aureus, but both gentamicin and phenoxyethanol caused only a small reduction in viability of the bacteria in 2 of the 3 strains. The viability of the *Proteus* species was decreased by all 3 antimicrobials but the effect was most marked with gentamicin and benzoyl peroxide 20%.

DISCUSSION

It should be noted that this test indicates the bactericidal effect of the materials in contact with the bacteria in a non-nutrient environment. The test system used in this work is only one of several test systems that could be utilized: for example, the minimum inhibitory concentration (bactericidal or bacteriostatic) in a nutrient environment with or without protective debris could be used. Results of such tests are merely indicators and would not necessarily predict the efficiency of the material in clinical use. Such tests do not measure but can indicate bacteriostatic effects or predict the potential of the active material when diluted by spreading on the skin. In a leg ulcer many bacteria must receive some protection by being in an environment with extracellular macromolecules and dead eukaryotic cells. Therefore, a material showing promise in this test would need to be tested in a clinical situation.

There are two published investigations on the treatment of ulcers with benzoyl peroxide. In an uncontrolled study, Pace (1976) found 20% benzoyl peroxide to be of considerable help in the management of pressure sores. However, Lookingbill et al. (1978) showed in a double-blind study that 10% benzoyl peroxide had no effect on leg ulcer flora. This is in contrast to our *in vivo* data and can be explained by the important differences between *in vivo* and *in vitro* studies, though the concentration of the benzoyl peroxide may also be important.

The mode of action of phenoxyethanol and gentamicin is antimicrobial. Benzoyl peroxide is antimicrobial but because it releases by weight 6% oxygen this could also be of help in healing of ulcers which are generally oxygen depleted.

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Inhibition of Hyperhidrosis by Topical Application of a Local Anesthetic Composition

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Abstract. An eutectic mixture of 5% lidocaine and 5% prilocaine applied locally to the skin inhibited epinephrine-induced sweating in healthy subjects. It also inhibited palmar and axillary hyperhidrosis from 1 to 6 hours after application to 15 of 17 patients tested. A placebo lotion was without effect. When used daily for 3–4 weeks, only 25% of the patients were very pleased with the treatment. The reason for the decrease of efficacy is uncertain.

Key words: Hyperhidrosis; Inhibition of sweating; Topical anesthetic; Antiperspirant

Excessive sweating can be severe, discomforting, and interfere with many social and occupational activities. Emotional and mental factors trigger hyperhidrosis in most subjects and it is especially evident on the palms and in the axillae. Such sweating does not occur during sleep and a hereditary tendency is sometimes seen. In other patients there is an increased sensitivity of the hypothalamic heat-regulating centre resulting in hyperhidrosis, especially in warm weather. This type can be worse at night and is often generalized, but may also be most apparent for the eccrine glands in the palms and axillae. The various metallic compounds and anticholinergics used as topical antiperspirants have recently been reviewed (8). The most successful is the application of a 20% solution of aluminium chloride or zirconyl chloride in absolute alcohol under occlusive dressing when the axilla is dry (7, 8). Axillary hyperhidrosis can be treated by surgical excision of the glands (3, 9). For palmar sweating there is no surgical remedy except cervicothoracic sympathectomy (1), but this is only recommended for special cases and has not gained wide acceptance.

Injection of procaine is known to reduce the sweat response induced by acetylcholine and

Table I. *Effect of local anaesthetics after one hour's topical application on normal skin of the forearm*

The figures indicate mean ± standard error of the mean. Pin-prick: numbers without pain of 10 tested. 0=no analgesia, 10=total analgesia
L=Lidocaine 10%; P=Prilocaine 10%; L+P=Lidocaine 5%+Prilocaine 5% mixture

	With occlusion				Without occlusion			
	L+P	L	P	Placebo	L+P	L	P	Placebo
Pin-prick	7.82	2.33	2.64	0.30	4.9	0.08	0.75	0.17
P-value L+P versus	–	<0.001	<0.01	<0.001	–	<0.01	<0.01	<0.01
Active sweat pores per cm^2	88.2	108.6	125.0	192.3	94.4	138.2	132.2	169.3
P-value L+P versus	–	<0.01	<0.05	<0.001	–	<0.05	<0.05	<0.01

abolish the sweat production seen after injection of epinephrine (6). We have applied locally a new anaesthetic composition that can penetrate the epidermal barrier and inhibit sweating. Its use in patients with palmar and/or axillary hyperhidrosis is reported.

METHODS

Comparison of Various Anesthetics for Effect on Sweat Inhibition in Normal Skin

Cellulose pads (2×2 cm) were soaked by a standardized procedure in an emulsion of each of the following compositions: A) lidocaine base 10%, B) prilocaine base 10%, C) lidocaine base 5% + prilocaine base 5%, D) placebo emulsion alone.

The pads were applied under occlusive dressing for one hour on the inside of the forearm of 12 healthy volunteers (10 men and 2 women). The area was marked, washed, and divided into two triangles.

A test for analgesia was then made in one triangle by pin-pricking 10 times with dental needles. The other triangle was injected after 30 minutes with 0.02 ml of epinephrine 1 : 10000. Five minutes after the injection, a 5% solution of *o*-phthaldialdehyde in xylene was painted on the area (4). The number of wet sweat pores per cm^2 was counted under magnification (×25).

Effect on Palmar and Axillary Hyperhidrosis

Patients

Seventeen patients, 6 men and 11 women, aged 12-48 years, were studied. They had all experienced severe problems for many years with hyperhidrosis of the axillae and/or palms. Most of them had previously tried local treatment with various anticholinergic drugs, but with little or no effect. Some had tried sedatives, or tranquillizers such as diazepam.

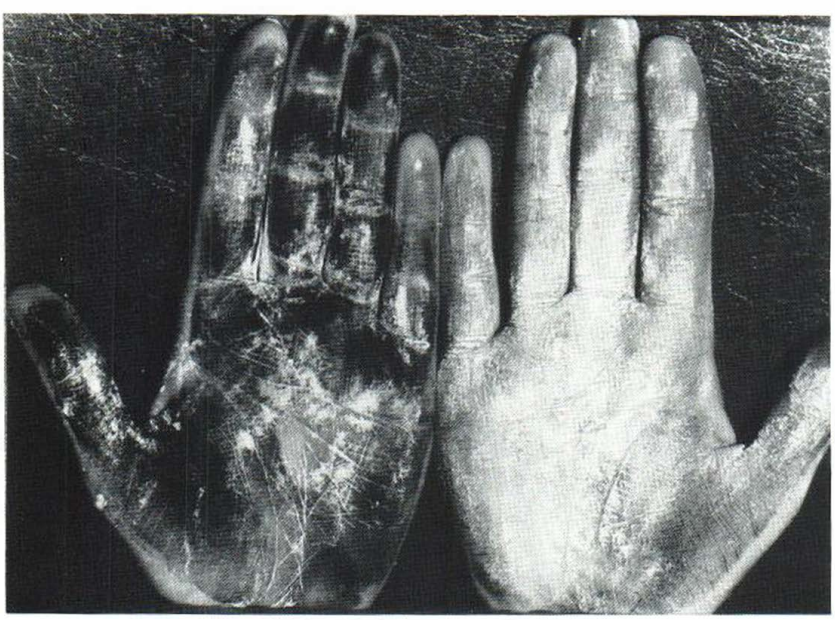

Fig. 1. Effect of local anesthetic mixture and placebo on palmar sweating as measured by the starch–iodine method.

Table II. *Effect of lidocaine–prilocaine mixture in patients with severe hyperhidrosis*

Pat. no.	Age	Sex	Treated area		Effect starch test		Effect when used in daily life	
			Hands	Axillae	Hands	Axillae	Hands	Axillae
1	20	♀	+	+	+	+	None	Uncertain
2	25	♀	+	0	+		Some	–
3	28	♀	+	+	+	+	Some	Some
4	31	♂	0	+		+	–	Good[a]
5	12	♀	+	+	+	None	Good	Uncertain
6	35	♂	+	+	Uncertain	Uncertain	Good[a]	Good[a]
7	23	♂	+	0	+		Not known	–
8	23	♀	0	+		+	–	Uncertain
9	47	♀	+	+	+	+	Some	Some
10	48	♀	+	+	+	Uncertain	Uncertain	Uncertain
11	21	♂	+	+	+	+	Good	Good
12	40	♂	+	0	+	+	None	–
13	26	♀	0	+		+	–	Some
14	25	♀	+	+	+	+	Some	Good
15	32	♀	0	+		+	–	Good
16	18	♂	+	0	+		None	
17	47	♀	+	0	Uncertain		None	None

[a] A good effect was noted when applied daily for 2 weeks. No real help was obtained during the subsequent months.

Treatment

About 2–3 ml of the emulsion of the eutectic mixture of 5% lidocaine and 5% prilocaine was applied for one hour under occlusive dressing on one hand and axilla. Surgical rubber gloves were used on the hands and a thin plastic wrap on the axillae. A placebo emulsion was used on the other side as control. After removing the occlusive dressing, the skin was washed and dried.

Measurement of effect

1. A 2% solution of iodine in ethanol was painted on the treated areas. Starch was applied as a powder or by pressing a paper against the painted area.

2. The patients were given the emulsion with the mixture of lidocaine and prilocaine for daily use at home. They applied it under occlusive dressing for about an hour in the morning or once a day a few hours before a period of subjection to stress. After 3–4 weeks they were seen again and interviewed about the effect of the treatment. It was graded as good, uncertain, or no effect.

RESULTS

The inhibitory effect on sweating in skin of normal appearance was strongest with the lidocaine–prilocaine mixture, on both occluded and non-occluded skin (Table I). This mixture also showed the strongest analgesic effect, with complete analgesia to pin-prick in several subjects. A real decrease in the number of wet sweat pores was, however, also seen with the OPT technique in those with little or no anesthesia.

In patients with hyperhidrosis an inhibitory effect of the lidocaine–prilocaine mixture was noted on the hands after 1 hour's application in 11 of 13 patients tested by the starch iodine method (Fig. 1). Sweating in the axilla was inhibited in 9 of 12 patients. The effect persisted for 4–6 hours. When using it at home every day, 6 considered that it had been really effective and stopped their axillary or palmar hyperhidrosis, 4 said the sweating had decreased to some extent but it was still a severe problem, and 6 considered the treatment to be of uncertain or no value (Table II).

In the axilla, none of the patients complained of any side effects. When applied on the hands, one patient (no. 2) complained of slight numbness and another felt that warm water was hot and almost painful when she was working in the kitchen.

DISCUSSION

The 10% mixture of lidocaine and prilocaine gives a pronounced inhibition of epinephrine-induced sweating, but it is not complete when measured by the sensitive *o*-phtaldialdehyde method. In patients with hyperhidrosis of the palms or axillae, the effect is best measured using the starch–iodine method. Here a striking inhibition of sweating was observed in most patients. After application at home and daily use, however, only 6 of the 16 subjects questioned were really pleased with the effect. Two of the 6 patients stated that it was less effective after 2

weeks. The reasons for the discrepancy in effect when tested in the hospital and at home may be many. The expectations of the patients might have been too high, since they wanted complete dryness and did not consider a certain decrease sufficient. Others had applied the lotion for too short a time before the wanted effect, and/or the sweat stimulus had been too strong or sudden, which could have resulted in an inadequate effect. Those who had experienced a good effect stated that the effect remained for 4–6 hours, and they considered the treatment to be a real advantage when compared with the various treatments tried before.

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