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Original Research Article

Study of the density of *Demodex* mite in patients with topical steroid damage

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ABSTRACT

Background: There is a possible association between the usage of topical steroids on the face and the density of *Demodex* mites. This study was undertaken with the aim to study the density of *Demodex* mites in patients with topical steroid-damaged faces.
Methods: This cohort study included 232 patients with TSDF (group A) and 40 patients with no facial dermatological lesions and conditions and with no history of use of topical steroids (group B). The sample from the skin was collected using the skin surface biopsy (SSB) technique with cyanoacrylic glue and skin tape stripping (STS) method.
Results: There was a significantly greater density of *Demodex* mites amongst group A subjects compared to group B subjects [18.5% vs 5.0%] (p value <.05). There was no statistically significant association between the duration and potency of TC use and the density of *Demodex* mites (p value >0.05). Clinical features were also not found to have a significant association with the potency of TC used.
Conclusions: Infestation of facial skin with *Demodex* mites is significantly associated with the use of topical steroids on the face. There was no statistically significant association between the duration and potency of TC use and the density of *Demodex* mites.

Keywords: *Demodex* mites, Demodicosis, Topical steroids, Topical steroid damaged face, Steroid misuse

INTRODUCTION

Demodex folliculorum and *Demodex brevis,* the *Demodex* mites are obligate saprophytic ectoparasites belonging to the family Demodicidae.[1,2,3] They usually remain asymptomatic and play a pathogenic role only when either present in high densities and/or there is an immune imbalance.[2] They are prevalent in up to 23%-100% population.[1,2] These are involved in acneiform eruptions, folliculitis, and a range of eruptions in immunosuppressed patients.[1]

Frequently affected sites by *Demodex* mites are the forehead, surrounding area of orbit, surrounding area of nose, chin, and surrounding area of the mouth.[4] Demodicosis is diagnosed when compatible clinical manifestations are present with a high density (>5/cm^2).[1]

Defective host-defense immune response following topical corticosteroid application can greatly increase the parasite population.[5] It was suggested that *Demodex folliculorum* can be considered an opportunistic infection of the skin in an immunocompromised host.[6]

Corticosteroids are known to have anti-inflammatory, anti-pruritic, immunosuppressive, and melanopenic action and thus are used for the treatment of many inflammatory dermatoses.[7] TC has been misused on the face as a wonder compound that is believed to correct any flaw or imperfection. Amongst the Indian population with facial dermatoses, 14.8% were found to be using TC. Amongst those using TC, 59.3% have been reported to use it on non-physician recommendations.[8]

The most commonly used TC is betamethasone cream followed by mometasone clobetasol, fluticasone, betamethasone, and fluocinolone acetonide, which are available in varying concentrations in different forms.[8] TC therapy carries local or systemic or both types of side effects. The side effects are the result of immunosuppression, inhibition of cell proliferation, or alteration in hormonal activity which leads to steroid-induced dermatological disturbances.[9]

Irrational, indiscriminate, unsupervised, or prolonged use of topical corticosteroids results in a plethora of cutaneous signs and symptoms and psychological dependence on the drug which causes semi-permanent or permanent damage to the skin of the face, this phenomenon is known as Topical Steroid Damaged/Dependent face (TSDF).[10] The facial skin has greater percutaneous absorption of drugs owing to its thinness.

Also, the larger sebaceous glands on the face and increased tendency to sweat particularly in hot and humid climates make it more liable to the ill effects of environmental factors such as sunlight and pollution, friction due to cleaning and rubbing, and application of drugs and cosmetics. Thus, topical application of steroids can also have a great adverse impact on the facial skin.[10]

Few pieces of literature have suggested a possible association between the usage of topical steroids on the face and the density of *Demodex* mites.[11,12] However, the evidence confirming the association between topical steroids on the face and the density of *Demodex* mites is insufficient. Thus, this study was undertaken with the aim to study the density of *Demodex* mites in patients with topical steroid-damaged faces.

METHODS

Study design, study population, sample size, sampling technique

This observational, cohort study was conducted in the Department of Dermatology, Venereology and Leprosy, Sri Aurobindo Medical College and PG Institute, Indore, India after obtaining approval from the institutional ethics committee. The study was carried out over a period of 18 months (from 1st April to 30th September 2022).

Inclusion and exclusion criteria

This study included 232 patients with TSDF (group A) and 40 patients with facial dermatological lesions and conditions and no history of topical steroid use (group B). Enrolment of subjects was done using the Convenience sampling technique. The study was conducted amongst adults. The study cohort included the subjects with a history of use of TC. The control group included the subjects not having any cutaneous lesions on faces and with no history of use of TC.

Pregnant and breastfeeding females with menstrual irregularity, patients using topical acaricide creams or gels containing tea tree oil, and patients having any co-morbidities such as Cushing syndrome/thyroid disorders (having similar clinical features as TSDF) were excluded from the study. Enrolment of subjects in the study was done using a convenience sampling technique.

Data collection

The information such as age, gender, duration of use of topical steroid on the face, the potency of topical steroid used, chief complaint, cause of topical steroid use, and duration of use of topical steroid was recorded in a predesigned proforma.

Figure 1: Cyanoacrylate glue.

The sample from the skin was collected using the skin surface biopsy (SSB) (Figure 1) technique with cyanoacrylic glue and skin tape stripping (STS) method (Figure 2). Samples were collected from cheeks and frontal areas in both TSDF patients and controls. The samples were transferred to a 10% potassium hydroxide drop and covered with a cover slip and were studied under an optical microscope (×40, ×100) (Figure 3). Visualizing more than 5 mites per cm square was considered a significant demodicosis.

Figure 2: Cellophane tape stripping method.

Figure 3: Microscopic view of *Demodex* mites.

Statistical analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) 21.0 version, IBM, Chicago. Data were analyzed for probability distribution using the Kolmogorov-Smirnov test, p value >0.05 indicated that the data were normally distributed. Descriptive statistics were performed. Data were described as mean and standard deviation, and number and percentages. The inter-group comparison was done using the Independent t-test and chi-square test. P value <0.05 was considered statistically significant.

RESULTS

The mean age of the participants belonging to Group A was 31.8±9.36 years and those belonging to Group B was 28.9±9.42 years. The difference in the age of the participants belonging to the two groups was statistically non-significant (p value>.05). Overall, the majority of the participants belonged to the age group of 18-30 years (48.2%). Overall, the majority of the subjects were females (80.1%). The majority of the subjects were from urban localities (76.8%). The proportion of subjects from rural localities was significantly more in group B [18 (45%)] as compared to that in group A [45 (19.4%)] (p value <0.05).

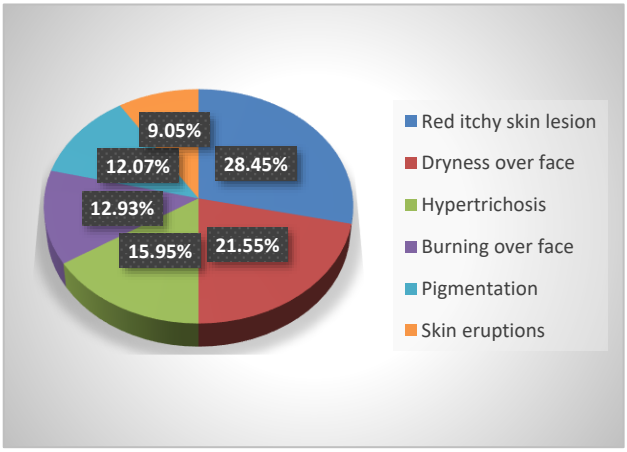

Figure 4: Chief complaint of the subjects belonging to study cohort.

The commonest chief complaint was red itchy skin lesion [28.55%] (Figure 4). Amongst the patients with TSDF, the majority of them were having complaints since ≤15 days [131 (56.5%)] whereas 86 (37.15) subjects were having complaints for 16-30 days and 15 (6.5%) reported to have a complaint for more than 30 days. The most common reasons behind the use of TC were the treatment of melasma (62.5%) and acne (22.4%), fairness was reported to be the reason by 9.9% of subjects and 5.2% said reasons other than these and most of them were using TC continuously (53.0%), remaining 47.0% reported intermittent use. The distribution of study participants based on the potency of topical steroids applied has been presented in Table 1.

Table 1. Distribution of study participants based on potency of topical steroid applied.

Potency of topical steroid	Number	Percentage
Very potent (clobetasol propionate)	159	68.5
Potent (betamethasone dipropionate/mometasone furoate)	63	27.2
Moderate (fluticasone)	10	4.3
Mild (hydrocortisone)	0	0.0
Total	232	100.0

Comparison between the 2 groups showed a significantly greater density of *Demodex* mites amongst group A subjects compared to group B subjects [18.5% vs 5.0%] (p value <0.05). In both the groups, *Demodex* mites were not detected in the majority of the subjects. The proportion of subjects with different densities of *Demodex* mites was not found to differ significantly

between the groups (p value >0.05). There was no statistically significant association between the duration and potency of TC use and the density of *Demodex* mites (p value >0.05) (Table 2). Clinical features were also not found to have a significant association with the potency of TC used (Figure 5).

Table 2: Association of *Demodex* density with duration and potency of topical steroid used.

Density of *Demodex* (per cm^2)	Duration of topical steroid use		Potency of topical steroid used		
	Continuous	Intermittent	Very potent	Potent	Moderate
Zero	100 (81.3)	89 (81.7)	129 (81.1)	52 (82.5)	8 (80.0)
One	18 (14.6)	16 (14.7)	22 (13.8)	10 (15.9)	2 (20.0)
Two	3 (2.4)	2 (1.8)	4 (2.5)	1 (1.6)	0 (0.0)
Three	1 (0.8)	1 (0.9)	2 (1.3)	0 (0.0)	0 (0.0)
Four	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Five	1 (0.8)	0 (0.0)	1 (0.6)	0 (0.0)	0 (0.0)
Six	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Seven	0 (0.0)	1 (0.9)	1 (0.6)	0 (0.0)	0 (0.0)
Total	123 (100.0)	109 (100.0)	159 (100.0)	63 (100.0)	10 (100.0)
Chi-square value	2.121		2.587		
Df	5		10		
P value	0.832		0.990		

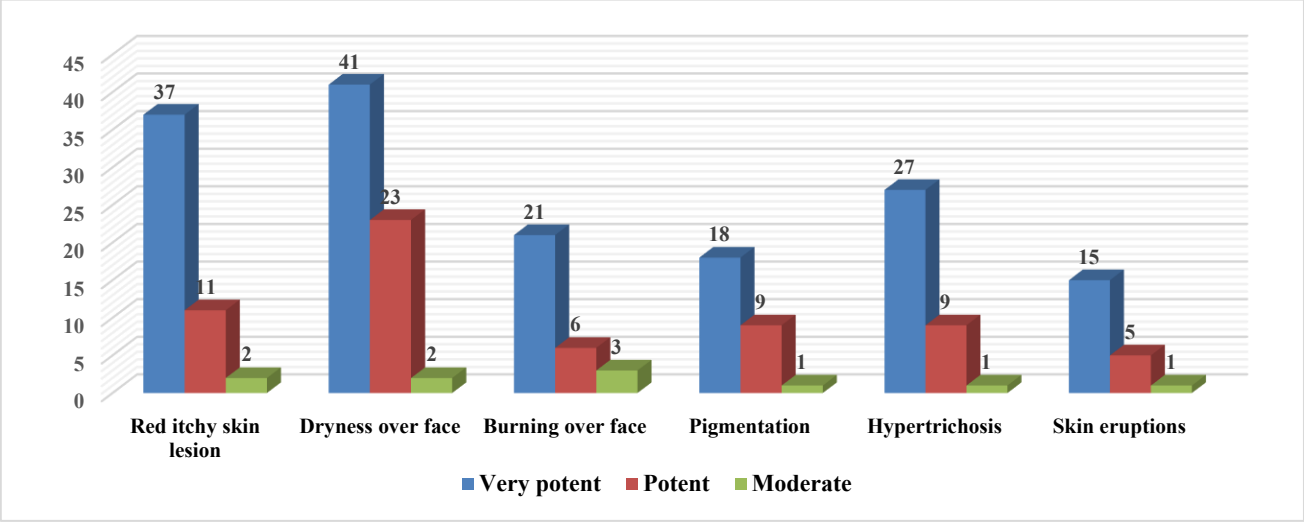

Figure 5: Association between clinical features and potency of topical steroid.

Chi square value: 6.557, df:10, p value: 0.776.

DISCUSSION

The application of topical steroids in inappropriate amounts, especially on areas with thinner skin such as the face has been shown to have many adverse effects such as atrophy, striae, rosacea, telangiectasias, and purpura.[14] Misuse of steroids on the face allows an increase in the proliferation of Propionibacterium *acnes*, and *Demodex folliculorum.*[15] Although the evidence supporting the same is scarce and thus, this study was planned.

In this study, we employed two methods for sample collection for *Demodex* mites which included superficial skin surface biopsy (SSSB) and skin tape stripping method. Superficial skin surface biopsy (SSSB) is commonly used and is considered a gold standard method by some investigators.[16] But the major sample collection was done using the skin Tape Stripping method. The tape stripping technique has currently drawn much attention since with this method sample of the epidermis can be collected with a minimally invasive technique and therefore, it has a remarkable advantage over skin biopsies with respect to discomfort for patients.[17]

We found that the age of the patients with TSDF was 31.8±9.36 years and that of patients in the control group was 28.9±9.42 years. In the study done by Al Dhafiri et al, the mean of the subjects was 29.1±11.6 years.[18] In the study done by Pal et al majority of the subjects with TSDF belonged to the age group of 20-29 years.[19] Similar findings had also been reported by Saraswat et al and Srivastava et al.[8,20] In the present study, the number of female subjects was more than the number of male subjects (80.6% vs 19.4%). In other studies, also females

outnumbered the number of males.[19,20] The common reason behind the use of topical steroids has been reported to be beauty concerns. Majority of the persons use TC for the treatment of acne vulgaris, and sometimes for fairness or general skin-care purpose without any underlying skin ailment.[8,19,21] The purpose behind the TC use explained the preponderance of TSDF amongst persons aged 18-30 years and amongst females. As young adults especially females are more concerned about their beauty.[22]

In our study, most of the subjects were found to be using potent TCs. The most common topical steroid used by our patients was Betamethasone valerate alone or in combination, and Betnovate TM was the most common brand name. Similar findings were reported by Saraswat et al and Lahiri et al.[8,10] They have reported that potent steroids (clobetasol propionate, betamethasone dipropionate, beclomethasone dipropionate, and betamethasone valerate) were being most commonly used in rural and sub-urban areas by patients who were in their second and third decade of life on the recommendation of non-dermatologists (friend, peer, relative, pharmacist, or beautician).[8,10] Availability of 'cocktail creams' have worsened the situation. They are easily available at low prices and are therefore easily misused.[13,21,23]

In the present study, most of the patients (n =209, 76.8%) belonged to urban areas, followed by those hailing from rural areas (n=63, 23.2%) which indicated towards greater prevalence of TSDF in the urban population. It has been speculated that the easy availability of drugs in urban areas and the lifestyle of urban people. Advertising campaigns for non-prescription medicines may, by creating a strong brand identity, present them as consumer products rather than pharmaceutical products. Advertisements for medicines only emphasize the advantage of the drug, not its risks.[24,25]

We found that the most common chief complaint amongst patients with TC use was red itchy skin lesion (n=66, 28.4%) followed by dryness over the face (n=50, 21.6%) followed by burning over the face (n=30,12.1%) and skin eruptions over face (n=21, 9.1%). Hameed et al in his study found facial redness and neatness, telangiectasia, and rebound phenomenon with papulopustular eruption as the most common presenting complaints amongst patients with topical steroid use.[21] We also found skin eruptions (acne form eruption) in 21 (9.1%) and hypertrichosis in 37 (15.9%) subjects. Dilatation of blood vessels, the release of proinflammatory cytokines, and the accumulation of nitric oxide have been thought to be responsible for the development of erythema, pruritus, and the burning sensation amongst patients with TC misuse on the face.[26]

In our study, the most common reasons behind the use of TC were the treatment of melasma (62.5%) and acne (22.4%). Fairness was reported to be the reason by 9.9% of subjects and 5.2% said reasons other than these. Similar findings were reported by Saraswat et al, Pal et al, and Hameed et al.[8,19,21]

Unsupervised misuse/abuse/overuse of topical corticosteroids of any potency on the face for continuous 7 days or intermittent for 15/ more days can result in TSDF.[10,20] In the present study, the continuous use of TC was reported by 53.0% whereas intermittent use was reported by 47.0% of subjects and the number of subjects using higher potency of drugs was found to be more as compared to those using low potency drugs.

In the present study, the presence of *Demodex* mites was found in both groups. According to Erbagci et al people free from skin disease may also have mites. It was postulated by them that increased blood flow in dilated vessels caused by any reason other than TC use can favor the multiplication and invasion of *Demodex* mites in the skin.[27]

The difference in the count of *Demodex* mites in the TSDF group and control group was found to be statistically non-significant (p value >0.05). Also, the potency or duration of use of TC was found to have no significant association with mite density. Contrary to our findings, Dolenc-Voljc et al found a significantly increased density of *D. folliculorum* in patients of perioral dermatitis with a history of TC use as compared to those without a history of TC use.[11] Keles et al also reported the growth of *Demodex* mites after immunosuppressive treatment.[12] Zhao et al identified TC use as a significant risk factor for *Demodex* infestation. They found the risk of *Demodex* infestation was 2.7 times higher amongst TC users as compared to non-users.[28] Another interesting finding was presented by Srivastava et al, they found no mites in the patients with TSFD.[20] The difference in the findings of various studies can be attributed to the fact that *Demodex* infestation is not only affected by TC use but also by skin type. Good hygiene practices might reduce demodicosis and *Demodex* infestation.[28]

This study has few limitations. In the present study, the number of subjects in the control group was not equivalent to the number of subjects in the study group. The effect of some confounding factors such as skin type, and hygiene practices have not been studied.

CONCLUSION

Infestation of facial skin with *Demodex* mites is significantly associated with the use of topical steroids on the face.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee of Sri Aurobindo Institute of Medical Sciences, Indore (M.P.), India (Registration number- ECR/748/Inst/MP2015/18RR)

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