Original Article

A clinicoepidemiologic study and patch testing in footwear contact dermatitis

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Abstract

Background: Contact dermatitis (CD) is an inflammatory response of the skin to an exogenous substance which accounts for approximately 90% of occupational dermatoses. Footwear allergy can develop in any age and also in both sexes. The highest prevalence is in warm climates. Friction and pressure are also significant. Patch test provides an accurate and relatively simple means of diagnosis and allows the physician to initiate appropriate management for alleviation of patients' suffering at the earliest. The purpose of this study is to evaluate clinical and epidemiological factors and the clinical relevance of patch testing in diagnosis of footwear CD in and around Kannur district. **Aim:** Is clinical and epidemiological study and the clinical relevance of patch testing in diagnosis of footwear contact dermatitis. **Materials and Methods:** Patients with clinically diagnosed footwear contact dermatitis were included in the study. Patients were examined in detail. Name, age, type of footwear used and history of exacerbating factors were recorded. All the patients were patch tested using CODFI approved fifteen antigens of Indian standard footwear series. Positive and negative results recorded. **Results:** Among 45 patients majority of were in the age group 21-40 years followed by 1-20 years. Slight female preponderance observed. Majority presented with itching. Duration of illness varied from 1to 6 years. Rubber foot wear and winter season are more among the exacerbating factors. Patch test positive in 13 patients. Black rubber mix, MBT, Glutaraldehyde, neomycin sulphate, disperse blue, Hydroquinone monobenzyl ether, Potassium dichromate, thiuram mix were found positive in decreasing order. **Conclusion:** Contact dermatitis is seen in good number of patients, out of which the footwear CD was quite significant. The higher incidence in third and fourth decade of life in our study is because of the fact that this age group is the productive and exposure to various antigens are high. Slight preponderance of females in our study may be due to their exposure to a wide variety of footwear. Patch testing, which was positive in 29% is found to be useful in the diagnosis of footwear contact dermatitis which can be helpful in reducing the incidence of footwear CD.

Key Word: Contact Dermatitis, Footwear, Patch Test, Allergens, Black Rubber Mix.

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INTRODUCTION

Contact dermatitis (CD) is an inflammatory response of the skin following exposure to an exogenous substance, which may be either an allergen or an irritant. Contact dermatitis accounts for approximately 90% of occupational dermatoses. Introduction of new potential sensitizers will increase the incidence of contact dermatitis[1]. Allergic Contact Dermatitis develops in only a small proportion of sensitized individuals and population estimates vary from 1.7 % - 6 %[2]. Foot wear allergy, a common form of contact dermatitis, is a cutaneous inflammation produced by external allergens present in footwear. Several chemicals coupled with hot and humid environment within a shoe create an ideal situation for its development. Prevalence ranges from 3% in England to 11.7% in India.[3,4] People in any age group can develop footwear allergy[5]. This disorder may affect both the sexes. ACD Footwear refers to predominant involvement of feet in eczematous process. Patient suffering from this seek a solution for their problem and also demand to know the cause. Footwear can be implicated as a cause for eczema only if the eczematous

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process is restricted to the pattern of footwear.[6] The highest prevalence rates have been recorded in warm climates. The hot and humid environment within a shoe combined with hundreds of chemicals creates an ideal situation for the development of allergic or irritant contact dermatitis. Friction and pressure also may play a significant role in the pathogenesis of foot wear dermatitis. Shoes are being manufactured with new materials like plastics, glued together with different adhesives.[7] Since 1930 with the wide usage of patch test in foot wear dermatitis, more awareness regarding this allergic disease is seen. The introduction of leather dyes, anti oxidants and rubber accelerators in manufacturing of foot wear led to a rise in the number of cases of footwear dermatitis. The diagnosis of footwear allergy is difficult without patch testing and the pre patch test clinical diagnosis can often go wrong. The assessment of the etiological agent rests on patient's history, examination and patch testing. Patch testing is useful in differentiating of foot wear contact dermatitis from dermatitis of endogenous origin or external irritant causation. Properly applied and correctly interpreted patch tests provides an accurate and relatively simple means of diagnosis and allows the physician to initiate appropriate management for alleviation of patients suffering at the earliest . The purpose of this study is to evaluate clinical and epidemiological study of footwear allergy and the clinical relevance of patch testing in diagnosis of footwear contact dermatitis in and around Kannur district using the CODFI approved Indian Battery of allergens.

MATERIALS AND METHODS

Patients with clinically diagnosed footwear contact dermatitis attending the outpatient department of dermatology at Academy of Medical Sciences, Pariyaram from December 2008 - December 2009 were included in the study. All patients were examined and studied in detail. Name and age were also recorded. Each patient was questioned in detail regarding the type of footwear used or history of other exacerbating factors. Past history of allergic disorders or any dermatological conditions were recorded. Detailed dermatological examination and the pattern of dermatological disorder were recorded and representative lesions were photographed. All the patients were patch tested using aluminium finn chamber method. Fifteen antigens of Indian standard footwear series were used for patch testing approved by CODFI.

OBSERVATION AND RESULTS

Table 1: Seasonal Variation

Exacerbating Factors	Frequency	Percentage
Rainy Season	7	15.6%
Winter	7	15.6%

Table 3: Affected areas

Affected Area	No	Percentage
Dorsum of feet	40	89
Sole + Toe	5	11

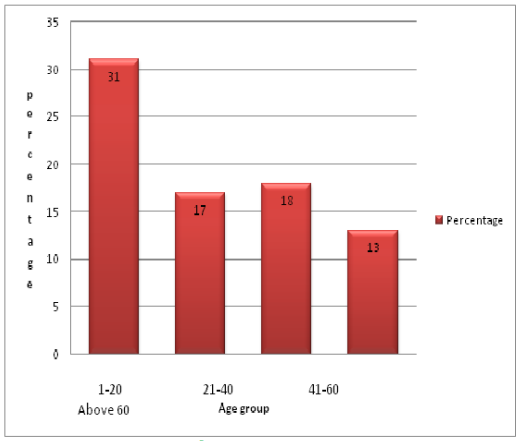

Figure 1

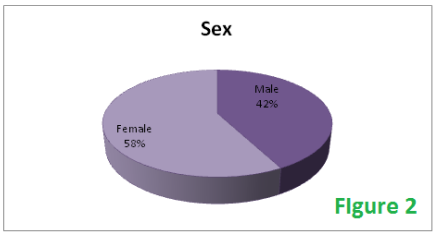

Figure 2

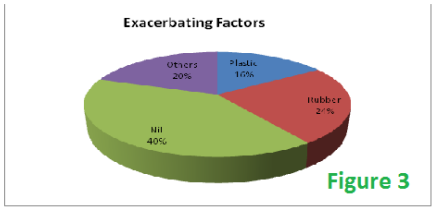

Figure 3

Figure 4

Legend
Figure 1: Age distribution
Figure 2: Sex distribution
Figure 3: Exacerbating factors
Figure 4: Commonly affected sites & positive patch tests

Patch test positivity

In our study out of 45 patients 13 patients (29%) were patch test positive and 32 patients (71%) were patch test negative. No patients showed an irritant reaction. 18% of patients had a positive reaction to black rubber mix. MBT and Glutaraldehyde were positive in 7 % of patients, neomycin sulphate and disperse blue 4.4%, Hydroquinone monobenzyl ether, Potassium dichromate, thiuram mix were found positive in 2.2 % of patients in our study.

Table 4: Patch test positivity

	Allergens	No. of positive cases	%
1	Formaldehyde (1%)	0	0
2	Mercaptobenzothiazole (2%)	3	6.6%
3	Potassium dichromate (0.5%)	1	2.2%
4	Nickel sulphate (5%)	0	0
5	Colophony (20%)	0	0
6	Epoxy resin	1	2.2%
7	Neomycin sulphate (20%)	2	4.4%
8	Hydroquinone	1	2.2%
9	Thiuram mix (1%)	1	2.2%
10	Black rubber (0.6%)	8	18%
11	Glutaraldehyde	3	6.6%
12	Dioctly phthalate (5%)	1	2.5%
13	Disperse orange	0	0
14	Disperse blue	2	4.4%
15	Kaathon CG (0.2%)	0	0

DISCUSSION

In this study majority of the patients were in the age group of 21-40 years .The youngest was 9 year old and the oldest patient was 85 years old. According, to a study by Romaguera C, Grimalt. F and Vilabana J, people of all ages can develop footwear allergy[8] .In our study, higher incidence of footwear contact dermatitis was seen in the age group of 21-40 years (17 patients or 38 %). In a study by K S Priya ,Ganesh Kamath et al conducted over a period of 16 months in which 50 patients with foot eczema were included in the study and the peak age of onset of footwear CD was found to be 20-30 years[13] which constituted almost 48% of the patients. In a study by Suzanne Freeman footwear contact dermatitis was found to have a higher incidence in the age group between 20-49 years[9]. In a study by Handa S et al the most common age group of presentation of footwear CD was between 20-30 years[16]. In this study females were more affected as compared to males [Female 26 (58%), Male 19 (42%)]. Suzanne Freeman also found the female patients were more in number compared to male patients with a ratio of 62% females having footwear CD compared to 38% male[9]. In a study Zahida Rani et al out of 119 patients who were evaluated for footwear CD 21 males and 98 females were showed a higher female incidence.[10] The probable reason for this higher incidence of footwear CD in females could be due to the changing

attitude of Indian females towards being more fashionable and the footwear are always in a high fashion and the design and materials used in their manufacture of footwear are constantly changing. Out of the 13 positive patch test cases 8 were found to be females and 5 males. The duration of the foot wear contact dermatitis of the patients included in our study had a range of <1 year to >6 years, of which 67% of patient's had foot wear contact dermatitis within 1 year .In a study conducted by Freeman, also showed that most of the patients 55% had presented with history of footwear CD of <1 year followed by 30% presented with a history of foot wear CD of less than 5 years[9]. In our study the majority of the patients presented with itching, which was followed by burning sensation, oozing and pain and few patients with secondary infection. Erythema, papules, papulovesicles, scaling and lichenification were also present in some patients. In some earlier studies which was conducted by Srinivas et al and Sharma et al the most common symptoms was found to be itching, erythema, lichenification etc.[4,11] In footwear CD the most commonly affected sites are the dorsum of the feet, side of the sole and over the toes. In our study 89% of patients had lesions over the dorsa of the feet and 11% over the sole and toe. In a study conducted by K S Priya et al, the most common affected site was the dorsum of the feet corresponding to the shape of the foot wear (v–shaped chappals)[6]. This type of footwear is usually worn without socks and is preferred by people living in warm and humid tropical climates as in this coastal town . CR Srinivas et al also reported that allergic contact dermatitis to footwear presented with dermatitis over the dorsa of the feet. D.V Belsito also in his study mentions the occurrence of dermatitis which is usually severe over the dorsal aspects.[12] In our study majority had no significant seasonal variation. Only 15.6 % of patients showed exacerbation in winter compared to 13.3 % in summer season. In an earlier study conducted by Brar KJ et al most of the patients had winter exacerbation, the improvement of dermatitis in summer in their patients was attributed to sweating that must have softened the skin[13]. In another study which was conducted by Roul S et al, exacerbation was seen during hot weather, a combination of occlusions during the hot weather (with resultant sweating) friction and pressure which in footwear, in the presence of multiple allergen may trigger an episode of footwear CD[5]. Aggravation in summer was also seen in 39.5 % of patients in a study conducted by Zahida R et al. 13.3% of patients in our study had exacerbation while wearing black rubber footwear. Black colour is preferred colour in footwear and socks hence PPD is a common allergen as noted by Srinivas et al in their earlier study. Saha et al has documented a case report of PPD sensitivity in footwear contact dermatitis[4]. In India the poor people still use black rubber footwear, thus black rubber mix happens to be one of the most common contributory allergens. Freeman conducted a study and found that the rubber was the most common allergen (42%) in footwear and 80% of patients presented with hyperhidrosis of feet and sweat helps to leach out chemicals from footwear, thus contributing to sensitization.[14] In our study 20% of patients had a history of atopy. In earlier study by Roul et al history of atopy either personal or familial had favoured dermatitis. In a earlier study by Sandra et al 6% of the patients were atopic and 4 % of the patients gave a family history of atopy[13]. A personal or family history of atopy was seen in 38.6% of patients in a study by Zahida R et al implying that atopics have a susceptibility to the development of allergic contact dermatitis in footwear.[10] In our study 5 patients (11%) had a family history of similar illness which was reported in earlier studies by Srinivas et al and Sharma et al.[4,15] Out of 45 patients patch tested 13 (29%) patients were found to be positive to patch test and 32 (71%) patients were negative for patch testing. No patients showed an irritant reaction. In our study 18 % of patients had a positive test for black rubber mix. In a study by Handa et al, rubber chemicals were the commonest allergens detected in 26 patients(17.3%)[16]. In a study conducted by S. Freeman 66.6%of patients showed positive patch test to rubber chemicals. In an another study by Freeman 43% of patients were positive to rubber mix followed by potassium dichromate 23.6%[17], 30% of patients were reactive to additives used in manufacturing and processing of rubber in a study conducted by Majid et al[15]. In another study by Rahber et al glues were identified as the most common sensitizers (34%) followed by neomycin (22%),rubber chemicals(14%) followed by potassium dichromate[14]. Nadeem et al reported that in his 23.5% of patients the main allergens were neomycin (34%), nickel (21%)and potassium dichromate(19%).[18] MBT and Glutaraldehyde were positive in 7 % of patients .In a earlier study by Sanjay G and Sanjib C the contributory allergens in order of frequency were: potassium dichromate (45.8%), cobalt chloride(38.06%), paraphenylene diamine (32.25%), epoxy resin(20%),black rubber mix(20%) nickel sulphate (14.83%), MBT (12.9%), and formaldehyde (4.5%).[19] Neomycin sulphate and disperse blue were positive in 4.4% of patients in our study. Neomycin sulphate (29%), nickel sulphate (23%) and MBT (27%) were the common sensitizers in a study conducted by Sandra et al[20]. Potassium dichromate (31%) continues to be the commonest sensitizer in our population as reported in earlier Indian studies. Potassium dichromate was one notable exception in that its sensitivity was very low in

females as compared to males, which may be due to difference in preferred footwear, but may also reflect high rate of occupational exposure to this antigen in males. Hydroquinone, potassium dichromate, thiuram mix and epoxy resin were found to be positive in 2.2% of patients in our study. In a study by Priya et al the highest number of patients showed positive reaction to MBT (36%), followed by colophony (32%), potassium dichromate (12%), formaldehyde (18%), nickel sulphate (6%) , black rubber (4%) and thiuram mix (8%)[6]

CONCLUSION

Contact dermatitis accounted for quite a good number of patients, out of which the contribution from footwear CD was quite significant. The higher incidence among the patients belonging to the third and fourth decade of life is because of the fact that this age group is the productive age group wherein the chances of exposure to various antigens are high. There was a slight preponderance of females in our study, may be their exposure to a wide variety of footwear, due to constantly changing fashion and their increased awareness of cosmetic disfigurement. In our study 45 patients were patch tested out of which 13 (29%) patients had a positive patch test and 32 (71%) patients were negative for patch testing. Patch testing, which was positive in 29% of patients is found to be very useful in the diagnosis of footwear contact dermatitis which can be very helpful in reducing the incidence of footwear CD, which is not only an occupational hazard but also a socioeconomic problem. In situations, where ever possible, a change of occupation, can be advised which definitely can bring down the incidence. If this is not possible, patients can be advised to take proper precautions to reduce the incidence and to avoid the concerned footwear. 18% of patients were positive to black rubber mix which was the most common allergen in our study.

REFERENCES

1. Singhal V, Reddy BSN. Common contact sensitizers in Delhi. J Dermatol 2000; Vol 27 (7): 440-445.
2. A.K.Bajaj, A.Saraswat, G.Mukhija, S.Rastogi, S.Yadav .Patch testing experience with 1000 patients.Indian J Dermatol Venerol Leprol 2007; Vol.73(5):313-8.
3. Storrs F.J. Dermatitis from clothing and shoes.In:Fischer AA,editor.Contact dermatitis :Lea and Febiger,1986;263-337.
4. Saha M,Srinivas C R, Shenoy S D ,Balachandran C,Acharya S. Foot wear dermatitis.Contact dermatitis 1993;28:260-4.
5. Roul S, Ducombs G,Leaute-Labreze C,Lobbe.L. Foot wear contact dermatitis in children . Contact Dermatitis 1996;35;334-6.
6. K S Priya, G.Kamath,J Martis, D.Sukumar. Foot eczema: The role of patch test in determining the causative agent using standard series. Indian J Dermatol 2008;53:68-69.
7. Fisher .A.A Contact Dermatitis .5th ed .Philadelphia Lippincott Williams and Wilkins ;2001.p393.
8. Romaguera C, Grimalt F,Vilana J ,Eczematous and purpuric allergic contact dermatitis from boots. Contact dermatitis 1989:21:269.
9. Freeman .S .Shoe Dermatitis .Contact Dermatitis 1997;36:247.
10. Zahid Rani, Ijaz Hussain and Thahir Saeed. Common allergens in shoe dermatitis: Our experience in Lahore .Pakistan .The international Journal of Dermatology 2003 ;42:605-607.
11. Sharma VK, Sethuraman G, GargT, Verma KK, Raman M. Patch testing with the Indian standard series in New Delhi. Contact Dermatitis 2004;5:319-321.
12. Marks JG, Belsito DV, De Leo VA et al. North American Contact Dermatitis Group standard tray patch test results [1992 to 1994]. Am J Contact Dermatitis 1995;6:160-5.
13. Kamal Jeet Brar , Shenoi SD, Balachandran C, Vandana Raj Mehta, Clinical profile of fore foot eczema. A Study of 42 patients. Indian J Dermatol venerol Leprol May-June 2005 vol. 71 issue 3.
14. Rahber H, Haroon TS. Shoe dermatitis. A clinico-aetiological study. In programme and abstract: 9th Biennial Conference of Dermatology Lahore, Pakistan 1996:9.
15. Majid Suhail, Amer Ejaz, Khalid Jameel Value of Patch testing in shoe dermatitis. Journal of Pakistan Association of Dermatologist 2009;19:66-73.
16. Handa S, Sharma SC, Sharma VK, Kaur S. Footwear dermatitis –Clinical patterns and Contact Allergens .Indian J Dermatol Venerol Leprol 1991;57:174-7.
17. S.Freeman . Shoe dermatitis Aust J Derm 1983:24,63.
18. Angelini G. Vena GA, Meneghini CL . Shoe Contact Dermatitis . Contact Dermatitis 1980;6:279-83.
19. Sanjiv Chowdari, Sanjay Ghosh .Epidemiological studyin 153 cases of foot wear dermatitis. Indian J Dermatol Venerol and leprol. Sep-Oct 2007: vol. 73; issue 5.
20. Eapen BR, Shenoi SD, Sandra A .Patch testing with shoe series in suspected cases of footwear dermatitis. Indian J Dermatol 2001;45:146-8.

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