is that part of the denture which rests on the tissue and carries the artificial teeth. Heat cured acrylic resin materials are widely used as a polymeric denture base materials. The material should be easy to manipulate and have an adequate strength properties and good dimensional stability over a period of time.

Midline fracture of dentures are the most common discussed in both clinical and materials science terms. Many midline fractures can be avoided by the application of established prosthodontic principles in constructing and maintaining dentures. Improvements in the resins and processing techniques can also reduce the incidence of midline fracture. The most promising approach to prevent or reduce the incidence of this problem appears to be reinforcement in the anterior part of the palate of the denture, *Beyli et al., in (1981)*[10] .

Zuhair et al., in(1983)[1] reported that acrylic resin denture base material offer relatively low resistance to breakage when a load is applied by an impact. So trials were made to improve the impact strength of conventional acrylic resin by addition of plasticizing ingredients in order to be more resistant to fracture by obliterating the micro-cracks present in the material.

Darbar et al., in (1994)[16] the fracture of dentures is an unresolved problem. Despite increasing costs incurred by the nation on the repair of these prosthesis, very little has been documented on the type of fracture encountered. This survey was carried out to determine the prevalence of type of fracture by the distribution of questionnaires to three different laboratories. Results obtained showed that 33% of the repairs carried out were due to debonded /detached teeth. Twenty-nine percent were repairs to midline fractures, more commonly seen in upper complete dentures. The remaining 38% were other types of fractures, the majority of which constituted repairs to upper partial dentures. The latter involved detachment of acrylic resin saddles from the metal in metal based dentures and the fractures of connectors in the all-acrylic resin partial dentures.

Jagger et al., in (1999)[28] the fracture of acrylic resin dentures remains an unresolved problem. Over the years, various approaches to strengthening acrylic resin have been suggested, including modifying or reinforcing the resin. Different types of fibers have been added to polymer materials to improve their mechanical properties, *Aydin et al., in (2002)*[6].

Uzun et al., in (1999)[69] fracture strength of denture base resins is of great concern, and many approaches have been used to strengthen acrylic resin dentures.

The fracture of acrylic dentures is a long-standing problem and a common clinical occurrence in prosthodontic practice. Dentures often fracture because of fatigue during mastication or because they are dropped into a wash basin or onto the floor *(Polyzois et al., in (2001) [52]).*

Memon et al., in (2001)[40] the impact strength and the flexural properties of denture base materials are of importance in predicting their clinical performance upon sudden loading.

Most denture base repairs are made using a chemical activated acrylic resin polymer for reasons of cost and expediency. Heat-activated polymers are not typically used because of longer polymerization time. But repairs made using a chemically activated polymers compared with a heat activated polymer have reduced flexural strength, poorer color stability, increased water sorption and weak bend strength to existing acrylic resin.

Nishigawa et al., in (2003)[44] self-curing acrylic resin is generally used for the repair of a fractured denture base. However, re-fracture of the repaired denture base resin often occurs because of poor bonding strength between the base resin and self-curing repair resin.

The ultimate goal of any denture repair is to restore the original strength of the denture and to avoid further fracture. The repair procedure should be time saving, strong, match the original color of the material and should not affect dimensional accuracy ***(****Polyzois et al., in (2001)* [(52)] *and Rached et al., in (2004)*[(54)] ***)***.

Different materials and techniques were used for repair of acrylic resin denture bases and may give different results. The best materials and methods for repair have not been conclusively determined.

Thus the present investigation was done to study and evaluate the effect of addition of alumina and zirconia to the autopolymerized resin to repair heat cured acrylic resin. Some properties of repaired specimens were tested.

REVIEW OF LITERATURE

Types of Denture Base Materials:

1- Conventional heat cured polymethyl methacrylate:

It is supplied as a powder and liquid. The powder can be supplied in bulk but usually is dispensed in individual packets. The liquid is supplied in a brown glass jar with a measuring cylinder. The powder contains a copolymer of polymethylmethacrylate in the form of spheres or beads to which the benzoyl peroxide initiator is added. Coloring pigments and fibers often are added for improved esthetics. The liquid is methyl methacrylate (MMA) monomer with a cross-linking agent (usually 5 to 15% ethylene glycol dimethacrylate) and a small amount of inhibitor (hydroquinone) to avoid premature polymerization and enhance shelf life.

MMA is a flammable liquid of low viscosity, like water. It is extremely volatile and boils at approximately 100°C. When it polymerizes, it shrinks approximately 21 % by volume. It can be a physical irritant to the skin, producing an itching feeling, and is known allergen. A correctly heat-processed denture base could have as little as 0.3% to as much as 2% residual MMA monomer. The high temperature at which conventional dentures are processed ensures a thorough, although not complete polymerization. The high-temperature processing also leads to a greater dimensional

change, however, resulting in a shrinkage of approximately 0.4% across the molar region *Ferracane et al., in (2001)* [25].

2- Chemically activated denture base resin:

Chemical activation does not require the application of thermal energy and therefore may be completed at room temperature. Chemically activated resins are often referred to as cold curing, self-curing or autopolymerizing resins. In most instances, it is accomplished through addition of tertiary amine, such as dimethyl-para-toluidine to the denture base liquid that is the monomer. When the powder and liquid components are mixed, the tertiary amine causes decomposition of benzoyl peroxide. Consequently, free radicals are produced and polymerization reaction is initiated. *Anusavice in (1996)* [5] .

3- High-Impact Strength Materials :

These are denture base materials that have greater impact strength. Their polymers are reinforced with butadiene-styrene rubber. The rubber particles are grafted to methylmethacrylate to bond to the acrylic matrix. These materials are supplied in a powder-liquid form and are processed in the same way as other heat accelerated methylmethacrylate materials. *Craig and Ward et al., in (1997)* [13] .

4- Pour Type Denture Resin :

The chemical composition of the pour type denture resins is similar to poly(methylmethacrylate)materials that are polymerized at room temperature.

The principal difference is in the size of the polymer powder or beads. The pour type denture resins commonly referred to as fluid resin have much smaller powder particles when mixed with monomer, the resulting slurry is very fluid. The mix is quickly poured into an agar-hydrocolloid or modified plaster mold and allowed to polymerize under pressure at 0.14 Mpa. Centrifugal casting and injection molding are techniques used to inject the slurry into the mold. *Craig and Ward et al., in (1997)* [13] .

5- Gel Types:

Denture base plastics such as vinyl acrylics can be supplied in a gel form. These gels have in general the same components as the powder-liquid type, except the liquid and powder have been mixed to form a gel and shaped into a thick sheet. Chemical accelerators cannot be used in a gel, because the initiator, accelerator, and monomer would be in intimate contact. The storage temperature of a gel and the amount of inhibitor present have a pronounced effect on the shelf life of the material. When stored in a refrigerator, the shelf life is about 2 years. *Craig and Ward et al., in (1997)* [13] .

6- Rapid Heat-Polymerized Resins:

These are hybrid acrylics that are polymerized in boiling water immediately after being packed into a denture flask. The initiator is formulated from both chemical and heat-activated initiators to allow rapid polymerization without the porosity might expect. *Craig and Power et al., in (2002)* [(14)] .

7- Light-Activated Denture Base Resins:

This denture base material consists of a urethane dimethacrylate matrix with an acrylic copolymer, microfine silica fillers, and a photo-initiator system . It is supplied in premixed sheets having a claylike consistency .*Craig and Power et al., in (2002)* [(14)] .

8- Microwave polymerized polymers:

Poly(methylmethacrylate) resin also may be polymerized using microwave energy. This technique employs a specially formulated resin and a non-metallic flask. A conventional microwave oven is used to supply the thermal energy required for polymerization. The major advantage of this technique is the speed with which polymerization may be accomplished. *Anusavice in (1996)* [(5)] .

Requirements of denture base materials:

O'Brien et al., in (1997) [(45)] stated that, ideal properties of denture base materials should have good appearance ,high flexural strength