



Are the Increased Frequency of Hand Washing After the COVID-19 Pandemic and Xerosis on the Hands Associated with the Occurrence of Hand Warts?

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Abstract

Aim: The COVID-19 pandemic has changed hand-washing habits. Exposure to water more frequently and time than normal causes dryness, dermatitis, and damage to the skin barrier. We aimed to investigate the relationship between the frequency and duration of exposure to water on the hands, obsession with hand washing, and warts on the hands.

Material and Method: A questionnaire was administered to hand warts group (n=94), plantar warts group (n=46), and healthy volunteers (n=30) questioning the factors that predispose to wart formation, hygiene behaviors, hand moisturizing habits, and hand washing obsession. The presence of warts, localization, number, and clinical type, presence of xerosis, and hand dermatitis were recorded. Data from the hand warts group were compared with control groups of healthy volunteers with plantar warts.

Results: The total exposure time of the hands to water per day was significantly higher in hand warts group than in the plantar warts group and healthy ones (<0.001, both). While xerosis was observed in 51.1% of the hand warts group, further clinical evaluation was recommended with the suspicion of handwashing obsession in 26.6%. The suspicion of handwashing obsession was reinforced by bilateral warts, hand dorsum involvement, more than one anatomical region involvement, and a high number of warts (p=0.039, p=0.048, p=0.027, p=0.018; respectively).

Conclusion: Water exposure might be a novel unrecognized risk factor for hand warts. Patients with hand warts should be evaluated regarding OCD and the need for moisturizer by questioning the frequency of handwashing.

Keywords: Wart, hand washing, xerosis, nail-biting, obsessive-compulsive disorder

INTRODUCTION

Cutaneous warts are mucocutaneous lesions caused by the human papillomavirus (HPV). According to the site of involvement and morphology, they are classified by different nomenclatures such as verruca vulgaris, verruca plana, verruca plantaris, and condyloma acuminata (1). Cutaneous warts are a common viral infection in the general population, especially in children. One-third of primary school children have one or more warts on their hands or feet, with an incidence of 29 per 100 person-years for developing new warts (2). The estimated prevalence of warts has been reported to be 33% in children aged 6-12 years and 3.5% in adults (3). It is a usual reason for dermatology outpatient clinic applications.

Transmission of infection usually occurs through direct

contact or, more rarely, through contaminated objects (4). Infection occurs when the virus penetrates through a damaged epithelial barrier, especially in poorly perfused areas such as the hands, fingers, or feet. Microtraumas expose basal layer keratinocytes and facilitate transmission (5). HPV infecting basal cells causes abnormal acceleration of the cell cycle and the emergence of neoplasia. Immunosuppression, close contact with family members with warts, handling meat, walking barefoot for plantar warts, nail-biting, and palmoplantar hyperhidrosis are predisposing factors (6-9). The more frequent hand warts in some occupational groups have been attributed to trauma in some studies (3,6).

It is clear that washing hands with soap and water is crucial for protection from viruses and bacteria, contamination

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control, and sanitation (10). Hand hygiene practices began to be widely implemented after the COVID-19 outbreak. Washing hands with soap and using alcohol-based hand sanitizer is known to reduce the spread of the virus (11).

However, more frequent and more prolonged exposure to water than usual causes xerosis, dermatitis, and damage to the skin barrier on the hands (12). Prolonged exposure of hands to water can be caused by various occupational reasons such as dishwashing, housewife, babysitting, cleaning, hairdressing, or various psychiatric reasons such as anxiety and obsessive-compulsive disorder (OCD) (13,14). Although it is sensible that the factors increasing the risk of xerosis on the hands may also predispose to hand warts, the best of our known, no study has been done on this subject.

This study aimed to investigate the relationship between the frequency and duration of exposure to water on the hands due to various reasons and warts on the hand.

MATERIAL AND METHOD

Patients and Study Design

The study was conducted with participants aged 15-45, between April and September 2021, when the weather is milder in our geography, to minimize the seasonal effect on xerosis. Approval for the study was granted by the Erzurum Atatürk University Clinical Research Ethics Committee, (reference no: B.30.2ATA.0.01.00/335). Informed consent forms were obtained from all participants. The study was performed per the latest version of the "Helsinki Declaration" and the "Guidelines for Good Clinical Practice."

Patients with verruca vulgaris only on their hands and only on their plantar regions and healthy individuals who have never had warts were recruited for the study. It was reported that warts in family members and schoolmates are a risk factor for transmission (15). In order to adjust the groups in terms of family history of warts, some of the healthy individuals were selected from the relatives of other patients who presented with verruca vulgaris. This selection of healthy volunteers was intended to reinforce the assumption of exposure to HPV. Patients with plantar warts and healthy individuals were considered two separate control groups in the study. The reasons for attributing patients with plantar warts to the control group were the reduction of the risk of type 1 statistical error and the fact that the feet are end organs with perfusion characteristics similar to the hands.

Participants' sociodemographic data, current number, localization and distribution of warts, complaint duration, family history, and the number seeking treatment were recorded. While the number of handwashing, water exposure length, soap usage, and disinfectant exposure were recorded, some questions with dichotomous (Yes/No) answers were asked to the patient to screen for the presence of a cleaning obsession: Do you think you have a cleaning obsession?/Do you feel the urge to wash your

hands repeatedly after washing them? / Does your hand washing or cleaning job take up hours? / Does the feeling of contamination occupy your mind all the time? Patients suspected of handwashing obsession were referred to psychiatry. Also, the nail-biting/onychophagia behavior of all participants was questioned.

Exclusion criteria from the study were as follows: Palmoplantar hyperhidrosis, history of frequent exposure to irritant agents other than water or soap, atopic dermatitis, allergic contact dermatitis, presence of any systemic disease or regular supplementary food products or drug use, immunosuppression, topical steroid/calcineurin inhibitory use of inhibitor, the simultaneous presence of concomitant warts in distant localization from the relevant area. Besides, patients with subungual warts were not included in the study.

Statistical Analysis

All procedures were performed using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA, v21.0) software. After checking the normality distribution of scale variables by Kolmogorov-Smirnov test, continuous parameters were compared using Kruskal-Wallis H and Mann-Whitney U tests according to the number of samples. The exact significance test for the Mann-Whitney U test was performed when the sample size was insufficient. Pearson's chi-square or Fisher's exact tests compared independent categorical variables according to the sample sizes. Continuous variables were stated as mean±standard deviation or median (interquartile range), and categorical variables as numbers (percentages). Bonferroni correction was applied post-hoc if significant results were obtained in more than two-sample comparisons. The p-values achieved after post-hoc analysis were tabulated in an adjusted manner. A two-sided p-value<0.05 was considered statistically significant.

RESULTS

One hundred and seventy individuals participated in the study: hand warts (n=94), plantar warts (n=46), and healthy individuals (n=30). The study groups were similar in terms of age and gender (p=0.172, p=0.881; respectively). Comparisons of some data of patients with hand warts with the other two separate control groups (patients with plantar warts and healthy individuals) were presented in Table 1. The sociodemographic and clinical characteristics of the patients, the use of water, soap, disinfectant, and moisturizer, the presence of xerosis in the hands, the suspicion of handwashing obsession, and the nail-biting behavior were compared in Table 1. There was no difference between those with hand and plantar warts in terms of the total number and distribution of warts. The frequency of handwashing was significantly higher in patients with hand warts than in both plantar warts and healthy controls (p<0.001; post-hoc: adjusted p<0.001, adjusted p=0.046; respectively). Similarly, the total exposure time of the hands to water per day was

significantly higher in patients with hand warts than in plantar warts and healthy ones (<0.001 ; post-hoc: adjusted $p<0.001$, adjusted $p=0.001$; respectively). On the other hand, there was no difference between the groups

regarding the use of moisturizer ($p>0.05$). No relationship was found between hand warts and nail-biting behavior ($p=0.828$).

Table 1. Comparison of some data of patients with hand warts and 2 separate control groups consisting of healthy individuals and those with plantar warts

Parameters		Patient group		Control groups		p-value
		Warts on hands (A; n=94)	Plantar warts (B; n=46)	Healthy individuals (C; n=30)		
Age, years		25.3±7.8	24.4±5.7	27.8±7.5		0.172
Sex	Man	47 (50.0%)	25 (54.3%)	15 (50.0%)		0.881
	Woman	47 (50.0%)	21 (45.7%)	15 (50.0%)		
Education level	Middle school & below	19 (20.2%)	8 (17.4%)	6 (20.0%)		0.921
	Secondary school & above	75 (79.8%)	38 (82.6%)	24 (80.0%)		
Direction of warts	Unilateral	54 (57.4%)	31 (67.4%)	-		0.258
	Bilateral	40 (42.6%)	15 (32.6%)	-		
Total number of warts		5.3±6.1	4.6±4.5	-		0.723
Complaint length; months		12.9±15.1	8.9±8.1	-		0.335
Family history of warts; Yes		29 (30.9%)	14 (34.1%)	11 (36.7%)		0.775
Number of seeking treatment for warts		2.4±2.6	2.3±2.0	-		0.928
Number of handwashing per day		12.5±8.6	7.3±3.5	8.0±3.1		<0.001^{ab}
Total daily water exposure time to hands; min. (including handwashing and all other activities)		33.1±37.1	16.5±23.1	11.0±9.6		<0.001^{ab}
Reasonable and mandatory occasion for water exposure to hands (e.g., job, hobby)	Yes	11 (11.7%)	3 (6.5%)	5 (16.7%)		0.379
	No	83 (88.3%)	43 (93.5%)	25 (83.3%)		
Soap type	Bar	23 (24.5%)	16 (34.8%)	5 (16.7%)		0.190
	Liquid	71 (75.5%)	30 (65.2%)	25 (83.3%)		
Total number of disinfectant usages per day		3.5±3.0	2.9±2.9	3.9±3.7		0.220
Habit of using any moisturizer	Never	34 (36.2%)	19 (41.3%)	15 (50.0%)		0.434
	Rarely	36 (38.3%)	18 (39.1%)	12 (40.0%)		
	Regularly	24 (25.5%)	9 (19.6%)	3 (10.0%)		
Frequency of using a moisturizer per day for regular users (n=36)		2.0±1.9 (n=24)		2.4±1.4 (n=12)		0.129
Xerosis cutis on the hands	Yes	48 (51.1%)	11 (23.9%)	6 (20.0%)		0.001^{ab}
	No	46 (48.9%)	35 (76.1%)	24 (80.0%)		
Irritant dermatitis on the hands	Yes	13 (13.8%)	3 (6.5%)	1 (3.3%)		N/A
	No	81 (86.2%)	43 (93.5%)	29 (96.7%)		
Suspicion of handwashing obsession	Yes	25 (26.6%)	2 (4.3%)	0 (0.0%)		0.001^{ab}
	No	69 (73.4%)	44 (95.7%)	30 (100.0%)		
Presence of nail biting/onychophagia behavior	Yes	22 (23.7%)	9 (19.6%)	6 (20.0%)		0.828
	No	71 (76.3%)	37 (80.4%)	24 (80.0%)		
Total number of actions per day in those with nail biting behavior (n=37)		7.5±9.8 (n=22)		6.9±9.9 (n=15)		0.897

Min.: minute, Data are expressed as mean±standard deviation or number of patients (percentage). Kruskal-Wallis H, Mann-Whitney U, and Pearson chi-square tests were used, where is appropriate. Bonferroni correction was applied as post-hoc if significant results were obtained in more than two-sample comparisons. Significant values were shown in bold. Superscript a for the difference between A and B groups; superscript b for the difference between A and C groups; superscript c for the difference between B and C groups

The relationship between the distribution and number of warts on the hand and the presence of xerosis, suspicion of handwashing, and nail-biting behavior is presented in Table 2. Accordingly, xerosis was significantly more common in older patients with hand warts and those who washed their hands more frequently ($p=0.006$, $p=0.022$; respectively). Dorsum involvement was significantly more common in patients with warts on xerotic hands ($p=0.014$). While xerosis was observed in 51.1% of the patients with

hand warts, further clinical evaluation was recommended with the suspicion of handwashing obsession in 26.6%. In patients presenting with hand warts, the suspicion of handwashing obsession was reinforced by bilateral warts, hand dorsum involvement, more than one anatomical region involvement, and a high number of warts ($p=0.039$, $p=0.048$, $p=0.027$, $p=0.018$; respectively). No correlation was found between nail-biting behavior and the distribution and number of warts on the hands ($p>0.05$).

Table 2. The relationship between the distribution and number of warts on the hand and the presence of xerosis, suspicion of handwashing obsession and nail-biting behavior

Parameters	Xerosis cutis on the hands		Suspicion of handwashing obsession		Nail-biting behavior		p-value	
	Yes (n=48)	No (n=46)	Yes (n=25)	No (n=69)	Yes (n=22)	No (n=71)		
Age, years; Med (IQR)	24 (12)	20 (5)	22 (10)	22 (9)	20.5 (5)	22 (11)	0.117	
Sex; n (%)	Man	24 (50.0%)	23 (50.0%)	9 (36.0%)	38 (55.1%)	10 (45.5%)	37 (52.1%)	0.585
	Woman	24 (50.0%)	23 (50.0%)	16 (64.0%)	31 (44.9%)	12 (54.5%)	34 (47.9%)	
Direction of warts on the hands; n (%)	Unilateral	28 (58.3%)	26 (56.5%)	10 (40.0%)	44 (63.8%)	13 (59.1%)	41 (57.7%)	0.911
	Bilateral	20 (41.7%)	20 (43.5%)	15 (60.0%)	25 (36.2%)	9 (40.9%)	30 (42.3%)	0.039
Periungual inv.; only; n (%)	10 (20.8%)	9 (19.6%)	3 (12.0%)	17 (24.6%)	5 (22.7%)	13 (18.3%)	0.106	
Combined inv. co-existing periungual inv.; n (%)	11 (22.9%)	12 (26.1%)	9 (36.0%)	14 (20.3%)	5 (22.7%)	18 (25.4%)	0.117	
Periungual inv.; combined or only	n (%)	21 (43.8%)	21 (45.7%)	11 (44.0%)	31 (44.9%)	10 (45.5%)	31 (43.7%)	0.936
	Med (IQR)	2 (3)	2 (4)	2 (7)	2 (2)	1.5 (5)	2 (2)	0.222†
Periungual and/or finger inv.	n (%)	23 (62.2%)	28 (66.7%)	14 (66.7%)	37 (63.6%)	11 (57.9%)	39 (66.1%)	0.814
	Med (IQR)	2 (3)	2 (2.5)	2 (7.25)	2 (2.5)	2 (6)	2 (2)	0.243
Dorsum of the hands; only; n (%)	n (%)	12 (25.0%)	3 (6.5%)	4 (16.0%)	11 (15.9%)	3 (13.6%)	12 (16.9%)	1.000‡
	Med (IQR)	10 (20.8%)	12 (26.1%)	9 (36.0%)	12 (17.3%)	4 (18.2%)	18 (25.4%)	0.048
Dorsum inv. co-existing dorsum inv.; n (%)	n (%)	22 (45.8%)	15 (32.6%)	13 (52.0%)	24 (34.8%)	7 (31.8%)	30 (42.3%)	0.131
	Med (IQR)	3 (7)	3 (3)	3 (9)	2.5 (4)	2 (2)	3 (5)	0.150†
Palm and/or finger inv.; n (%)	n (%)	13 (27.1%)	16 (34.8%)	6 (24.0%)	23 (33.3%)	7 (31.8%)	22 (31.0%)	0.387
	Med (IQR)	11 (22.9%)	16 (34.8%)	6 (24.0%)	15 (21.7%)	6 (27.3%)	21 (29.6%)	0.816
Combined inv. co-existing palm inv.; n (%)	n (%)	24 (50.0%)	32 (69.6%)	18 (72.0%)	38 (55.1%)	13 (59.1%)	43 (60.6%)	0.140
	Med (IQR)	3 (5)	2 (3)	2 (3)	2 (3)	2 (1.5)	2 (3.5)	0.969
Palm and/or finger inv; combined or only	n (%)	14 (29.2%)	18 (39.1%)	13 (52.0%)	19 (22.5%)	7 (31.8%)	25 (35.2%)	0.027
	Med (IQR)	9 (18)	6 (12)	11 (10)	5 (6)	5 (11)	7 (10)	0.049†
Total number of warts	Med (IQR)	3 (6)	3 (4)	5 (11)	3 (4)	2 (5)	3 (5)	0.018
	Complaint length; months; Med (IQR)	12 (21)	6 (10)	12 (20)	6 (10)	9 (10)	9 (21)	0.206
Number of seeking treatment for warts; Med (IQR)	Med (IQR)	2 (1)	2 (1)	1 (1)	2 (1)	1 (1)	2 (1)	0.519
	Number of handwashing per day; Med (IQR)	15 (14)	9 (5)	17.5 (5)	8 (7)	6 (15)	10 (9)	<0.001
Total daily water exposure time to hands, minutes; Med (IQR)	Med (IQR)	20 (35)	17.5 (20)	45 (30)	10 (25)	17.5 (21)	20 (35)	<0.001
	Presence of nail biting/onychophagia behavior; n (%)	Yes	8 (17.0%)	14 (30.4%)	9 (37.5%)	13 (18.8%)	-	-
	No	39 (83.0%)	32 (69.6%)	15 (62.5%)	56 (81.2%)	-	-	0.064

Med (IQR): Median (Interquartile range); Inv: Involvement, Data are expressed as median (interquartile range) or number of patients (percentage). Mann-Whitney U, Pearson chi-square, and Fisher's exact ‡ tests were used, where is appropriate. Exact significance test † for Mann-Whitney U test was performed when the sample size was not sufficient. Significant values were shown in bold

Dermatologists' opinions on handwashing habits and moisturizing requirements for patients with hand warts were distributed as in Figure 1. In 19.1% of patients with hand warts, it was necessary to make behavioral recommendations to change frequent or prolonged handwashing habits in addition to moisturizers. Apart from this, the opinion that only moisturizer should be recommended in 23.4% of the patients was adopted.

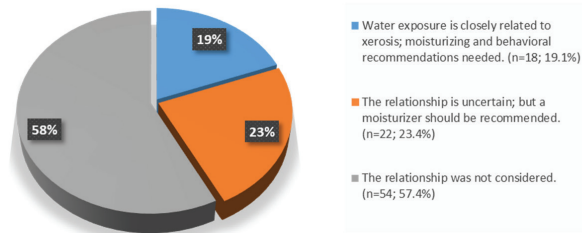


Figure 1. Dermatologists' opinions on handwashing habits and moisturizing requirements for patients with hand warts

DISCUSSION

The main risk factors for skin infections are age, sex, ethnicity, medical history, family history, local climate, lifestyle, and hygiene habits (6). However, studies evaluating the relationship between viral warts and hygiene habits are lacking. One of the most important causes of hand eczema is water exposure and alcohol-based hand rubs. The clinical presentation includes rough, dry, scaly skin, erythema, and a burning sensation (16). Also, it may develop clinically as dryness and roughness in the hands without dermatitis after exposure to water. Irritant contact dermatitis can be seen with a frequency of 17-30% in cases of occupational predisposition such as housewives and healthcare workers; compared to the general population with a prevalence of 5.4% (16-18). In this study, the groups were similar in terms of the existence of a reasonable and necessary condition, such as a job or hobby, to explain the exposure to water. Since our study was conducted during the COVID-19 pandemic period, we found that handwashing frequency, duration, and disinfectant use were relatively high in the patient and control groups. However, handwashing frequency, daily water exposure time, and xerosis cutis on the hands were significantly higher in patients with hand warts than in plantar and healthy controls. Xerosis was observed in 51.1% of patients with hand warts, and dorsum involvement was significantly higher in xerotic hands. As dermatologists, we considered that 42.6% of the patients with hand warts might have an uncertain relationship with xerosis.

The estimated prevalence of OCD in the United States has been reported to be 2.3% for lifetime and 1.2% for one-year criteria (19). The most common obsessive thoughts are pollution, contamination, and the risk of infection. The most common compulsive behaviors are cleaning/washing, checking, repeating, counting, and ordering/arranging (20). Contamination obsessions and cleaning/washing compulsions are seen in cleaning OCD. Therefore, it is not surprising that hand dermatitis is one of the

most common symptoms in patients with cleaning OCD. Studies have shown that OCD patients begin psychiatric treatment only 8-10 years after the first symptoms. In this period, dermatological symptoms and findings generally become chronic (21). Various studies have revealed that 9% to 35% of patients with OCD consult a dermatologist with skin conditions such as dermatitis, hand eczema, and lichen simplex chronicus before psychiatry (22). We realized that warts on the hands have never been evaluated in this respect in the studies. Suspicion of handwashing obsession was significantly more common, especially in those with warts on their hands than in those with plantar warts and healthy ones in this study. As a dermatologist, we think that 26.6% of patients with warts on their hands deserve further evaluation in terms of OCD, and hand dryness was clearly associated with handwashing habits in 19.1%. These data suggest that hand warts accompanying dryness and roughness on the hands are also an indicator reinforcing the suspicion of OCD. Indeed, we found that bilateral involvement, involvement of more than one anatomical hand region, and increased number of warts in patients with hand warts reinforce the suspicion of OCD.

Nail-biting is a compulsive behavior common among children and young adults. It seems to be associated with OCD and usually occurs with psychopathological symptoms (23,24). It has been reported that cuticle peeling and nail-biting behaviors increase the risk of subungual warts (9). This study did not confirm our assumption that nail-biting may be associated with the number and presence of periungual warts. Besides, nail-biting behavior did not affect the distribution and number of warts on the hands. However, the exclusion of those with atopic dermatitis, allergic contact dermatitis, immunodeficiency, and systemic disease in our study shows that nail-biting alone may not be a potential risk factor for hand warts.

Kampf and Ennen emphasized that in case of repeated and frequent hand washing, the regular use of a moisturizer immediately after hand washing prevents hand drying. Especially in subjects with dry skin, it was observed that the skin condition improved despite intensive washing (25). Symanzik et al showed that in the presence of frequent and repetitive hand washing, the use of a moisturizer immediately after washing and the use of syndet have positive effects on epidermal barrier homeostasis. Their findings imply the effect of using syndet and moisturizer as part of treatment in patients with warts on xerotic hands, especially those with prolonged water exposure (26). In our study, the fact that there was no difference between the groups regarding moisturizer usage habits indicates the necessity of recommendation in this regard.

CONCLUSION

Our study revealed that water exposure might be a novel unrecognized risk factor for hand warts, possibly facilitating transmission by disrupting the skin barrier and increasing the effect of microtraumas. In the presence of warts on the hands, the patients should be evaluated

regarding OCD and the need for moisturizer by questioning the frequency of handwashing. We think that this will contribute to the early detection of OCD patients. In addition, the use of moisturizers and changes in hygiene habits may contribute to the success of the treatment of hand warts. Further studies with larger sample sizes should support our results.

Study Limitations

Although this is the first study on this subject, its limitations should be noted. The sample size is relatively small. Therefore, the relationship between warts and hand eczema could not be evaluated statistically. Due to technical impossibility, trans-epidermal water loss (TEWL) could not be measured. Xerosis on the hands is determined subjectively by the physicians' opinion. In addition, the study was conducted during the pandemic period. This situation may have caused an increase in the frequency of xerosis, eczema, and OCD suspicion. Although patients with suspected OCD were referred to psychiatry, the psychiatrist's opinion could not be interpreted due to the disruption in patient follow-up. However, patient selection criteria and the prospective design of our study allowed us to interpret our results under optimal conditions

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