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ARTIFICIAL DENTURES AND PROCESS OF PREPARING

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The present invention relates to artificial dentures with soft cushion linings and particularly to a process of making such dentures and to providing satisfactory attachment between the soft cushion lining and the denture base material.

Artificial dentures prepared from methyl methacrylate have the advantage of physiological and chemical indifference as well as of good mechanical properties. According to a known process these dentures may be prepared by the following method:

Mixtures of monomeric, liquid, polymerizable methacrylic acid derivatives and polymers, for instance polymeric methyl methacrylate, together with suitable catalysts, for instance organic peroxides, are packed into a conventional denture mold and hardened therein by polymerization with the application of pressure and heat. It is of advantage to provide the surface of the denture which is permanently in contact with the tissue of the mouth with a lining of a soft material which, due to its resilience, does not irritate the tissue of the mouth. Such a lining gives the dentures an accurate fit in the mouth and improves the adhesion of the dentures to the tissue.

The tissue of the mouth with which dentures are permanently in contact consists of mucous membrane and includes the gums. For convenience, the side of the denture making permanent contact with the tissue of the mouth is referred to herein as the tissue side.

It is known to prepare soft cushion linings on dentures from polymers containing plasticizers. Because of the volatility of the plasticizers these polymers show the disadvantage of becoming hard with use.

It is an object of this invention to provide artificial dentures having soft cushion linings which are durable and do not shrink, separate or peel, and which do not become hard and distorted with use.

It is another object of the invention to provide a process for making artificial dentures having soft cushion linings which are durable and do not shrink, separate or peel, and which do not become hard and distorted with use.

It is a further object of the invention to provide a process of economically and conveniently producing soft cushion lining materials in a convenient form for making improved artificial dentures.

It is still a further object of the invention to provide suitable materials for producing strong chemical union between the soft cushion lining material and the hard denture base material.

Still further objects will become apparent as the following description proceeds.

In accordance with the present invention it has now been found that improved dentures with soft cushion linings can be prepared in a technically simple process by utilizing for the lining a soft and non-hardening material comprising a copolymer of acrylates or methacrylates together with butadiene. It has proved to be especially

advantageous to incorporate with these copolymers antioxidants such as they are known from rubber chemistry. Of course, these antioxidants must be non-toxic and shall preferably not give rise to discoloration.

The application of the afore-said copolymers on artificial dentures to form soft cushion lining thereon can be accomplished by most various methods, for instance by leaving a recess on the tissue side of the denture or cutting away the portion of the denture to be replaced with the soft and non-hardening material, and applying this material to this place while effecting strong union between the soft material and the denture with the aid of an autopolymerizing plastic.

Suitable autopolymerizing plastics for this purpose are especially mixtures of polymers having a basis of methyl methacrylate with polymerizable liquid monomers which polymerize by addition of redox systems within a comparatively short time without the application of higher temperatures.

Another method of preparing dentures with soft cushion linings consists in applying the soft and non-hardening material to a mixture of polymeric and liquid polymerizable compounds and effecting solidification by polymerizing in a conventional denture mold with the application of pressure and heat (see copending application Ser. No. 235,096, filed July 3, 1951, by Hermann Schnell and Wilhelm Becker). According to this method it has proved to be preferable to employ an excess of compounds giving off oxygen and/or reducing agents, especially in the case of a soft material containing stabilizers.

The copolymers of acrylates or methacrylates together with butadiene can be produced by the most various methods. Besides acrylates or methacrylates, other polymerizable vinyl compounds or divinyl compounds may be employed. The term "butadiene" as herein used is intended to refer to butadiene as such, its homologues and derivatives. Examples of stabilizers are phenyl-β-naphthylamine and the reaction products of substituted phenols and formaldehyde. Suitable activators according to the invention are compounds giving off oxygen, for instance benzoyl peroxide. As reducing substances there may be used amines or organic sulfinic acids, salts or derivatives thereof.

The soft and non-hardening materials obtained by the herein described process retain their soft consistency and are further distinguished by high tensile strength. It was surprising that these polymers provide an excellent adhesion with dentures prepared for instance from methyl methacrylate. This could not be foreseen since, as is known, the production of a proper chemical union between non-hardening foils of natural rubber or polymers containing a high proportion of butadiene with dentures of plastic material involves difficulties. Previously, these materials could often be attached to one another by mechanical anchorage only. A particularly high technical advantage brought about by the present invention resides in the fact that polymerization of the denture base materials is not delayed by polymerization-inhibiting stabilizers incorporated in the soft material. This is accomplished especially by the application of an excess of catalysts or by addition of reducing substances. The catalysts or reducing substances can be added either by dissolving them in the monomeric component of the denture base material or applying them to the surface of foils prepared from the herein described copolymers in the form of a lacquer or varnish coating, for instance by brushing. It is also feasible to incorporate the activators and reducing agents into the foils directly.

The soft cushion linings prepared according to the invention on dentures are durable and do not separate

or peel, they do not shrink or become foul and do not become hard or distorted with use.

The present invention is further illustrated by the following examples without being restricted thereto.

Example 1

15 grams of polymethyl methacrylate and 0.015 gram of benzoyl peroxide are soaked with 5 cc. of monomeric methyl methacrylate wherein 0.015 gram of the morpholine salt of o-ethylene benzene sulfinic acid are dissolved and left standing in a covered vessel to form a dough. The dough thus obtained is packed into a conventional dental flask and pre-shaped under pressure with a sheet of cellophane interposed between the surfaces of the flask and the material. The flask is opened and a sufficient portion of the dough of monomeric and polymeric methyl methacrylate is removed to permit the application of a foil made from a copolymer of 40% of butadiene and 60% of methyl methacrylate, which copolymer contains 1% of 2.2'-methylene-bis-(4-methyl-6-cyclohexylphenol) as stabilizer. After finally closing under pressure the flask is heated in the water-bath to 100° C. for 30 minutes and the dough hardened by polymerization. After cooling the flask is opened and a denture removed which is provided on the tissue side with a soft and non-hardening lining that is attached to the denture by a proper chemical union and distinguished by high tensile strength and excellent stability to mouth fluids.

Example 2

A denture made from polymeric methyl methacrylate is embedded, upside down, into a dental flask and, after opening the flask, a portion of the hard denture material is removed, for instance by milling, in proper position and in proper relation to the thickness of the soft material to be applied thereto. Thereupon a mixture is prepared from 4 grams of a copolymer consisting of 6% of acrylonitrile and 94% of methyl methacrylate, 0.24 gram of benzoyl peroxide with 2 grams of monomeric methyl methacrylate and 0.1 gram of dimethyl-p-toluidine. The mixture is brushed to an appropriately sized foil of a copolymer of 35% of butadiene and 65% of methyl methacrylate stabilized as described in Example 1 and the foil thus coated is slightly heated above a flame and placed in position on the denture with the application of pressure. The flask is closed and left standing under pressure for about 20 minutes. The flask is then opened and a denture removed which is provided on the tissue side with a strongly adhering soft and non-hardening lining which is distinguished by excellent tensile strength and stability to mouth fluids.

Example 3

Foils of a copolymer consisting of 30% of butadiene, 60% of methyl methacrylate, and 10% of butyl acrylate, which is stabilized with the reaction product of p-cresol and formaldehyde, is placed into a denture flask. The side of the foil which does not face the plaster of Paris is coated with tertiary butyl hydroperoxide and the flask is packed with a dough of 15 grams of a copolymer consisting of 99% of methyl methacrylate and 1% of ethyl acrylate and 5 grams of monomeric methyl methacrylate, wherein 0.015 gram of benzoyl peroxide is dissolved, in the manner common to dental technology. After closing the flask the latter is heated in an oven to 70° C. for 8 hours and to 100° C. for another hour and the dough solidified by polymerization. After cooling the flask is opened and the denture removed. The denture thus obtained is provided on the tissue side with a soft and non-hardening lining attached to the denture in strong chemical union and distinguished by excellent tensile strength and stability to mouth fluids.

We claim:

1. An artificial denture comprising a hard, artificial base material and a soft cushion lining integrally attached to the tissue side of said base material, said lining consisting essentially of a copolymer of (1) a member of the group consisting of polymerizable vinyl and divinyl compounds and (2) butadiene.

2. An artificial denture comprising a hard, artificial base material and a soft cushion lining integrally attached to the tissue side of said base material, said lining consisting essentially of a copolymer of (1) an acrylate and (2) butadiene.

3. A process of preparing artificial dentures having soft cushion linings which comprises applying, to the tissue side of a hard, artificial base material, a soft cushion lining consisting of a copolymer of (1) a member of the group consisting of polymerizable vinyl and divinyl compounds and (2) butadiene by means of a polymerizable composition comprising (1) a methacrylate polymer, (2) a polymerizable liquid, ethylenically unsaturated monomeric compound, and (3) a polymerization catalyst, and hardening by polymerization reaction to produce a proper chemical union between the two layers.

4. The process of claim 3, wherein the polymerization reaction is effected with the application of pressure and heat.

5. The process of claim 3, wherein the copolymer of the group consisting of vinyl and divinyl compounds is an acrylate.

6. A process of preparing an artificial denture having a soft cushion lining comprising the steps of packing an acrylic resin into one part of a two part denture mold, placing over said resin a thin sheet of a mixture of (1) a polymer of methyl methacrylate, (2) a polymerizable liquid monomeric compound selected from the group consisting of esters of acrylic acid and methacrylic acid, and (3) a polymerization catalyst, placing over said sheet at the open face of the mold a soft cushion lining consisting essentially of a copolymer of acrylates and butadiene, closing the mold to shape the acrylic resin and the lining and hardening the dough by the polymerization reaction to produce a proper chemical union between the two layers.

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