ORIGINAL CONTRIBUTIONS

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Occupational facial dermatoses related to mask use in healthcare professionals

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Abstract

Background: Mask use can lead to facial dermatoses due to factors, such as hyperhydration, seborrhea, high humidity caused by sweating, and the occlusive effect of the mask.

Aim: We investigated mask-related facial dermatoses in healthcare personnel who, since the beginning of the COVID-19 pandemic, had to wear a mask for long hours.

Methods: In this study, healthcare professionals working at Medipol Mega University Hospital since the beginning of the pandemic were screened for facial dermatoses between December 2020 and February 2021 with a dermatological examination and interview.

Results: Of the 101 healthcare professionals, 51 (50.5%) were doctors and 50 (49.5%) nurses, and 36 (35.6%) were male and 65 (64.4%) were female. All the participants had been actively working at the hospital for 35–46 weeks since the beginning of the pandemic and wearing N95 or surgical masks for an average of 6–13 h a day. During the dermatological examination, the most common facial dermatosis was acne, which was observed in 55.4% ($n = 56$) of the cases. Of the 56 acne cases, 41.1% ($n = 23$) had acne in their history, while 58.9% ($n = 33$) had new-onset acne. Being female, using a N95 surgical mask compared to surgical mask, and the daily average duration of mask use were determined as risk factors for acne development due to mask use.

Conclusions: The use of masks, more frequently N95, caused both an increase in existing acne and the development of new acne.

KEYWORDS
COVID-19, face mask, facial dermatoses, healthcare professionals

1 | INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) is a respiratory disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which has resulted in a global pandemic. The most common mode of transmission of SARS-CoV-2 is respiratory droplets and aerosol particles. Since the virus can spread through droplets during speaking, sneezing, and coughing by presymptomatic and asymptomatic individuals, face masks have been proposed as a simple and low-cost strategy to reduce viral transmission.[1-3] Healthcare professionals working in the forefront in the fight against the pandemic have had to wear N95 or surgical masks for long hours to both protect themselves when caring for patients and to prevent the spread of infection. As a result, it has been reported that there has been an increase in facial dermatoses among healthcare personnel working under these conditions.[4] The use of facial masks increases facial skin temperature and humidity. Changes in local temperature directly affect the sebum excretion rate (SER), with every one-degree

increase in temperature increasing SER by 10%.[5] Sweating and increased humidity lead to the swelling of epidermal keratinocytes, thus affecting the keratinocytes of pilosebaceous follicles, and this acute obstruction results in the exacerbation of acne. N95 and surgical masks have been reported to cause dehydration, increased PH, and microenvironment changes in the skin.[6] Dehydration, transepidermal water loss, and sebum dysregulation are pro-comedogenic factors that support the proliferation of *Cutibacterium acnes*.[7] The release of *C. acnes* enzymes can help develop acne inflammation.[8] Changes in both surface sebum composition and skin hydration contribute to the disruption of the skin barrier, causing an imbalance in bacterial microflora. Mechanical stress can sometimes lead to follicular inflammatory reactions in patients without acne.[9,10] The widespread use of facial mask during the ongoing COVID-19 pandemic has led to an increase in acne formation, which is often referred to as "maskne."[11,12] Demodex folliculorum, which is considered a trigger in rosacea, increases inflammation (papules, pustules, and erythema) by taking advantage of excessive sebum production.[13] Due to the irritating and allergic substances used in mask production, the use of masks can cause various dermatological findings, such as facial dryness, redness, burning, and swelling.[14,15] N95 and surgical masks have been documented to contain formaldehyde and other preservatives.[16] One of the chemical component used in these masks is formaldehyde, to which some people have sensitivity/allergy. Furthermore, urticaria and contact dermatitis may develop due to sensitivity to such mask components.[17]

In the literature, it has been reported that acne and facial dermatoses, such as facial dermatitis, seborrheic dermatitis, and rosacea, can also be aggravated by mask use.[15] In this study, our aim was to investigate the presence of these facial dermatoses associated with mask use, whether mask used aggravated these conditions or factors that facilitated their emergence among healthcare personnel who both work longer hours compared to the general population and continuously wear different masks, such as N95.

2 | MATERIALS AND METHODS

The study was approved by the Ethics Committee of Istanbul Medipol University and conducted between December 2020 and February 2021. Doctors and nurses who had been working at Medipol Mega University Hospital during the period covering the beginning of the COVID-19 pandemic and wearing masks for long hours were included in this study. Healthcare personnel that started working at the hospital after the beginning of the pandemic, newly recruited personnel, and those that were following flexible work hours due to comorbidities, such as diabetes, hypertension, and cardiac disease, were excluded from the study. In addition to the demographic data, the duration of daily mask use (in hours), type of mask that was most commonly used, history of facial dermatoses or increasing presence of facial dermatoses due to mask use, lesion areas, lesion type, and use of daily moisturizer, sunscreen, make-up, and facial cleansing were noted. The participants were questioned about their dermatological conditions before and after mask use and underwent a dermatological examination, after which a clinical diagnosis was made. The Global Acne Grading System (GAGS) was used to determine the clinical severity of acne.[18]

2.1 | Statistical analysis

SPSS v. 15.0 for Windows was used for statistical analyses. Descriptive statistics were presented as numbers and percentages for categorical variables, and mean and standard deviation for numerical variables. The rates in independent groups were compared using the chi-square test. Since numerical data did not meet the normal distribution assumption, the comparison of two independent groups was undertaken with the Mann-Whitney U test. Determinative factors were examined using the logistic regression analysis. The statistical alpha significance level was accepted as $p < 0.05$.

3 | RESULTS

A total of 101 healthcare professionals, 36 (35.6%) male and 65 (64.4%) female, were included in the study. The participants consisted of 51 (50.5%) doctors and dentists and 50 (49.5%) nurses (service and intensive care unit), and the mean age was 30.0 ± 7.5 (20–57) years. The participants had been wearing masks for an average of 40.7 ± 3.5 (35–46) weeks for an average of 10.8 ± 1.3 (6–13) h per day, and 34 participants most commonly used N95 (33.7%) while 67 (66.3%) used surgical masks. The characteristics of the participants of the study are summarized in Table 1.

The dermatological physical examination revealed that 56 (55.4%) of the participants had acne vulgaris, two (2%) had acne rosacea, one (1%) had seborrheic dermatitis, and one (1%) had contact dermatitis. These patients stated that their lesions increased with mask use. Thirteen (23.2%) of the acne cases were male and 43 (76.8%) were female. Twenty-three (41.1%) of the patients had a history of acne before mask use, while 33 (58.9%) had no history of acne. Among all the participants, the rate of new-onset acne was found to be 32.7%. Of the participants with acne who had been wearing masks for an average of nine to 13 (11) h a day for 35–46 (40.5) weeks, 36 (64.3%) used surgical masks and 20 (35.7%) used N95 masks. Factors that can be associated with acne development are summarized in Table 2. Being female compared to male and longer daily working hours were found to be statistically significant risk factors for the development of acne.

In 55 (98.2%) of the 56 cases that were detected to have acne during the dermatological examination, acne was severe in the mask area (right cheek, left cheek, chin, and nose) than the non-mask area (chest and upper back, and forehead), and 54.5% of the participants described an increase in acne with mask use. Of the participants, 32.7% had new-onset acne and 22.8% had the activation of existing acne. In one (1.8%) case, acne was more severe in the non-mask area

TABLE 1 General characteristics of the participants

	N	%
Gender		
Female	65	64.4
Male	36	35.6
Age Mean ± SD (min-max)	30.0 ± 7.5 (20–57)	
Profession		
Doctor	51	50.5
Nurse	50	49.5
Total mask use, weeks Mean ± SD (min-max)	40.7 ± 3.5 (35–46)	
Daily mask use, hours Mean ± SD (min-max)	10.8 ± 1.3 (6–13)	
Dermatological disease history		
Absent	69	68.3
Present	32	31.7
Acne vulgaris	23	22.8%
Seborrheic dermatitis	4	4.0%
Urticaria	3	3.0%
Acne rosacea	2	2.0%
Contact dermatitis	1	1.0%
Mask type		
N95	34	33.7
Surgical	67	66.3
Mask replacement frequency		
Every 10–12 h	32	31.7
Every 0–3 h	29	28.7
Every 4–6 h	40	39.6
Moisturizer use		
Present	47	46.5
Absent	54	53.5
Sunscreen use		
Present	21	20.8
Absent	80	79.2
Make-up use		
Present	27	26.7
Absent	74	73.3
Facial cleanser		
Soap	33	32.7
Syndet	58	57.4
Water	10	9.9
Dermatological examination		
Acne vulgaris	56	55.4
Acne rosacea	2	2
Seborrheic dermatitis	1	1
Contact dermatitis	1	1

Abbreviation: SD, standard deviation.

(chest and upper back, and forehead), and mask use did not increase acne severity. Twenty-three (41.1%) cases had a history of acne before mask use but described an increase in the severity of acne with mask use, while 33 (58.9%) cases did not have a history of acne before mask use and stated that this problem emerged with the use of masks. Areas of acne lesions and lesion types recorded during the dermatological examination of the patients are summarized in Table 3. Among the individuals who developed acne due to mask use, the most common lesion area was the chin ($n = 42$, 41.6%), and the common lesion type was a papule ($n = 22$, 21.8%). Of the 56 acne cases, 55 (98.2%) had mild acne and one (1.8%) had moderate acne. The mean GAGS score of those with a history of acne was statistically significantly higher than those who did not have a history of this disease ($p < 0.001$).

In the univariate analysis, there was a relationship between mask type and mask-related acne development based on the significance level of $p < 0.250$, and N95 was determined as a risk factor compared to surgical mask use (odds ratio [OR] [95% confidence interval, CI]: 7.45 [1.33–41.81], $p = 0.023$). Being female compared to male was also a risk factor for acne formation [OR (95% CI): 5.38 (1.66–17.47), $p = 0.005$]. Another risk factor for acne formation was the presence of an acne history [OR (95% CI): 4.71 (1.51–14.64), $p = 0.007$]. The results of the multivariate logistic regression analysis of acne risk factors are summarized in Table 4. With the backward method, being female compared to male, presence of an acne history, and working hours per day were found to be statistically significant factors.

4 | DISCUSSION

In studies investigating the relationship between mask and facial dermatoses in healthcare personnel during the ongoing COVID-19 period, it has been reported that mask use has caused or exacerbated dermatoses, especially acne, rosacea, seborrheic dermatitis, and contact dermatitis.[4,9,19–21] In a survey conducted in Singapore among healthcare professionals during the severe acute respiratory syndrome (SARS) pandemic period, acne was reported to be the most common facial dermatosis associated with wearing a mask for a long time.[2] In a survey conducted in Thailand with healthcare workers and non-healthcare workers, it was shown that the most common facial dermatosis caused by mask use was acne, and surgical masks caused more skin reactions than cloth masks.[22] In another study, Damian et al., who included 30 patients with acne and 36 with rosacea, reported that both facial dermatoses were triggered after at least 6 weeks of mask use.[23]

In the literature, among the studies investigating the relationship between mask use during the COVID-19 pandemic and acne development in healthcare professionals, the highest rate of acne was reported as 62.3% by Aravamuthan and Arumugam,[10] and the lowest rate as 12% by Shubhanshu and Singh.[24] Other studies[9,19,22]

TABLE 2 Factors associated with acne development

	Acne					
	Present		Absent			
	N	%	n	%	OR (%95 CI min-max)	p
Gender						
Male	13	23.2%	23	51.1%	I	
Female	43	76.8%	22	48.9%	3.46 (1.47–8.11)	0.004
Age Mean ± SD/min-max (median)	28.7 ± 6.3 21–50 (26)		31.7 ± 8.5 20–57 (28)		0.95 (0.90–1.00)	0.053
Profession						
Doctor	24	42.9%	27	60.0%	I	
Nurse	32	57.1%	18	40.0%	2.00 (0.90–4.44)	0.088
Dermatological disease history						
Absent	31	55.4%	38	84.4%	I	
Present	25	44.6%	7	15.6%	4.38 (1.67–11.47)	0.003
Acne vulgaris	23	41.1%	0	0.0%		
Seborrheic dermatitis	1	1.8%	3	6.7%		
Urticaria	2	3.6%	1	2.2%		
Acne rosacea	0	0.0%	2	4.4%		
Contact dermatitis	0	0.0%	1	2.2%		
Weekly working hours Mean ± SD/min-max (median)	40.2 ± 3.3 35–46 (40.5)		41.2 ± 3.7 35–46 (41)		0.92 (0.82–1.03)	0.161
Daily mask use Mean ± SD/ min-max (median)	11.0 ± 1.1 9–13 (11)		10.5 ± 1.4 6–13 (10)		1.41 (1.02–1.96)	0.037
Mask type						
Surgical	36	64.3%	31	68.9%	I	
N95	20	35.7%	14	31.1%	1.23 (0.53–2.84)	0.627
Mask replacement frequency						
Every 0–3 h	18	32.1%	11	24.4%	I	0.697
Every 4–6 h	21	37.5%	19	42.2%	0.68 (0.26–1.79)	0.430
Every 10–12 h	17	30.4%	15	33.3%	0.69 (0.25–1.92)	0.481
Moisturizer use						
Absent	28	50.0%	26	57.8%	I	
Present	28	50.0%	19	42.2%	1.37 (0.62–3.02)	0.437
Sunscreen use						
Absent	44	78.6%	36	80.0%	I	
Present	12	21.4%	9	20.0%	1.09 (0.41–2.88)	0.860
Make-up use						
Absent	39	69.6%	35	77.8%	I	
Present	17	30.4%	10	22.2%	1.53 (0.62–3.77)	0.360
Facial cleanser						
Water	7	12.5%	3	6.7%		0.304
Soap	15	26.8%	18	40.0%	0.36 (0.08–1.63)	0.183
Syndet	34	60.7%	24	53.3%	0.61 (0.14–2.59)	0.500
GAGS score Median (IQR)	7 (4–10)		0 (0–0)		2.38 (1.59–3.56)	<0.001

Abbreviations: CI, confidence interval; GAGS, Global Acne Grading System; IQR, interquartile range; OR, odds ratio; SD, standard deviation.

determined this rate to be 39.9%, 53.1%, and 56.0%, respectively. The rates of new-onset acne were calculated as 31.2% and 17.8%.[10,19] In a survey conducted in Singapore with healthcare professionals during the severe acute respiratory syndrome pandemic period, 59.6% of the participants regularly wearing N95 masks reported that they had acne problems.[2] Most studies investigating the relationship

TABLE 3 Distribution of acne according to body area and lesion type

	No lesion		Comedones		Papules		Pustules	
	N	%	N	%	N	%	n	%
Forehead	88	87.1	6	5.9	7	6.9	-	-
Right cheek	63	62.4	3	3.0	33	32.7	2	2.0
Left cheek	68	67.3	9	8.9	22	21.8	2	2.0
Nose	81	80.2	18	17.8	1	1.0	1	1.0
Chin	59	58.4	11	10.9	22	21.8	9	8.9
Mask area	45	44.6	6	5.9	39	38.6	11	10.9
Non-mask area	87	86.1	6	5.9	8	7.9	-	-

TABLE 4 Results of the multivariate logistic regression analysis of acne risk factors

		p	OR	95% CI
Enter method				
Gender (Ref: male)	Female	0.005	5.38	1.66–17.47
Age		0.842	1.01	0.93–1.10
Profession (Ref: doctor)	Nurse	0.137	4.29	0.63–29.24
Dermatological disease history presence		0.007	4.71	1.51–14.64
Weekly working hours		0.650	0.96	0.82–1.13
Daily working hours		0.082	1.44	0.95–2.16
Facial cleanser (Ref: water)		0.267		
	Soap	0.139	0.20	0.02–1.69
	Syndet	0.108	0.19	0.02–1.44
Mask type (Ref: surgical)	N95	0.023	7.45	1.33–41.81
Mask replacement frequency (Ref: every 0–3 h)		0.654		
	Every 10–12 h	0.730	0.79	0.20–3.07
	Every 4–6 h	0.363	0.57	0.17–1.90
Backward method				
Gender (Ref: male)	Female	0.003	4.24	1.62–11.10
Dermatological disease history presence		0.003	5.02	1.73–14.56
Weekly working hours		0.033	1.50	1.03–2.18
Mask type (Ref: surgical)	N95	0.050	2.79	1.00–7.76

Abbreviations: CI, confidence interval; OR, odds ratio; ref: reference.

between mask use and facial dermatoses in the literature have utilized the survey method. In our study, the rate of acne in those using masks was similar to the literature, but the rate of new-onset acne was found to be higher. The strength of our study was that unlike survey studies, all participants were also dermatologically examined.

Similar to our study, Aravamuthan and Arumugam[10] reported a statistically significant relationship between female gender and acne development due to mask use among healthcare professionals. In that survey study, 50% of the participants with acne had the new onset of the disease, and the remaining 50% presented with the exacerbation of existing acne. In contrast, our rate of new-onset acne was high, while the exacerbation of existing acne was observed at a lower rate.

Scarano et al[25] determined that N95 masks were less tolerated than surgical masks in terms of facial comfort due to the increase in facial skin temperature. Aravamuthan and Arumugam[10] reported no relationship between mask type and mask-related acne and determined a similar incidence of acne between the N95 and surgical mask users ($p > 0.005$). In the same study, no statistically significant difference was found between the duration of daily mask use and acne development between the participants who developed acne after mask use and those without acne. In our study, N95 was observed to be a risk factor in the development of acne compared to the surgical mask, and this was at a statistically significant level ($p = 0.023$). The duration of daily mask use was 11 ± 1.1 h for the participants with mask-related acne, which was statistically significantly higher than those without acne (10.5 ± 1.4 h) ($p = 0.037$).

In similar studies, most lesions have been found in areas covered with masks.[19,26,27] Han et al[26] reported five patients in the general population who had their first acne attack due to wearing a mask

for a long time. The most common symptoms were comedones and papules on the cheek and nose. Our results were similar, with the majority of lesions being papules and comedones observed in areas covered by the mask (chin, cheeks, and nose).

In the literature, it is recommended to apply non-comedogenic moisturizers before and after mask use, avoid face make-up during acne attacks, use mild cleansers close to the skin's natural pH (pH: 5), and avoid irritants, such as hot water and ethanol, which disrupt the skin's protective barrier.[28,29] It is also recommended to wash hands before putting on the mask and after removing it. In order to reduce the amount of water vapor coming out of the mouth and sweating, two layers of gauze should be placed inside the mask.[10] N95 and surgical masks should be replaced every 3 days and every 4 h, respectively, and there should be a 15-min interval without mask use every 2 h.[10,20] In our study, we questioned the use of moisturizers, sunscreens, cleanser type, makeup, and mask replacement intervals (in hours) among all the participants and detected no statistically significant difference between these data and acne formation.

During the ongoing COVID-19 pandemic, an increase in facial dermatoses, such as irritant contact dermatitis, seborrheic dermatitis, and rosacea, has been reported in healthcare professionals due to mask use.[4] In a survey completed by 404 healthcare professionals, all 26 rosacea cases with a history of inflammatory facial dermatoses and 37.5% (n = 9) of patients with seborrheic dermatitis reported disease activation.[21] In our study, disease activation was observed after mask use in participants with rosacea and seborrheic dermatitis. No new-onset disease was observed in facial dermatoses other than acne.

This study had certain limitations. Only medical personnel were included in the study, and therefore, the results do not reflect the situation in the general population. Increasing the number of participants in future or conducting a similar study in the general population may produce different data.

5 | CONCLUSION

Acne presents as the most common facial dermatosis that has increased among healthcare personnel who have had to wear N95 or surgical masks for long hours since the beginning of the pandemic. This is especially observed in those who wear N95 masks and work long hours.

CONFLICT OF INTEREST
All authors have contributed significantly, and all authors are in agreement with the content of the manuscript. There is no conflict of interest among all authors.

ETHICAL APPROVAL
The study was approved by the Ethics Committee of Istanbul Medipol University.

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