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Progress Report

DENTURE BASE RELINERS FOR SELF USE

by

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DENTURE BASE RELINERS

FOR SELF USE

Abstract

The chemical compositions of and effects on denture base resin of ten brands of denture relining materials for self use were investigated. On the basis of approximate composition the reliners may be divided into three groups, one containing solvents, another plasticizers as a major constituent and the third little or no plasticizers or solvent. The reliners containing the large percentages of plasticizer and the one containing the solvent appear to adversely affect the physical properties of a denture base resin.

1. INTRODUCTION

Denture relining materials are no innovation. For the past few years they have been used extensively [1, 2].

Some physical and working properties of the reliners for self use and the effects of these relining materials on certain physical properties of denture base resins are presented in this report. A qualitative picture of the chemical compositions of the reliners is also included.

2. MATERIALS STUDIED

Ten relining materials were investigated. A list of the products and the companies manufacturing or distributing them is given in Table 1.

These reliners were purchased at retail stores with the exception of Dendex and Com-Fit Pads which were procured directly from the manufacturer. Dates of procurement are also given in Table 1.

3. EXPERIMENTAL PROCEDURE AND RESULTS

3.1 Analysis and Composition

In order to explain the effect of these relining materials on denture base resins it was necessary to determine their compositions. It was also desirable to have this information since they are obviously not the self-curing acrylic reliners which are in common use by the dental profession. Also since the relining materials are in prolonged contact with the mucous membranes information on composition would be helpful to other investigators if the evaluation of possible toxic effects is desired in the future.

Preliminary experiments consisting of heating to several temperatures from 100° to 175°C and ignition at dull red heat showed that these relining materials are primarily organic in nature and that nine of the ten materials do not contain solvents.

To obtain qualitative data on composition each material was placed in a small still pot which was enclosed within a

temperature-controlled air jacket. The still pot was a glass tube closed at one end and with a ground glass ball joint which could be connected to the delivery tube by means of a ground glass socket joint and clamp. The temperature was raised in approximately 50°C increments until 350°C was reached. In this manner the resins were depolymerized or degraded and the plasticizers were distilled over. In the case of Dendex distillation was done at 100° to 120°C at atmospheric pressure in order to separate the solvents from the resin. These distillates were, in turn, fractionally distilled to separate the distillates by boiling range. The fractions were identified by infrared spectra, physical properties or qualitative organic methods.

After the major components were identified separations were usually obtained by solvent extraction methods using a soxhlet apparatus and quantitative estimates of the constituents were made. In one case vapor phase chromatographic methods were used. Because of the complexity of the constituents and the methods of analysis used the analyses are believed to be reproducible to 5 percent.

The compositions of these relining materials are given in Table 2. An inspection of this table shows that the materials can be classed roughly in three groups. One group contained solvents, another plasticizers as a major constituent and the third little or no plasticizer or solvent.

3.2 Setting Time

To determine the time of setting, a thin coat of reliner, approximately 1 millimeter in thickness, was placed on duplicate glass slides by methods which followed as closely as possible the procedures outlined in the manufacturer's directions. One of the coated slides was left in air at 37° ± 1°C (98.6° ± 1.8°F) and the other was placed in water at 37° ± 1°C (98.6° ± 1.8°F). Tests were conducted with a standard one pound Gillmore needle which was allowed to rest on the surface for thirty second intervals. The test was repeated at various time intervals ranging from one to twenty-four hours until no perceptible circle could be observed. If setting had not occurred by the end of one month the tests were discontinued. The results are given in Table 3.

To demonstrate volatility differences in the reliners at room temperature an experiment was performed in which small quantities of the material were placed on individual cover glasses and weighed periodically. The procedure follows: Clean cover glasses were weighed on an analytical balance. Approximately 0.2 gram of reliner was placed on the glass and the cover glass and material were immediately weighed. These samples were then stored in a relatively dust-free atmosphere at 21° ± 1°C (69.8° ± 1.8°F). Weighings were made after one, two and three hours from initial weighing on the first day. After the first day, weighings were made every twenty-four hours for five days. Staze, Poli-Grip, Dr. Heath's Deodoriz-

ing Denture Adhesive, Dentur-Eze, Com-Fit Pads, Snug Denture Cushions and Ezo Dental Cushions showed no loss in weight. Perma-Fit and Brimms Plasti-Liner, both highly plasticized, showed very little loss in weight (1.2 and 0.5 percent, respectively). The sample of Dendex had the largest loss in weight, approximately 37 percent. The results summarized in Table 3 show that the faster setting materials had the greater loss in weight.

3.3 Adhesion to Denture Base Resin

To obtain some information on the relative adhesion of the different relining materials to methyl methacrylate, rods, 1/4 inch in diameter, were cut to approximately two inch lengths and ends made plane and parallel. Two pieces of the methyl methacrylate rod with a small amount of reliner between them, were inserted into a glass tube used as a guide for alignment. The two pieces of rod were compressed toward each other giving a thickness of reliner varying from 0.5 to 1 millimeter. After removal from the alignment tubes, the test specimens were stored for one week in distilled water at 37° ± 1°C (98.6° ± 1.8°F). Three specimens were tested for each of the relining materials. The results are shown in Table 3. Those reliners having no adhesion contain little or no plasticizer and no solvents.

3.4 Distortion and Crazing of Denture Base Resin

It was noted that some of the specimens used for setting time determination displayed wrinkled surfaces as if dimensional changes of the reliners were taking place. It was believed that these changes might give rise to forces which would tend to cause distortion when applied to an artificial denture.

Clear resin discs 0.5 millimeter in thickness, and 50 millimeters in diameter were cut across their diameters and coated on one side with reliners. These and an uncoated half-disc were placed in water at 37° ± 1°C (98.6° ± 1.8°F). After one month of immersion, the halves were placed against a straight edge and the amount of warpage measured with a toolmaker's microscope. Only one specimen of each material was prepared. The unlined specimen showed a change of approximately 0.001 inch. The reliners which exhibited wrinkled surfaces did show distortion of the resin base. The data are shown in Table 4.

Specimens of a clear denture base resin were used for the crazing test. These specimens were lined with each of the materials to determine if the solvents or plasticizers present would relieve strains as indicated by cracking or crazing which would appear in the resin base. The lined specimens were placed in distilled water at 37° ± 1°C (98.6 ± 1.8°F) and visual exam-

inations were made for crazing at the end of four hours and one week of storage. The specimens lined with Perma-Fit, Brimms Plasti-Liner and Dendex showed crazing at the end of four hours. The crazing increased over the one week period. From Table 2 it is apparent that these reliners contain solvent or large amounts of plasticizer. Specimens lined with Snug Denture Cushions and Dentur-Eze showed no crazing at the end of four hours, however, the specimens did show slight crazing after being relined for one week.

The results for crazing are shown in Table 4.

3.5 Effect on Transverse Stiffness and Strength of Denture Base Resin

To determine the effects of the reliners on the stiffness and strength of the denture base resin, transverse test specimens as described in American Dental Association Specification No. 12 for Denture Base Resin [3] were prepared and coated with the relining materials. The thickness of reliner averaged 0.5 millimeters. Tests were run on specimens lined with all ten reliners four hours after application. Only four reliners, Dentur-Eze, Perma-Fit, Brimms Plasti-Liner and Dendex appeared to have adverse effects on the transverse stiffness and strength of the denture base. Additional specimens were coated with these four materials and tested twenty-four hours and one week after application. All specimens were stored and tested in water at 37° ± 1°C (98.6 ± 1.8°F). Tests were conducted according to the specification testing procedure. The results on lined

and unlined specimens are shown in Table 5.

4. SUMMARY

There appears to be some correlation between the composition of the reliners and their effects on the physical properties of a denture base resin. The reliners containing the higher amounts of plasticizer (Perma-Fit and Brimms Plasti-Liner) and the solvent containing reliner (Dendex) all craze, distort and reduce the transverse strength and stiffness of the denture base resin to about the same degree. Snug Denture Cushions, and Com-Fit Pads do not appear to affect the properties of the denture base resin as greatly as Perma-Fit, Brimms Plasti-Liner, Dentur-Eze and Dendex. Ezo Dental Cushions, Dr. Heath's Deodorizing Denture Adhesive, Staze and Poli-Grip are composed of either paraffin wax and gum Tragacanth or Cotton Cloth and do not affect the properties of the denture base resin.

BIBLIOGRAPHY

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2. Beall, J. R. and Caul, H. J. "Liners" for Dentures. J.A.D.A. 33:304 March 1946.
3. Swaney, A. C., Paffenbarger, G. C., Caul, H. J., , and Sweeney, W. T. American Dental Association Specification No. 12 for Denture Base Resin: Second Revision. J.A.D.A. 46:54 January 1953.

Table 1. Reliners Investigated

Brand	Manufacturer or Distributor	Date of Procurement
Brimms Plasti-Liner	Plasti-Liner Co., Inc. Buffalo, New York	July 1955, August 1956
Com-Fit Pads	Com-Fit Company Scipio, Indiana	September 1955
Dendex	Dendex Company Los Angeles, Calif.	September 1955
Dentur-Eze	Dentur-Eze Inc. Seattle, Washington	July 1955
Dr. Heath's Deodorizing Denture Adhesive	International Cosmetics. Co. Chicago, Illinois	July 1955
Ezo Dental Cushions	Ezo Products Company Philadelphia, Penna.	July 1955
Perma-Fit	Perma-Fit Company Chicago, Illinois	July 1955, August 1956, September, November 1957
Poli-Grip	Hudson Products Jersey City, N. J.	July 1955
Snug Denture Cushions	Midland Pharmacal Corp. New York, New York	July 1955, August 1956
Staze	Staze, Inc. New York, New York	July 1955

Table 2

Approximate Compositions of Reliners
(per cent by weight)

Brand	Resins					Misc.			Plasticizers					Solvents		
	Poly (Methyl Methacrylate)	Poly (Vinyl Acetate)	Cellulose Nitrate	Poly (Butyl Methacrylate)	Coumarone-Indene	Paraffin Wax	Gum Tragacanth	Cotton Cloth	Fatty Acid Triglyceride	Dibutyl Phthalate	Glyceryl Triacetate	Ester Type	Butyl Phthalyl Butyl Glycolate	Acetone	Ethyl Alcohol	Toluene
Dendex																
Material*			40							15				25	10	10
Solvent														100		
Brimm's Plasti-Liner	15										85					
Perma-Fit	25					15					60					
Dentur-Eze**		P			P					P						
Snug Denture Cushions				80					20							
Com-Fit Pads		90											10			
Dr. Heath's Deodorizing Denture Adhesive						45	50					5				
Ezo Dental Cushions						85		15								
Poli-Grip						50	50									
Staze						50	50									

* Tentative composition analysis.
** Methods of analysis have not yet been found.
P Present.

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Table 3. Some Properties of Reliners

Material	Setting Time 37° ± 1°C) (98.6° ± 1.8°F)		Loss in Weight Stored in Air 21° ± 1°C (69.8° ± 1.8°F)	Adhesion Tensile Strength
	Water Days	Air Days	Per Cent	PSI
Dendex	1	1	37	400 ± 40
Brimms Plasti-Liner	4	*	0.5	1500 ± 80
Perma-Fit	2	*	1.2	1200 ± 40
Dentur-Eze	*	30	None	200 ± 20
Snug Denture Cushions	*	*	None	100 ± 0
Comfit Pads	*	*	None	**
Dr. Heath's Deodorizing Denture Adhesive	+	*	None	None
Ezo Dental Cushions	Softens	*	None	None
Poli-Grip	+	*	None	None
Staze	+	*	None	None

* Does not harden within 30 days.
** Not tested, only one side adhesive.
\+ Swells in water, no setting time measureable.

Table 4

Effect of Reliners on a Denture Base Resin

Brand	Crazing at One Week	Distortion Inches
Dendex	Crazing	0.044
Brimms Plasti-Liner	Crazing	0.031
Perma-Fit	Crazing	0.028
Dentur-Eze	Slight crazing	0.005
Snug Denture Cushions	Slight crazing	None
Comfit Pads	None	0.001
Dr. Heath's Deodorizing Denture Adhesive	None	None
Ezo Dental Cushions	None	None
Poli-Grip	None	None
Staze	None	None

Table 5

Transverse Tests
Effect of Reliners on a Denture Base Resin

Material	Time Reliner Remained on Resin Before Testing					
	4 Hours			24 Hours		
	Deflection from 1500 gm to		Load at Failure	Deflection from 1500 gm to		Load at Failure
	3500 gm	5000 gm		3500 gm	5000 gm	
	mm	mm	gm	mm	mm	gm
Dendex	1.9	4.1	4900	1.9	4.0	4900
Brimms Plasti-Liner	2.3	+	4600	2.0	3.9	5000
Perma-Fit	2.5	+	4300	2.0	4.4	5100
Dentur-Eze	1.9	4.0	4900	2.0	4.1	4900
Snug Denture Cushions	1.8	3.7	5300			
Comfit Pads	1.8	3.7	5700			
Dr. Heath's Deodorizing Denture Adhesive	1.8	3.9	5800			
Ezo Dental Cushions	*					
Poli-Grip	1.8	3.7	5300			
Staze	1.8	3.6	5700			
Unlined Denture Base	1.8	3.9	5500			

\+ All specimens broke before readings could be made.
* Wax was not adhesive, therefore, not tested.

Table 5 (Continued)

Transverse Tests
Effect of Reliners on a Denture Base Resin

Material	Time Reliner Remained on Resin Before Testing: 1 Week		
	Deflection from 1500 gm to		Load at Failure
	3500 gm	5000 gm	
	mm	mm	gm
Dendex	2.0	4.2	5000
Brimms Plasti-Liner	2.0	+	4600
Perma-Fit	2.0	+	4600
Dentur-Eze	2.0	+	4800
Snug Denture Cushions			
Comfit Pads			
Dr. Heath's Deodorizing Denture Adhesive			
Ezo Dental Cushions	*		
Poli-Grip			
Staze			
Unlined Denture Base			

\+ All specimens broke before readings could be made.
* Wax was not adhesive, therefore, not tested.