

Preliminary Communication

Treatment of irritant contact dermatitis in workmen with perfluoropolymethylisopropyl ether (Fomblin HC)

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Synopsis

Non-allergic contact dermatitis is a major dermatological problem for the workmen of an important factory which manufactures industrial machines (SAIMP SpA) located at Padua. Such dermatitis is due to the presence in the environment of paints, solvents, surfactants, lubricants and metal powders (steel and cast-iron). As medical treatment, the factory doctor practises the use of common barrier creams which do not give completely satisfactory results. To cope with this problem, some workmen were treated with preparations containing Fomblin HC.

The highly successful results of this new type of treatment are reported: among other findings this study shows, through experimental evidence, that Fomblin HC has a protective effect not only against water soluble substances but also against oil soluble substances (in fact, the latter are probably the main cause of contact dermatitis contracted by these workmen).

Résumé

Traitement par un éther perfluoropolyméthylisopropylique de travailleurs atteints de dermatite de contact

La dermatite de contact non-allergique est un problème majeur pour les employés d'une importante fabrique de machines industrielles (SAIMP S.A.) située à Padoue. Cette dermatite est occasionnée par la présence sur le lieu de travail de peintures, solvants, tensio-actifs, lubrifiants et poudres de métal (acier et fonte).

Le médecin du travail prescrit un traitement médical à base de crème de protection qui ne donne pas de résultats vraiment satisfaisants. Afin de pallier à ce problème, certains employés ont été traités avec des préparations contenant de l'éther perfluoropolyméthylisopropylique (Fomblin HC).

Les résultats spectaculaires de ce nouveau type de traitement ont été reportés: parmi d'autres découvertes, cette étude montre, par une évidence expérimentale que l'éther perfluoropolyméthylisopropylique a un effet protecteur non seulement contre les substances hydrosolubles mais également contre les substances huileuses (ces dernières étant probablement la cause principale de la dermatite de contact affectant ces travailleurs).

Introduction

According to statistics, occupational contact dermatitis is the major occupational disease: 60% in Italy and France, 70% in Germany and 65% in the US. Workmen in the building

industry are particularly affected; in this case dermatitis is caused by cement, while paints and metals are the main causes in other industrial sectors [1–3].

An investigation was carried out in a large factory (SAIMP SpA, Padua, Italy) which manufactures industrial machines for the automotive, aircraft, mechanical and electrical industries. Half of the 500 employees of the factory are skilled and unskilled workmen. A large number of them, particularly those involved in mechanical activities, have contracted contact dermatitis of the hands. SAIMP's workmen are generally affected by non-allergic contact dermatitis.

The factory's surgery keeps the workmen under constant surveillance. According to the infirmary staff, years of experience has proved that the best prevention, though not satisfactory, is the use of common barrier creams; gloves are not a suitable solution since they obviously restrict freedom of the hands.

Two types of barrier creams are used: water soluble creams and water insoluble creams. Water soluble creams protect against substances (such as metal powders, oils, fats, paints *etc*) which do not contain water. These creams are not very effective in the case of excessive perspiration; besides they must be reapplied every time the hands come into contact with water (a difficult rule to apply in a factory).

Water insoluble creams (also called water repellent creams) are protective against water soluble substances (mineral acids, surfactants, hydro-solutions *etc*). The advantage is that they are not removed by a simple washing of the hands; they are, however, occlusive and prevent the skin from naturally perspiring by obstructing the outer orifices of the sebaceous and perspiration glands. Both water soluble creams and water insoluble creams are not a satisfactory solution; furthermore, it is not always possible to apply these creams as many times as actually required.

Recently, a new material, perfluoropolymethylisopropyl ether (Fomblin HC), has been proposed as an ingredient for barrier creams with indications of good results in perfecting such preparations [4–6].

This investigation involved a barrier cream containing Fomblin HC/R (a high molecular weight perfluoropolyether) and 25 patients affected by chronic irritant dermatitis.

Patients, materials and methods

Patients

Twenty-five male subjects with severe chronic irritant dermatitis of the hands were treated. They were aged between 22 and 50 years of age (42 was the average age). Among these 25 subjects, 20 were millers/turners, four were painters and one was a rectifier. In all patients, patch tests were performed. Patients with allergic contact dermatitis were excluded from the study.

Materials

Patch testing was performed by Patch Test Trolab (Hermal-Reinbek, Hamburg). The composition of the Fomblin HC-containing cream is given in Table 1.

Methods

The patients started by applying the cream every morning before starting work. After 15 days the cream was applied twice a day, the second time after lunch. One patient needed

Table 1. Composition of barrier cream containing perfluoropolymethylisopropyl.

<i>Component</i>	<i>Wt/wt %</i>
Fomblin HC/R *	3.00
Caprylic/capric triglyceride	12.00
PEG C ₁₂₋₁₈ alkyl ester	8.50
Glycerin	6.00
Cetearyl alcohol	1.00
Glyceryl stearate	1.00
Lactic acid	0.05
Preservatives	q.s.
Water	to 100.00

* Registered trade name of a high molecular weight perfluoropolyether (MW = 6.600) manufactured by Montefluos SpA, Milan, Italy.

three daily applications. Some subjects with particular cleansing problems used soaps containing Fomblin HC.

A file was kept for every patient and weekly check-up results were duly recorded. In some cases photographs were taken to give objective comparisons. In four cases one hand was treated with a Fomblin-containing cream and the other with a common commercially available barrier cream.

Results

All patients, as seen from the personal medical files and by the patients' statements, showed improvements. Experiments began on January 15 and were completed on April 10.

Two patients decided to stop the treatment. Some problems in regularly applying the treatment arose owing to changes in work-shifts and sick-leave. For six patients these problems resulted in temporary interruption (one or two days) of the treatment.

The results of the treatment were:

- a remarkable improvement from the start in desquamative lesions;
- improvement of the erythema;
- better dirt-repellency and easier cleansing;
- improvement of the transversal creases and disappearances of the longitudinal creases (especially of the fingers);
- lowering of the number of erosions and rhagades (Figs 1, 2).

In the four cases treated with a control cream, the first check-up, after seven days, showed a marked improvement in the hand treated with the Fomblin HC cream compared



a)



b)

Figure 1. Patient with contact dermatitis: (a) before treatment; (b) after treatment with a barrier cream (Fomblin HC/R 3%) for a month.



a)



b)

Figure 2. Patient with contact dermatitis: (a) before treatment; (b) after treatment with a barrier cream (Fomblin HC/R 3%) for a month.

to the unchanged effect of the hand treated with a barrier cream. The four workmen decided to self-prescribe Fomblin HC cream on both hands. Two of the 25 patients interrupted the treatment after a few applications.

We would like to point out that after the first few days (controls made after a week) the results showed marked improvement. This was followed by a stationary phase. Further improvements were obtained by increasing the number of applications.

Some workmen who could not use the cream for a week, because of late delivery, showed deterioration of the dermatitis which improved as soon as the Fomblin HC cream was reapplied.

Discussion

Four types of substances are the main causes of contact dermatitis at the SAIMP factory: metal powders, paints (and solvents), soaps (and surfactants) and cutting oils.

Metal powders, mainly cast-iron and steel, are produced by the millers. These powders are normally very fine and penetrate the epidermis: they cause microscopic lesions. Metal powders are difficult to remove from the perungual creases.

Paints and solvents are used in large quantities in SAIMP's painting section. These substances can have direct irritant effects, whereas solvents have indirect effects by removing the cutaneous hydrolipidic film.

SAIMP's workmen have to wash their hands frequently, and to do so, they use common commercial soaps (alkaline salts of fatty acids), liquid detergents (alkylsulphates) and degreasing pastes.

In the factory, two types of cutting oils are used to avoid overheating of both the machines and the items manufactured. In addition to conventional oils, which are insoluble in water due to their composition (a base of mineral oil plus several additives with various functions), they use emulsified oils which are more compatible with water since they contain emulsifiers.

The use of Fomblin HC containing preparations is recommended by various theoretical and experimental considerations [7-9]. Chemically, perfluoropolyethers are low molecular weight polymers containing carbon, oxygen and fluorine atoms. Owing to their very low surface tension, perfluoropolyethers form films which can protect the skin from external irritant agents without occluding or altering the normal physiological activities of the skin (including the so-called 'perspiratio insensibilis'). These compounds are neither soluble in water (or in polar solvents such as ethanol, acetone or dimethylformamide) nor in oils (or in apolar solvents such as aromatics, carbon tetrachloride or carbon sulphide). We believe that the insolubility of perfluoropolyethers in almost all substances, with the exception of highly fluorinated solvents, is a very remarkable property. In addition, they are both lipophobic and hydrophobic; so, skin preparations with long-lasting protective effects against lipo- and hydro-soluble substances are possible.

A large number of the irritant substances responsible for occupational dermatitis are lipo-soluble (lubricants and other industrial oils, solvents, paints *etc*) and that the common barrier preparations based on oils do not have sufficient protective action against these substances.

Our investigation confirms previous reports on the clinical utility of barrier creams containing Fomblin HC in the prevention and treatment of chronic irritant dermatitis in workmen.

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