STUDIES OF A NITROCELLULOSE SILICONE CREAM AS A SKIN PROTECTANT AGAINST ECZEMATOGENOUS CONTACT ALLERGENS*

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The silicones consist of molecular chains of alternate oxygen and silicone atoms and differ from ordinary organic compounds in that certain carbon atoms are replaced by silicon atoms (1).

The silicones are chemically inert and possess water repellent and adhesive properties. Their physical properties are unusually independent of extremes in temperature. They have been used as lubricants, insulators, in weather resistant paints and in the treatment of fabrics to render them water repellent, to mention but a few of their many uses. More recently the silicones have been incorporated in various ointment bases and used as skin protectants. A recent report (2) on the clinical evaluation of such a preparation states that 30% silicone oils in a petrolatum base proved beneficial in 58 of 61 dermatologic conditions.

The present report is an evaluation of a special plasticized combination of silicone (dimethylpolysiloxane), nitrocellulose and castor oil suspended in a greaseless vanishing cream base.†

PRELIMINARY STUDY

In a preliminary evaluation of this product, 21 subjects were skin tested in the manner outlined below, with the one exception that orthodox patch tests were used instead of the open skin test method. Little or no protective efficiency was demonstrated. In fact, in a few of the subjects, the patch test response was greater at the sites prepared with the silicone cream than on an anatomically symmetrical site not so protected. These findings were not unlike those of Madsen (3) who made an evaluation of a new protective cream known as Kerodex by means of the patch test method.

In the opinion of the writers the patch test is not a satisfactory method of studying the protective efficiency of a protective cream. The prolonged close contact, occlusion, maceration, heating and friction are greatly at variance with the true conditions of usual clinical exposures to most eczematogenous allergens. It was felt that the open skin test method would more nearly simulate actual clinical contact with the allergenic substance; and that a cream's protective efficiency, if any, could be more readily demonstrated by this means.

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METHOD

Measurement of the quantity of cream required to inunct a given area of the body. In order to be certain that the test subjects applied an amount of cream adequate to entirely cover the test site or sites, it was necessary to predetermine the amount of cream necessary by applying quantities of the creams to selected areas on two of the participants. By expressing measured amounts of the cream from the tube in which the cream is supplied, the following quantities were found necessary to cover the stated areas: a) for one-half of the upper back (from midline to posterior axillary line and from shoulder to waist), 2.5 inches of cream as expressed from the tube; b) for the lateral aspect of the thigh (from midline of anterior aspect to midline of posterior aspect and from knee to greater trochanter), 2.0 inches of cream as expressed from tube; c) for the anterior aspect of arm (from midline of medial aspect to midline of lateral aspect and from antecubital fossa to shoulder) 1.5 inches of cream as expressed from tube.

Selection of subjects. Subjects were selected from the patients seen in the allergy section of the Skin and Cancer Unit. These subjects were selected on the basis of having previously shown a positive reaction to the standard concentration (4) of one of a variety of commonly encountered eczematogenous contact allergens. Selection was also made according to the cooperativeness and intelligence of the patient in regard to proper inunction of the cream.

Preparation of test sites. Detailed directions for the method and frequency of application of the creams were mimeographed for distribution to the test subjects. The subjects were instructed to thoroughly inunct the designated amount of the protective cream on the selected test site, twice daily. They were instructed to bathe as usual and return for skin testing in a given number of days (2 to 18 days). The selection of actual test sites depended on several factors: a) the number of tests to be applied, b) areas most suitable to the subjects as well as the testers, c) areas of greatest ease of inunction. In each case an anatomically symmetrical site, on which no protective cream had been inuncted, was used for a comparative series of tests.

Method of testing. After the subjects completed the inunction for the specified length of time, a series of skin tests was applied, using graded dilutions of the allergens to both the prepared site and the contralateral unprepared site. The open skin test method was employed. The various dilutions of the allergens were painted on an area approximately 2 x 2 centimeters. The site of each skin test was previously outlined by a skin marking pencil. All allergens were incorporated into liquid vehicles. With a few exceptions the tests were read in 48 hours.

Comparison and evaluation of the results. By comparing the skin test reactions on the prepared site with those on the unprepared contralateral site, it was ascertained whether the silicone cream offered any protection, and if so, to what degree. The results of the skin test are recorded according to a modified Bloch Classification.*

Method for comparison of the protective efficiency of silicone cream with several other skin protectant creams and ointments. After ascertaining the end points of the skin test reactions in the preceding tests, several dilutions of the allergen above and below the end points, were used to compare the protective efficiency of silicone cream with other available preparations. Tests were applied after a single application of silicone cream and the other protective cream selected for

* – No reaction.
(+) Faint erythema.
+ Definite erythema.
++ Erythema, edema and beginning papule and/or vesicle formation.
+++ Papule and vesicle formation, erythema and infiltration or bullae.
++++ Large confluent bullae, erythema and edema, or denudation and necrosis.

the comparison. Where end point determinations were performed on the back, the comparative study with the other protective cream was performed on the thighs and vice versa. Anatomically symmetrical sites were selected for the comparison. After each cream was thoroughly inuncted, one-half of each inuncted site was washed with lukewarm water. Identical dilutions of the allergen, using the open skin test method, were applied to a washed and unwashed site on each selected area. The tests were read in 48 hours.

RESULTS

Thirty six subjects (Table I) with known allergic eczematous contact sensitivities were tested by the open skin test method using graded dilutions of the allergens. One series of the tests was applied to a site previously prepared by inuncting with a silicone cream. Another series of the tests was applied to an anatomically symmetrical site not inuncted. With two exceptions,* the tests were read in 48 hours. Thirty of the thirty-six subjects demonstrated protection in varying degrees on the silicone cream inuncted site as compared to the unprepared site. In five subjects there was no difference in the skin test reactions between the prepared site and the unprepared site on the contralateral side. It is possible that in these five cases also, had the dilutions of the allergens been graded to a finer degree, some protection could have been demonstrated. In one subject the skin test response was greater on the prepared site as compared to the unprepared site.

Generally speaking, the greater the number of days the silicone cream was applied prior to testing, the greater was its protective efficiency.

As demonstrated in Table II, the silicone cream was compared with three other skin protectant preparations, both before and after washing. Preparations A and B are commercially available preparations that do not contain silicone. Preparation C is a purchasable silicone-containing ointment with a petrolatum base. The silicone cream under study in the above mentioned experiment (Covicone-Abbott) was found superior in protective efficiency to preparations A and B both before and after washing (Cases 1, 3, 7, 8 and 11). Preparation C was found to protect slightly more than Covicone in two of the three cases tested when the sites of the protective preparations were not washed before testing, (Cases 9, 10 and 25). However preparation C was slightly less protective than Covicone in all three cases when the sites of the protective preparations were washed before testing.

As a skin protectant, Covicone has all the obvious advantages of a greaseless vanishing cream base plus protective efficiency before and after washing. It is colorless when applied to the skin.

No allergic sensitivities to Covicone were encountered during the course of this study. However, in two cases being prepared for testing during the summer months, a pustular eruption, due probably to an occlusion of the sweat and/or the sebaceous ducts, developed and was confined to the sites of application.

* See Table I.

TABLE I

Allergic skin reactions to open tests obtained in experimental comparison of covicone prepared skin with unprepared skin[1,2]

CASE NO.	NO. DAYS TEST SITE PREPARED	ALLERGEN	SITE PREPARED–UNPREPARED	ALLERGEN DILUTIONS AND PATCH TEST RESPONSES																			
				1–2	1–4	1–8	1–10	1–20	1–40	1–50	1–80	1–100	1–200	1–300	1–400	1–500	1–600	1–800	1–1000	1–2000	1–5000	1–10,000	1–100,000	1–1,000,000
1	18	Resorcin in water	Prep. Unprep.									(+) (+)	(+) (+)			(+) (+)			(+) (+)		(+) (+)	— (+)	— (+)	— (+)
2	5	L.C.D.* in alcohol	Prep. Unprep.					(+) (+)		— —		— —				— —			— —	—	— —	— —	— —	— —
3	7	P.P.D.** in alcohol	Prep. Unprep.							++ ++		+ +	+ +		+ +		+ +	— +	— (+)		— —	— —	— —	— —
4	7	P.P.D. in water	Prep. Unprep.							— +		— +	— —		— —		— —		— —		— —	— —	— —	— —
5	9	P.P.D. in water	Prep. Unprep.							(+) (+)		(+) (+)	(+) (+)		— (+)		— (+)	— —	— —					
6	5	P.P.D. in alcohol	Prep. Unprep.							++— +++ ++— +++		++ ++	+ ++		(+) +		— +	— +	— +		— —	— —	— —	— —
7	7	P.P.D. in water	Prep. Unprep.							(+) (+)		— —	— —		— —		— —	— —	— —		— —	— —	— —	— —
8	2	P.P.D. in alcohol	Prep. Unprep.							+++ +++		++ ++	— (+)		— —		— —	— —						
9	7	P.P.D. in water	Prep. Unprep.							+ +		— +	— +		— (+)		— (+)	— (+)	— (+)		— —	— —	— —	— —
10	7	P.P.D. in alcohol	Prep. Unprep.							+++ +++		+ (+)	+ —		(+) —		(+) —	(+) —	(+) —		— —	— —	— —	— —

11	7	P.P.D. in water	Prep. Unprep.							+ +		+ +	(+) (+)		− −		− −	− −	− −		− −	− −	− −	−
12	4	P.P.D. in water	Prep. Unprep.							+ +		+ +	+ +		+ +		+ +	+ +	− −		− −	− −	− −	−
13	6	P.P.D. in water	Prep. Unprep.							− +		− +	− (+)		− (+)		− −	− −	− −		− −	− −	− −	−
14	7	P.P.D. in water	Prep. Unprep.							+ +		+ +	+ +		− +		− −	− −	− −		− −	− −	− −	−
15	7	Potassium dichromate in water	Prep. Unprep.												− +		− +	− −	− −			− −	− −	−
16	7	Potassium dichromate in water	Prep. Unprep.												− +		− +	− +	− +			− −	− −	−
17	3	Rhus in acetone	Prep. Unprep.		++ +++		− +++		− +++			− +++				− ++			− −			− −		
18	3	Rhus in acetone	Prep. Unprep.		− +		− −		− −			− −				− −			− −			− −		
19	3	Rhus in acetone	Prep. Unprep.		+++ +++		+++ +++		+++ +++			++ +++				− ++			− ++			− −		
20	2	Rhus in acetone	Prep. Unprep.	− ++	− ++	− +	− +		− −			− −												
21	4	Rhus in acetone	Prep. Unprep.		− +		− −		− −			− −				− −			− −			− −		
22	10	Rhus in acetone	Prep. Unprep.	++ ++++	++ ++++	++ ++++	++ ++++	+ +++	+ +++		+ +++	+ +++				+ +++			− +++			− +++		

TABLE I—*Continued*

CASE NO.	NO. DAYS TEST SITE PREPARED	ALLERGEN	SITE PREPARED–UNPREPARED	ALLERGEN DILUTIONS AND PATCH TEST RESPONSES																			
				1–2	1–4	1–8	1–10	1–20	1–40	1–50	1–80	1–100	1–200	1–300	1–400	1–500	1–600	1–800	1–1000	1–2000	1–5000	1–10,000	1–100,000	1–1,000,000
23	10	Rhus in acetone	Prep.	++	++	++	+	+	+		+	+				–			–			–		
			Unprep.	++++	++++	++++	++++	++++	+++		+++	+++				+++			+++			+++		
24	5	Nickel sulfate in water	Prep.				–	–	–		–			–			–		–		–	–	–	–
			Unprep.				+	+	+		+			+			+		+		+	+	+	+
25	7	Nickel sulfate in water	Prep.				–	–	–		–			–			–		–		–			
			Unprep.				+	(+)	–		–			–			–		–		–			
26	5	Nickel sulfate in water	Prep.				+	–	–		–	–		–			–		–		–	–	–	–
			Unprep.				+	–	–		–	–		–			–		–		–	–	–	–
27	5	Nickel sulfate in water	Prep.				–	–	–		–	–		–			–		–		–	–	–	–
			Unprep.				+	–	–		–	–		–			–		–		–	–	–	–
28	10	Nickel sulfate in water	Prep.				++	++	+		–	–		–			–		–			–	–	–
			Unprep.				++	++	+		+	–		–			–		–			–	–	–
29	10	Nickel sulfate in water	Prep.				+	+	–		–	–		–			–		–			–	–	–
			Unprep.				++	++	+		+	–		–			–		–			–	–	–
30	7	Nickel sulfate in water	Prep.				++	++	++		–	–		–			–		–			–	–	–
			Unprep.				+++	+++	+++		++	++		+			–		–			–	–	–
31	6	Bichloride of mercury in water	Prep.													–			–	–	–	–	–	–
			Unprep.													+			(+)	–	–	–	–	–

32	7	Bichloride of mercury in water	Prep. Unprep.																	++ ++	+ +	+ +			
33	4	Bichloride of mercury in water	Prep. Unprep.														++ ++— +++			++ ++— +++	+ ++— +++	— (+)	— (+)	— —	— —
34	6	Benzocaine in alcohol	Prep. Unprep.					+ ++		— ++		— ++	— +		— —		— —	— —		— —		— —	— —	— —	— —
35	7	Benzocaine in alcohol	Prep. Unprep.					— +		— +		— +	— +		— +		— +	— +		— +		— +	— +	— +	— +
36	5	Benzocaine in alcohol	Prep. Unprep.					++— +++ +++		++ +++		+ +	— (+)		— (+)		— —	— —		— —		— —	— —	— —	— —

* L.C.D. = liquor carbonis detergens.

** P.P.D. = paraphenylendiamine.

[1] See text of this report for interpretation of skin test response (a modified Bloch Classification.)

[2] All skin tests were read in 48 hours with the exception of Case 33 (24 hour reading) and Case 17 (98 hour reading).

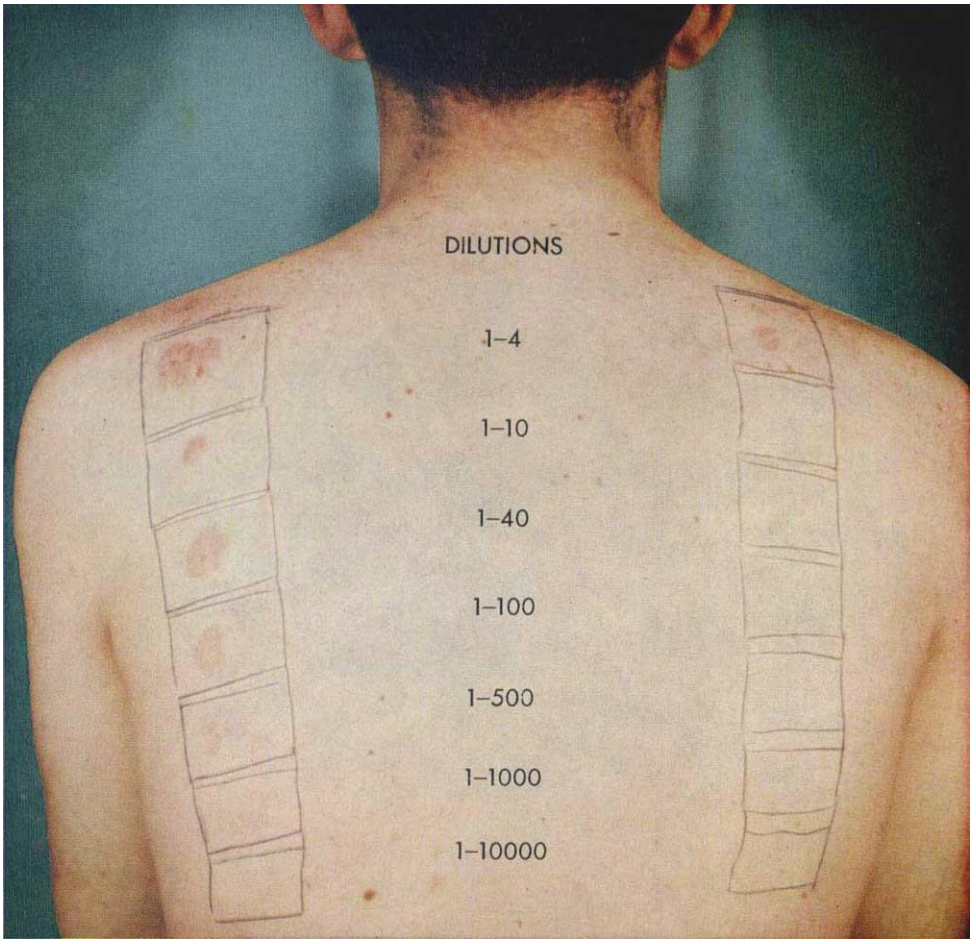

FIG. 1. Demonstrating the degree of protection with Covicone 96 hours after applying graded dilutions (acetone) of oleoresin from toxicodendron (poison ivy). (*Color plate Courtesy Abbott Laboratories, North Chicago, Illinois*)

TABLE II

Allergic skin reactions to open tests obtained in experimental comparison of the protective efficiency of Covicone with three other skin protectants

CASE NO.			DILUTIONS OF ALLERGENS												
			1–10	1–20	1–40	1–50	1–100	1–200	1–400	1–600	1–800	1–1,000	1–5,000	1–10,000	1–100,000
11	N. W.	Cc				(+)	−	−	−						
		A				+	+	+	(+)						
	W.	Cc				+	(+)	(+)	(+)						
		A				+	+	+	(+)						
7	N. W.	Cc				(+)	−	−	−						
		A				+	−	−	−						
	W.	Cc				(+)	−	−	−						
		A				++	+	+	(+)						
3	N. W.	Cc						(+)	(+)	(+)	−	−	−		
		A						+	+	+	(+)	(+)	(+)		
	W.	Cc						+	+	+	+	(+)	−		
		A						+	+	+	+	+	−		
8	N. W.	Cc				+++	(+)	−	−						
		B				+++	++	++	−						
	W.	Cc				+++	++	−	−						
		B				+++	+++	++	−						
1	N. W.	Cc										−	−	−	−
		B										+	+	+	+
	W.	Cc										−	−	(+)	−
		B										(+)	(+)	(+)	(+)

10	N. W.	Cc				++	+	+	−	−	−	−	−		
		C				++	(+)	(+)	−	−	−	−	−		
	W.	Cc				++	+	+	(+)	(+)	−	−	−		
		C				++	(+)	(+)	(+)	(+)	(+)	(+)	−		
25	N. W.	Cc	−	−	−										
		C	−	−	−										
	W.	Cc	−	−	−										
		C	+	−	−										
9	N. W.	Cc				+	(+)	−	−	−	−	−			
		C				(+)	−	−	−	−	−	−			
	W.	Cc				+	+	(+)	(+)	(+)	−	−			
		C				+	+	+	+	+	−	−			

N. W. = not washed.
W. = washed.
Cc = Covicone.
A, B, C = three different protective creams.

Although detailed clinical evaluation of Covicone in actual use was not attempted in this study, our results to date have been encouraging in a variety of dermatologic conditions, including diaper rash and as an interval protectant in chronic and chronic recurrent eczematous eruptions of the hands.

CONCLUSIONS

Using graded dilutions of a variety of commonly encountered allergens and employing the open skin test method, varying degrees of protection were demonstrated in 30 of 36 subjects who had previously prepared test sites with Covicone.

In comparing Covicone with three other skin protectant preparations, Covicone was found superior to all three when the sites of application of the protective creams were washed before applying the skin tests. Covicone was also found superior to two of the three preparations, to which it was compared when the sites of application of the protective preparations were not washed prior to testing.

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