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3,372,484

ORTHODONTIC METHOD

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ABSTRACT OF THE DISCLOSURE

A method of applying a flowable medical grade siloxane rubber, which is curable at body temperature, to the teeth and to appliances on said teeth and allowing the rubber to cure to form a protective non-toxic coating for providing temporary cosmetic effects to protect oral tissues of the user against injury.

This invention relates generally to dental cosmetic techniques. It is especially concerned with methods of coating orthodontic devices, including metal bands, wires, and other appurtenances, so as to protect the oral tissues against injury and also to form a cosmetic shield which improves the appearance of persons wearing such devices.

The devices used in orthodontia are characteristically unsightly. They are a source of embarrassment to the user and for this reason there is considerable reluctance to wear them. Another common objection to orthodontic appliances is that rough protruding ends and edges can irritate or injure the soft mucous membranes of the lips and cheeks.

This invention resides in the formation of a temporary dental coating which can be easily applied and removed by the individual. The preferred coating is a soft material, such as an artificial rubber or a suitable plastic or the like, which can be readily applied over orthodontic appliances while in the mouth in order to minimize or prevent injury to the overlying oral tissues. It is contemplated that the coating can be pigmented to match closely individual tooth shades in order to mask unsightly orthodontic appurtenances, as well as partial clasps and disfigurements which may appear on the teeth until removed or repaired. It is also a feature of the invention that the coating be a medical grade material which is non-injurious to the oral tissues and which has a neutral reaction in the body.

In accordance with the general foregoing description, the present invention provides for the formation of a dental coating which includes the following characteristics:

- (1) It can be readily applied to the teeth and cured in situ at body temperatures without the use of pressure;
- (2) It has a soft rubber-like consistency in a moist atmosphere;
- (3) It is non-toxic;
- (4) It can be pigmented to obtain a desired hue;
- (5) It is relatively non-absorbent; and,
- (6) It will stay in place for a plurality of hours yet can be easily removed by the user when desired.

There are several materials which satisfy the listed criteria and are thus suitable for the purposes of the present invention. One class of materials which has been used successfully are siloxanes, and particularly silicone elastomers having the required characteristics. By way of example, silicone elastomers sold under the trademark Silastic RTV silicone rubbers by Dow Corning are room temperature vulcanizing and can be adjusted to obtain low working and set-up times. Such rubbers are characterized by only a slight amount of heat and shrinkage during vulcanizing, and a satisfactory set-up can be obtained at body temperatures in the mouth of the user. The raw material can be readily pigmented, while the

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vulcanized material is resistant to weathering and body fluids and will contain a rubbery consistency over a wide temperature range.

A preferred medical grade Silastic RTV elastomer is sold under the trademark Medical Silastic 382 elastomer and may be identified by the following typical properties.

Before catalyzing:

Viscosity, centipoises	50,000
Color	White
Specific gravity at 77° F.	1.13

After vulcanizing for 24 hours at 77° F.:

Color	White
ASTM D676 durometer hardness, Shore A scale	43
ASTM D412 tensile strength, p.s.i.	400
ASTM D412 elongation, percent	160
ASTM D746 brittle point, degrees F.	-100

Shrink, linear, percent—	
After 3 days at 77° F.	0.4
After 6 days at 77° F.	0.6
After 14 days at 77° F.	0.7
Water absorption, percent, after 7 days' immersion at 77° F.	0.4

Thermal conductivity, cal. per. (cm.) (degrees C.) (sec.)	0.525×10^{-3}
Volume coefficient of thermal expansion, per degree C. (0 to 100° C.)	7.50×10^{-4}

The curing agent utilized in the process of this invention should be non-toxic and capable of vulcanizing the coating material at body temperatures and within a short set-up time to a cured coating which can be safely retained in the mouth. Stannous octoate has been shown to be especially suitable as a catalyst for the preferred Medical Silastic 382 elastomer, as well as other silicone rubber products. Stannous octoate is a fast setting catalyst which is relatively innocuous and promotes curing of the elastomer at room temperatures to a soft, rubber-like protective coating. The preferred stannous octoate coating should have no visible contamination and a minimum tin content of about twenty-six percent (26%).

In a specific example of this invention, a quantity of liquid Medical Silastic 382 elastomer was reacted at room temperature to initiate curing by mixing it thoroughly just before using with the stannous octoate catalyst. A working time of about two minutes or less and a set-up time of less than ten minutes was obtained by a proportion of about six drops of catalyst per one ounce of liquid elastomer. However, if desired, the working and set-up times can be altered by proportionately varying the amount of catalyst used. Before mixing, the liquid elastomer was pigmented to match the tooth shade of the patient by adding food coloring.

The catalyzed mixture was applied to the anterior surfaces of the upper teeth of the patient and to an attached orthodontic band simply by spreading the mixture in place with a spatula. The mixture was cured in situ at body temperature to form a thin coating which covered the orthodontic device including all of the rough irritating ends and edges, so as to protect the overlying oral tissues against injury. At the same time, the pigmented coating served effectively to mask the orthodontic device so as to improve the appearance of the patient.

One important aspect of the present invention resides in the discovery that the cured rubber coating is at least mildly adherent to the teeth and will be retained in place for a plurality of hours or even days. At the same time, the coating can be easily removed simply by stripping or peeling it from the underlying surfaces. In the described

example, the coating was retained on the teeth and orthodontic device for four days before being removed by the user. In another example, the coating was applied to the smooth anterior surface of one tooth and was retained for about four hours.

Other silicone rubbers suitable for the purposes of the present invention include Silastic S-5391 RTV sold by Dow Corning. Silastic S-5391 RTV also is room temperature vulcanizing silicone rubber of medical grade which can be catalyzed by stannous octoate. Other silicone elastomers are manufactured by Union Carbide and the General Electric Corporation. For example, one of the medical silicones manufactured by General Electric under the general trade designation "Silicone Rubber" and sold under the trademark Elasticon and distributed by Kerr Manufacturing Company, division of Ritter Manufacturing Company, has been used experimentally for this purpose with very satisfactory results. Still other siloxane elastomers which may be used to form the desired coating are disclosed in U.S. Patent No. 2,571,039, issued Oct. 9, 1951, to James F. Hyde; U.S. Patent No. 2,833,742, issued May 6, 1958, to Robert J. Koch; U.S. Patent No. 2,927,907, issued Mar. 8, 1960, to Keith E. Polmanteer; and, U.S. Patent No. 2,843,555, issued July 15, 1958, to Charles A. Berridge.

It also is contemplated that plastic coatings which are non-injurious to the user and are retainable on the teeth can be provided. For example, a plastic coating which may be suitable for use in the method of this invention because of its adhesion to smooth enameled surfaces is prepared from styrene and butadiene and is more specifically disclosed in U.S. Patent No. 2,540,996, issued Feb. 6, 1961, to Lawrence L. Ryden.

The methods of this invention have been specifically disclosed for the purpose of masking orthodontic appliances and protecting the oral tissues against injury. It will be apparent, however, that the novel techniques also can be used for theatrical make-up or for other purposes with the intent of deliberately applying temporary disfigurements to the teeth. Still other uses and many modifications of the invention will be apparent to those skilled in the art in view of the foregoing detailed disclosure. It is to be understood, therefore, that within the scope of the appended claims the invention can be practiced otherwise than as specifically described.

What is claimed is:

1. A method of providing temporary cosmetic effects and protecting soft tissue adjacent the teeth of a user comprising: applying a flowable settable compound to the teeth and to an appurtenance or appliance associated with and already secured relative to the teeth, said compound being characterized in that it is elastomeric, non-toxic, at least mildly adherent to the teeth and curable at body temperatures while in the mouth; at least partially covering the appurtenance or appliance with the compound; and allowing the compound to cure in situ; whereby the cured compound can be retained in place for a plurality of hours and yet with purpose can readily be removed by the user.

2. The method of protecting oral tissues of a user against injury by an orthodontic device on the teeth comprising providing a flowable medical grade siloxane rubber product which is curable at body temperatures to form a protective coating layer, said layer being retainable on said device for a plurality of hours and readily removable by the user, applying said product to said device, and allowing the product to cure in situ at body temperature.

3. A method of coating a tooth of a user, the steps comprising providing a flowable non-toxic compound curable with a catalyst at room and body temperatures and adherent to teeth when catalyzed and cured while yet being readily removable therefrom, catalyzing said compound at room temperature to initiate curing, applying said partially cured compound to a tooth and allowing

the compound to further cure in situ into an adherent coating which can be retained in place for a plurality of hours and yet with purpose readily can be removed.

4. The method of protecting oral tissues of a user against injury by an orthodontic device on the teeth comprising mixing a medical grade silicone elastomer with a non-toxic catalyst to produce a flowable mixture, said mixture being characterized in that it cures at room temperature to form a soft, protective coating which is at least mildly adherent to the teeth for a plurality of hours and is readily removable, applying a thin coating of said mixture to said device and teeth, and allowing said mixture to cure in situ at body temperature.

5. The method as claimed in claim 4 wherein said elastomer and said catalyst are mixed just before using at room temperature.

6. The method as claimed in claim 4 wherein said catalyst is stannous octoate.

7. The method as claimed in claim 4 wherein said elastomer has the following typical properties:

Before catalyzing—

Viscosity, centipoises	50,000
Color	White
Specific gravity at 77° F.	1.13

After vulcanizing for 24 hours at 77° F.—

Color	White
ASTM D676 durometer hardness, Shore A scale	43
ASTM D412 tensile strength, p.s.i.	400
ASTM D412 elongation, percent	160
ASTM D746 brittle point, degrees ° F.	-100
Shrink, linear, percent:	

after 3 days at 77° F.	0.4
after 6 days at 77° F.	0.6
after 14 days at 77° F.	0.7

Water absorption, percent, after 7 days' immersion at 77° F.	0.4
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Thermal conductivity, cal. per (cm.) (degrees C.) (sec.)	0.525×10^{-3}
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Volume coefficient of thermal expansion per degree C. (0 to 100° C.)	7.50×10^{-4}
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8. In a method of protecting oral tissues of a user against injury by an orthodontic device, the improvement comprising applying to said device a settable medical grade elastomer and allowing said elastomer to cure in situ, said elastomer having the following typical properties:

Before catalyzing—

Viscosity, centipoises	50,000
Color	White
Specific gravity at 77° F.	1.13

After vulcanizing for 24 hours at 77° F.—

Color	White
ASTM D676 durometer hardness, Shore A scale	43
ASTM D412 tensile strength, p.s.i.	400
ASTM D412 elongation, percent	160
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Water absorption, percent, after 7 days' immersion at 77° F.	0.4
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Thermal conductivity, cal. per (cm.) (degrees C.) (sec.)	0.525×10^{-3}
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Volume coefficient of thermal expansion per degree C. (0 to 100° C.)	7.50×10^{-4}
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