

I. INTRODUCTION:

The skin has its own protective capacity and reactivity. The reactivity gets altered in a number of cases resulting in an 'allergic' or 'atopic reaction'. Those cases of allergy where there is inherent tendency for the skin to get into a state of 'altered activity' is considered as 'atopic dermatitis'. This atopic and allergic dermatitis as a result of sensitization is further differentiated from irritant dermatitis, where the cause is an irritant that produces reaction in any individual, irrespective of whether he is allergic or not.

The protective capacity may sometime fail, and a state of altered reactivity may result when the man exposes his skin to a variety of hazards to which it has not been exposed before. Paracellous¹ (1403-1541) in his book "Morbis Metallians" was the first to study occupational diseases of the skin caused by some compounds. Many observations of Damazinni² (1633-1714), on occupational skin diseases made in 1700 remain true even today. Since then, various workers in different parts of the world have carried out studies on dermatitis and correlated them with the occupational. In certain countries, occupational dermatitis due to some specific causes have been listed in the list of Compensable diseases.

Occupational dermatitis plays a major role in the industrial health and is responsible for large number of man hours lost thereby. It is an established fact that external irritants are the cause of many skin diseases. The defense mechanism of skin against external irritants consists of cornified cells of the outer most layer of the skin.

This layer is insoluble in water and alcohol and it can withstand action of fairly strong acids, but it is easily attacked by alkalies and sulphides, but the more vulnerable parts of the skin are the opening of the various ducts and hair follicles through which certain fat soluble compounds can easily enter.

In India, there is hardly any information on Industrial dermatitis among workers handling a variety of chemicals in different industries. A few studies however in industries like Jute³, tar and by-product plant⁴, photography⁵, and painting⁶, have proved beyond doubt that the skin of Indian workers is not immune to this industrial malady. Lobo Mendonca⁷ reported 105 cases of chemical dermatitis in Bombay state during the year 1950-54. Similarly 7 cases of allergic and eczematoid dermatitis due to industrial contactants have been reported by Desai et al⁸ and 15 cases of contact dermatitis from industrial causes by Dhurandhar⁹ focussing the magnitude of the problem of industrial dermatitis. Further the morbidity statistics of Industrial workers suffering from skin manifestations in 'Industrial medical units and out-patient skin departments of ESIS Hospitals are quite high in comparison to out-patients departments elsewhere. About 10% of the skin cases are considered to be due to Industrial origin.

II. AIMS & OBJECTS:

Industrial dermatitis is quite prevalent in an Engineering Industries. The use of various types of cutting oils, using petroleum products, lacquers, bakelite, resins, various types of solvents & paints etc in engineering works results in various type of occupational dermatitis. A morbidity survey of this nature among the workmen, engaged in various processes using chemical was undertaken to find out whether there was any relation with their occupation and suggest remedial methods.

III. METHODS OF STUDY :

A mere skin affection of an industrial worker does not necessarily mean it is of occupational origin. For proving that skin conditions of are of occupational origin, the certain criteria have to be satisfied:

- 1) The case history should indicate that skin affection was not present before the worker entered the occupation, but developed only during industrial exposure which may be over a short or long period.
- 2) The affection should improve and disappear with the cessation of industrial exposure within a reasonable time.
- 3) The same disease should occur or be exacerbated if the worker returns to his former work again.
- and 4) Normally the parts which are coming in contact with the offending material should show affection.

Accordingly, a detailed schedule for incorporating general information, clinical and special examinations was drawn up and filled up in respect of each worker. The total number of workers examined was 159.

The general information included age, years of employment, history of present and past occupations, familial and personal allergy etc. The workmen were checked at the place of their occupations so as to be familiar with the type of skin irritant in use.

The clinical examination was limited to details of skin manifestation. The main headings under which the skin manifestation were clinically examined are given in Table-III.

T A B L E - III

S.No.	SHOWING SKIN MANIFESTATION.
1.	Parts of the body affected.
2.	Clinical features of the lesion.
3.	Examination of hairs in and around the parts affected.
4.	Examination of nails if the parts affected are hand and or foot.
5.	Examination of the oral cavity and other mucous membranes.

Contd.,

The special examination included patch testing. To detect the allergen, samples of materials which workers handle in their day to day work were collected and a patch test was performed on the worker with the suspected allergen. The suspected material after suitable dilution is applied on the skin, preferably of the back and a gauze piece is put over it and it is sealed with adhesive plaster. Normal saline was used as a control. The reaction was read after 48-72 hours. The various material used were types of cutting oils, like straight mineral oils, fatty oils such as laid and sperm oils, soluble emulsifiable oils (diluted with water for use), diesel oil, lacquer, ETCR solution of Dichromate, Phosphoric and enamel paints, etc., Bakelite Powder and DMC Powder.

The interpretation of the test was read as:

- (i) Strongly-positive-erythema, edema & vasodilation
- (ii) Positive-Well defined erythema.
- (iii) Weakly positive-mild erythema.
- (iv) Negative - No reaction.

IV. RESULTS AND DISCUSSION:

Out of a total of 159 workmen examined in various workshops the breakup of cases in each workshop and the cases showing Dermatitis (57) are given in the following table.

TABLE - IV
SHOWING THE INCIDENCE OF SKIN MANIFESTATION
IN VARIOUS WORKSHOPS

Work Shop.	Total Cases Reviewed.	Cases showing contact Dermatitis
Tractor Parts	14	5
Switch-Gear (Bakelite)	32	11
SWT - Machine Shop	5	2
SWT - Paint Shop	32	4
SWT - Electroplaters	8	Nil
Eutetic	4	2
Bottling Dept. (Lacquering & Printing)	20	12
Machine Shop	44	21
TOTAL:	159	57 (35.9%)

It may be seen from the table that out of 159 workmen reviewed, as high as 57 cases (35.9%) cases showed definite skin manifestations. Majority of cases were found to be in the lacquer and printing department of the bottling division and also in various machine shops and Bakelite shops.

TABLE - V

SHOWING THE TYPES OF SENSITIZING/IRRITANT SUBSTANCES IN EACH
WORKSHOP

Work Shop	Sensitizing Substances
1. Machine	Various types of cutting oils (machine oils). (a) Soluble oils-oil in water emulsions. (b) Compound Oils: - i) Straight mineral oils - e.g. Keresene ii) Fatty Oils - e.g., laid oil. iii) Mineral Oil-compounded with suitable fatty oils. iv) Extreme pressure oils - these contain chemical additives like Sulphur & Chloride and are referred to as Sulphurized or Chlorinated oils

Industrial cutting oils: Among these substances capable of provoking the skin into an un-natural reaction, mineral oils and greases appear to be the foremost. This is due not so much to the fact that these substance are more particularly irritating than others, but that more people are exposed to them especially in industrial activities. In this mechanical age, almost every process involves the use of some type of machinery which, for its efficient operation requires oils either as 'lubericants or Coolants. The machanism by which oil dermatitis known as 'Oil acne' is produced can be explained as follows:

Dirt and grease, alongwith cutting oils, has attendancy to plug up skin pores and hair follicles, producing 'black heads'. The natural oil secreted by the oil glands, and bacteria normally found on the skin, accumulatte under the blackheads and set up 'an irritation which eventually develops into eruption or pimples resulting in a so called 'folliculor dermatitis'. Also, defatting of the skin by petroleum oils and other fat solvents causes dryness, less of pliability and fissuring, thus increasing the possibility of skin effects. Minute metal slivers which accumulate in the oil after prolonged use may aggravants the skin condition. These slivers collect on cotton waste or dirty towels used by the workers to wipe the oil from their hands and arms and may scratch the skin or become inbedded therein. If bacteria are present on the skin, they may enter the scratches and cause infection. In some persons, prolonged skin contact with foreign substances (including cutting oils) can frequently give rise to skin irritations without bacteria being the prime cause.

Cutting oils as prepared by the manufacturers are normally free from bacteria - the latter however, may occur as a contaminats from the skin, which causes the folliculitis from cutting oils and not the bacteria which may be in the oil. Contamination is hastened when worker pollute the oil by expectorating or throwing refuse into it or into the oil containers. Many antiseptics added to the cutting oils in an effort to prevent infection have proven of questionable value. Some anti septics may corrode the metal being machined or may in themselves, irritate the skin.

Contd.,

Differences in susceptibility do exist among those working with cutting oils. In general the known predisposing factors are: type of skin, race, age, sex allergy, pre-existing skin conditions, function of the skin glands, and personal habits of hygiene. Persons with hairy skin, probably because of their numerous and well developed hair follicles, are more likely to develop lesions of the follicular type. People with dark skin are more resistant; dry skin have a greater tendency to dermatitis than the oily variety. The prevalence of dermatitis is likely to be higher during the summer months. A large proportion of the acute industrial dermatoses occurs in the younger age groups and in those most recently engaged in their occupations. Oil dermatitis is more common among worker with poor personal hygiene associated with infrequent or inadequate bathing or failure to replace soiled clothing at frequent intervals.

TABLE - VI
SHOWING THE TYPE OF IRRITANT/SENSITIZING SUBSTANCES IN WORKSHOP

1. S W T BAKELITE SHOP	Bakelite and Dough Moulding Compound (DMC) - A unsaturated polyester resin compounded by adding various ingredients like filler, hardener, catalyst, pigments etc. various ingredients are: i) Polyester Resin ii) Catalyst-Benzoyl Peroxide or Para Tertiary butyl Benzoate iii) Calcium Carbonate iv) Glass Fibre. v) Zinc Stearate. vi) Pigments. vii) Styrene.
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Dermatitis is a frequent occurrence among workers making and using Synthetic resin. A resin is a solid or semi solid complex amorphous mixture of organic substances having no definite melting point and showing no tendency to crystallize.

Here Polyester resins are the usual cause of dermatitis. The Catalysts may also be skin irritants. The skin irritating properties of the chemicals from which the resin is made are retained in the resin as long as these chemicals are uncombined. The incidence of dermatitis in the manufacture of moulding resins is directly related to the amount of dust in the air and the amount of formaldehyde and hexamethylene tetramine that the dust contains. The eruption usually consists of scattered papules and vesicles on any erythematous base.

The process of moulding powders is practically the same for all resins. The powder is placed in a 'pill machine' and pressed into proper sizes for the moulds. The 'Pills' are issued to the moulder who put them into the moulds where they are subjected to heat and pressure which shapes and hardens them. During the moulding process, gases are given off from the moulds and the odour of formaldehyde in the workplace is strong, irritating the nose, throat and eyes and the moulders often suffer from dermatitis due to these fumes. This dermatitis may affect the face, neck and arms.

TABLE - VII
SHOWING THE IRRITANT SUBSTANCE IN WORKSHOP

<u>LACQUERING DEPARTMENT:</u>	The lacquering solution contains 1) Denatured Spirit 2) Flexo Inks-containing resins, dyes pigments, Butyl alcohol, Cellosolve dibutylphthalate, tricresyl phosphate (red dyes).
<u>PRINTING SECTION:</u>	The substances used are: 1) Mineral Turpentine 2) 'ETCH' solution containing Ammonia dichromate, phosphoric acid in water 3) Gum arabic-solution in water. 4) Staying Inks: Containing resins dyes pigment driers.

Lacquers are essentially composed of a base of cellulose nitrate or acetate dissolved in volatile solvents.

Paints consists essentially of a suspension of pigment in a drying oil. To this are added compounds of lead, manganese or cobalt to accelerate the drying and turpentine or thinners to thin the pain and facilitate its application. The linseed oil is the principle drying oil used in paints. Dermatitis is reported among workers who handle the linseed, the rash occurs on the hands, and arms and thighs. It is symmetrical and consists discrete macules, papules, scratch marks and crusts.

DRYERS: The drying of paints can be accelerated by the addition of small quantities of metallic oxides and salts like Red land, Land borate, borates and sulphates of manganese. They have not been reported to be the cause of dermatitis.

PIGMENTS - The coal tar dyes and metallic chromates are extensively used as paint pigments.

The chromate are responsible for occurances of skin lesion.

Yellow & Orange pigments consists of:

- Lead Chromate Zinc Chromate
- Barium Chromate Caonimum Sulphids.
- Yellow Oxide of mercurry.

TRINNERS: These are volatile substances which are added to paints to thin them to permit easier applications as well as to hold in solution. The oils and resins, which the paint contains. After the paint is applied, the volatile solvents evaporate and leave only the solid constituents of the paint. The fat solvent property of the thinners is sufficient in itself to make them skin irritants and a large percentage of dermatoses caused by paints is due to this class of substances.

Turpentine form any source in a skin irritant, it causes about 10% of reported cases of occupational dermatitis. Local contact of the skin with turpentine for a long time often repeated exerts an irritating and a drying effect on the skin causing it to crack and some time an active dermatitis may develop.

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CHROMATES: Chromic acid and chromate are powerful skin irritants and corrosives chrome causes lesions of the skin and mucous membranes. According to the resistance of the individual it produces dermatitis of varying severity. Constitutional symptoms with pain and swelling may accompany the acute dermatitis. Ulcers usually develop when chrome is deposited on an abrasion. They usually appear by tenacious crust. The ulcers in the nose are usually situated on the cartilaginous portions of the septum and are of present without and are near of them.

TABLE VIII

AGE IN YEARS	YEARS OF SERVICE					
	1	1 - 5	6 - 10	11 - 14	15 - 20	Above 20 years
20	1	3	-	-	-	-
21 - 30	-	14	11	5	-	-
31 - 40	-	5	1	10	2	-
41 - 50	-	-	1	-	-	-
Above 50 years	-	-	1	2	1	-

It will be seen from the table that 21 workers are in the age group of 21-30 and 31-40 years with service up to 10 years and of these a single major group of 22 workers have a period of service of 1-5 year. 14 of these are within the age group of 21-30 years. It seems that the younger group with less years of employment are more susceptible to skin manifestation. This seems to confirm the view of Dr. Schwartz, about young and new workers that these workers do not become immune or hardened to the offending material or that because they are less careful in handling them.

TABLE IX

SHOWING CLINICAL HISTORY AND PARTS OF THE BODY AFFECTED.

<u>HISTORY :</u>	
<u>Frequency of attack:</u>	1. First attack only 13 2. Recurrent attacks 44
<u>History of allergy:</u>	1. Personal History of allergy 8 2. Family history of allergy 3
<u>Parts affected:</u>	1. Hand only 32 2. Hand, Leg, Ankles & Feet 4 3. Hand, Arm, Forearm 11 4. Hand, Head, Face & Neck 2 5. Hand, Chest, Abdomen, back and shoulder 1 6. Legs, Ankles, Feet 5 7. Head, Face & Neck 2 8. Whole body NIL

It will be seen that 44 cases had history of recurrent attacks and 13 cases of first attack only. The recurrent attacks in a majority cases could be due to constant contact in some way with sensitizing agents during their daily occupational life. It is also noticed from the table that the majority of cases had involvement of skin of hands only, as these parts of body normally come in contact with materials while handling more often than other parts of the body. Next higher incidence was that of hands, forearms and upper arms, while no case showed any total involvement of whole body.

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PATCH TESTING: Before describing the results of patch testing, clean distinction must be made between substances which are primary skin irritants and those which are sensitizers. Some chemicals are primary skin irritants as well as sensitizers, like formaldehyde, phenols, mercurial salts etc. The reaction to patch testing depends on four factors, namely (i) Sensitivity of the patient, (ii) area of the patch tested, (iii) length of the time it is permitted to remain on the skin and (iv) the amount of substance per area of the skin.

Out of 57 workers, patch tests were done on 38 workers only. The remaining 19 cases were either unwilling for patch testing or had removed the patches soon after being applied or were not available at all as they were working in different shifts.

TABLE - X
SHOWING THE PATCH TESTING ON FIFTY-SEVEN WORKERS

WORKERS	PATCH TEST	P O S I T I V E				
		Strong	Positive	Weak	Negative	Not done
57	38	6	21	3	8	19

It is evident from the table that out of 38 cases were found to be positive while 8 case showed negative results. (The slide for patch testing is presented to show the nature of the reaction to patch testing. The classification were made as per statement given earlier.

Reference may be needed here to the limitations of patch testing as carried out in this study. Detailed chemical analysis of test materials used for patch testing showing positive reaction was neither done nor was possible. The materials which were often used by the workers on their jobs, were collected and some of it was used for patch testing as such and the result was assessed after a specified time.

As referred to earlier, the worker might not attach any importance to some of the materials, which would be the causative factors for his skin manifestations. For example, among paint shop workers, out of 4 showing skin affections, 2 cases were showed positive patch testing to thinners, which they used for initial treatment of castings and not to the spray paints, which were being extensively used.

In all these cases, where patch testing showed positive results the substances were cutaneous sensitizers. No case developed acute generalized skin manifestations as a result of patch testing.

V. PREVENTIVE MEASURES:

(a) Prevention of cutting oil Dermatitis:

Avoiding skin trouble depends mainly on removing the cutting fluid from the skin. It has been said that to avoid dermatitis, the emphasis should be put on cleansing the worker than oil. No amount of experimentation with creams, protective clothing, or other measures will justify a neglect of cleanliness. It is difficult to change the habits of some employee, and it is embarrassing to call attention to unclean habits. This poses a personal problem.

Excellent results in the prevention of dermatitis have been achieved where employees observed certain precautionary measures:

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(i) Work garments should be washed within reasonable frequency. Splash guards fastened to cutting machines have been found effective in affording protection from flying chips and oil spray.

(ii) Before starting work, at lunch time and when quitting work, wash with mild soap and warm water, generously. The protective barrier cream should be used before starting work and after each periodic washing.

(iii) Petrol, kerosene, naphtha, turpentine and similar solvents must not be used for the removal of oil or grease from the skin. Such solvents defat the skin and may thus cause dermatitis or aggravate existing skin disease.

(iv) Employees should be particularly careful to protect their clothing from becoming soaked with cutting oils.

(v) Every cut and scratch should receive medical attention to prevent any sepsis.

(b) Prevention of dermatitis due to various solvents and synthetic resins, paints, etc.

The general principles of prevention are by compelling the workmen to wash their hands with soap and water before going to work, use of barrier creams and washing them off with soap before eating lunch, reapplying it immediately after lunch, and removing it immediately upon finishing work for the day and leaving the plant. The wearing of rubber gloves over such applications of creams is also of value.

USE OF BARRIER CREAM:

Barrier creams have now gained an accepted place in Industrial hygiene. The incidence of dermatitis in explosive industries reached great proportions during the II world war and development of suitable barrier creams played a large part in overcoming the problem.

There is much confusion in industry as to the real purpose of barrier cream and it is unfortunately a fact that in many cases, the creams are used indiscriminately as an aid to cleansing rather than systematically as a prophylaxis against dermatitis.

Barrier Creams should be considered primarily as a prophylactic against dermatitis and the fact that they assist in cleaning the skin a secondary advantage. As a preventive measure they must be used regularly and must be applied as frequently as the nature of the work being done requires. These creams are meant to apply as a thin film on the skin which acts as a barrier against the offending agent.

TYPES OF BARRIER CREAMS:

(i) Simple vanishing cream type: containing zinc oxide which fills the pores of skin and prevents the entry of irritants into the pores.

(ii) Water repellent type: produces a thin film of water repellent substance (insoluble) which is useful for protection against acids, alkalies, paints, resins, cutting oils, coolant oils, kerosene, petrol, diesel oils and other chemicals.

(iii) Water soluble type: for protection against irritant powders and dust. Since it is readily soluble in water, it is reapplied every time, worker comes in contact with water.

(iv) Silicon creams: They form an extra layer of protective silicon on top of the horny layer of the skin and help in protection against various sensitizers.

VI. S U M M A R Y

(i) Out of a total of 159 cases surveyed for skin manifestation owing to their occupation, 57 (35.9%) had definite mild moderate evidence of occupational dermatitis.

(ii) Various types of Chemical and Powders sensitizer were studied.

(iii) The importance & Limitations and results of patch testing has been discussed.

VII. R E F E R E N C E S:

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A C K N O W L E D G E M E N T

My thanks are due to the Management for their co-operation in conducting this survey.

I am particularly thankful to the workmen for voluntarily submitting themselves to medical examination and application of patch tests on their back.

Cvk: