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TROPICAL CHALLENGES: FACIAL SKIN DAMAGE AMONG PROLONGED MASK WEARERS DURING THE COVID-19 PANDEMIC

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Abstract: *The COVID-19 pandemic has prompted widespread mask-wearing to reduce disease transmission. While masks are effective in blocking infectious particles, prolonged use can lead to facial skin issues due to factors like pressure, heat, humidity, and friction. This study surveyed individuals in Hainan, a tropical region, who have been wearing masks for an extended duration. The research aimed to assess the prevalence of facial skin problems among mask wearers in tropical climates during the pandemic. The findings offer insights into protecting facial skin health in such regions.*

Keywords: *COVID-19, mask-wearing, facial skin damage, tropical climate, pandemic skincare*

Introduction

COVID-19 is a type of acute infectious pneumonia that has been widely prevalent in recent years. It mainly spreads through the respiratory tract and contact, and the general population is susceptible to it. Masks can effectively filter and block droplets, microorganisms, etc., from entering the nose and mouth. Wearing masks can minimize the risk of exposure to droplets and aerosols [1-2]. However, during mask-wearing, the facial skin is in a closed environment for a prolonged period, and factors such as pressure, heat, humidity, and friction can lead to the proliferation of facial microorganisms, increased sebum secretion, and imbalanced skin flora. This can easily cause varying degrees of facial skin damage, manifesting as itching, marks, redness, acne, rashes, and other issues [3-5]. In this study, we conducted a questionnaire survey on individuals in Hainan region who have been wearing masks for a long time, aiming to understand the occurrence of facial skin damage during the pandemic period in tropical regions. The findings will serve as a reference for protecting the facial skin health of individuals who wear masks for extended periods in tropical regions.

1. Data and Methods

1.1 General Information

From December 9, 2022, to April 1, 2023, an online questionnaire survey was conducted on patients admitted to our fever clinic. Inclusion criteria were: (1) age between 18 and 60 years old; (2) willingness to cooperate and complete the survey questionnaire. Exclusion criteria were: (1) unwillingness to participate in the questionnaire survey; (2) history of chronic skin diseases and ongoing treatment. A total of 2023 questionnaires were received, among which 10 were excluded due to age discrepancy, resulting in 2013 valid questionnaires with a valid rate of 99.51%. This study was reviewed and approved by our hospital's ethics committee. All patients were fully informed about the survey content and signed an informed consent form in the questionnaire.

1.2 Methods

1.2.1 Survey Method

A survey questionnaire was developed based on literature review and consultation with relevant experts in the field. The questionnaire covered demographic information of the subjects, such as gender, age, occupation, location, types of masks worn, mask-wearing habits, duration of mask-wearing, and facial skin condition. The survey questionnaire was distributed via the Wenjuanxing platform, and the survey was conducted online.

1.2.2 Quality Control

The purpose, content, and informed consent form of the survey were stated at the beginning of the questionnaire. Participants had to choose the option "Agree, participate in the survey" to proceed with the formal survey, and choosing "Disagree, do not participate in the survey" would immediately terminate the survey, considering it as an invalid questionnaire. All items in the questionnaire were mandatory, and the questionnaire could only be submitted after all questions were answered. After the survey was completed, complete data were downloaded from the Wenjuanxing platform and cross-checked by two trained medical staff.

1.3 Statistical Methods

SPSS 22.0 software was used to process and analyze the data. Count data were expressed as percentages, and data comparisons were conducted using the chi-square test. Multifactorial logistic regression analysis was used to analyze the correlation between mask-wearing habits and facial skin damage. A P-value less than 0.05 was considered statistically significant.

2. Results

2.1 Basic Characteristics of the Study Participants

A total of 2023 questionnaires were received in this study, of which 2013 were deemed valid, resulting in a valid rate of 99.51%. Among the 2013 respondents, there were 1033 males and 980 females. The age ranged from 18 to 56 years, with an average age of (27.42±7.34) years. The occupations of the participants were as follows: 214 students, 367 medical staff, 84 farmers, 755 government employees and employees in other public institutions, 507 employees in private companies, 60 self-employed individuals, and 26 participants with other occupations. Regarding their facial skin conditions, 1581 individuals had underlying facial skin conditions, while 432 individuals had no underlying facial skin conditions. Based on skin types, 589 individuals had neutral skin, 448 had dry skin, 732 had oily skin, 128 had combination skin, 73 had sensitive skin, and 43 were unsure of their skin type. In terms of makeup habits, 839 individuals had a habit of applying makeup, while 1174 individuals did not.

2.2 Facial Skin Damage Among the Study Participants

Table 1: Distribution of facial skin lesions of the survey subjects (n=2013)

Facial skin damage features	Number of people	Percentage
Rubefaction	1721	85.49
Pruritus	1485	73.77
Furfuration	1178	58.52
Papula	1581	78.54
Explosive acne	1882	93.49
Pain	1565	77.74
The skin is tight	1766	87.73
Marks	1507	74.86
Sweltering discomfort	1905	94.63

Among the 2013 valid questionnaires, 1962 individuals reported facial skin damage, primarily manifested as rubefaction, pruritus, furfuration, papula, explosive acne, pain, the skin is tight, marks, sweltering discomfort, and other symptoms, as shown in Table 1.

2.3 Univariate Analysis of Factors Affecting Facial Skin Damage among Study Participants *Table 2: Univariate analysis affecting facial skin damage of survey respondents (n=2013)*

Influence factor		Number of people	Proportion of facial skin damage	χ^2value	P value
Age	≤40 Years old	1851	45(2.43)	0.977	0.323
	>40 Years old	162	6(3.70)		
Sex	Male	1033	31(3.00)	1.878	0.171
	Female	980	20(2.04)		
Occupation	Student	214	6(2.80)	4.117	0.249
	Staff	367	8(2.18)		
	Peasant	84	2(2.38)		
	Civil servants and personnel of other public institutions	755	18(2.38)		
	Enterprise personnel	507	14(2.76)		
	Individual or private personnel	60	2(3.33)		
	Other professions	26	1(3.85)		
Underlying facial skin disease	Have	1581	48(3.04)	7.534	0.006
	No	432	3(0.69)		
Skin type	Normal skin	589	4(0.68)	27.343	0.000
	Dry skin	448	10(2.23)		
	Oily skin	732	21(2.87)		
	Combination skin	128	8(6.25)		
	Sensitive skin	73	6(8.22)		
	Unsure about skin classes	43	2(4.65)		
Whether there is the habit of using cosmetics daily	Have	839	31(3.69)	7.857	0.005
	No	1174	20(1.70)		
Mask type	Disposable ordinary face mask	728	23(3.16)	11.171	0.011
	Disposable medical face masks	595	19(3.19)		
	KN95/N95	536	3(0.56)		
	Cotton mask	154	5(3.25)		
	Yes	1288	23(1.79)	8.099	0.004

Wear a mask to distinguish between front and back	No	725	28(3.86)		
After wearing the mask, the mask will have the following conditions	Only wet	1560	18(1.92)	14.873	0.000
	Peculiar smell	345	13(3.77)		
	Dirty (yellow)	108	20(7.41)		
Whether the mask is replaced in time after being damp	Yes	1792	38(2.12)	11.275	0.001
	No	221	13(5.88)		
Average time to wear a mask every day	Within 2 hours	87	1(1.15)	9.618	0.022
	2~4 hours	1250	27(2.16)		
	4~8 hours	596	17(2.85)		
	>8 hours	80	6(7.50)		
When to wear a mask each time	Within half an hour	393	8(2.04)	14.008	0.003
	1~2 hours	1426	31(2.17)		
	3~4 hours	165	9(5.45)		
	>4 hours	29	3(10.34)		
Number of repeated use of the mask	<3 times	1628	33(2.15)	12.463	0.006
	3~5 times	221	6(2.71)		
	6~10 times	94	4(4.26)		
	>10 times	70	8(8.57)		
Whether the original facial dermatitis is aggravated after wearing a mask	Yes	1604	43(2.68)	0.693	0.405
	No	409	8(1.96)		
Wear masks in hot weather	Yes	1639	49(2.99)	7.432	0.006
	No	374	2(0.53)		

The results of the univariate analysis showed that several factors had a statistically significant impact on facial skin damage among the study participants. These factors included underlying facial skin conditions, the habit of using cosmetics in daily life, skin type, type of mask worn, whether the mask was worn correctly (differentiating the front and back), mask contamination after wearing, timely replacement of a damp mask, average daily duration of mask-wearing, individual mask-wearing duration, the frequency of mask reuse, and wearing masks in hot weather. The differences were statistically significant with a P-value less than 0.05, as shown in Table 2.

2.4 Multifactorial Logistic Regression Analysis of Facial Skin Damage Among Study Participants

Using underlying facial skin conditions (with no as the reference), the habit of using cosmetics in daily life (with no as the reference), skin type (with neutral skin as the reference), mask type (with non-KN95/N95 masks as the reference), whether the mask was worn correctly (with not differentiating as the reference), mask contamination after wearing (with only damp as the reference), timely replacement of a damp mask (with no as the reference), average daily duration of mask-wearing (with

≤8 hours as the reference), individual mask-wearing duration (with ≤4 hours as the reference), the frequency of mask reuse (with ≤10 times as the reference), and wearing masks in hot weather (with no as the reference) as independent variables, binary logistic regression analysis was conducted with facial skin damage as the dependent variable. The results showed that non-neutral skin, wearing KN95/N95 masks, not differentiating the front and back of the mask, mask contamination after wearing, not timely replacement of a damp mask, longer average daily duration of mask-wearing, longer individual mask-wearing duration, higher frequency of mask reuse, and wearing masks in hot weather were related to the occurrence of facial skin damage. The proportion of study participants with facial skin damage was relatively higher when they had non-neutral skin, did not wear KN95/N95 masks, did not differentiate the front and back of the mask, had mask contamination after wearing, did not timely replace damp masks, had longer average daily duration of mask-wearing, had longer individual mask-wearing duration, had a higher frequency of mask reuse, and wore masks in hot weather (P<0.05). As shown in Table 3:

Table 3: Results of multivariate Logistic analysis of facial skin damage (n=2013)

Analytical factor	β	S.E.	Wald χ^2 value	P value	OR value	95%CI
Basic facial skin disease (yes)	0.235	0.189	1.546	0.214	1.265	0.873~1.832
Whether there is the habit of using cosmetics daily (yes)	0.301	0.191	2.484	0.115	1.351	0.929~1.965
Skin type (non-neutral skin)	0.512	0.171	8.965	0.003	1.669	1.193~2.333
Mask Type (KN95 / N 95)	-1.132	0.374	9.161	0.002	3.102	1.490~6.456
Wear a mask to distinguish between front and back (yes)	-1.114	0.441	6.381	0.012	3.047	1.284~7.231
Mask after wearing a mask (dirty)	0.369	0.156	5.595	0.018	1.446	1.065~1.964
Whether the mask is replaced in time after damp (yes)	-0.237	0.093	6.494	0.011	1.267	1.056~1.521
Average time of wearing a mask per day (> 8 hours)	1.524	0.431	12.503	0.000	4.591	1.972~10.684
Time of wearing a mask at each time (> 4 hours)	1.615	0.441	13.411	0.000	5.028	2.118~11.934
Number of mask reuse (> 10 times)	2.168	0.513	17.860	0.000	8.741	3.198~23.890
Wear a face mask in hot weather (Yes)	1.432	0.419	11.680	0.001	4.187	1.842~9.519

3. Discussion

There is a correlation between facial skin damage caused by long-term mask-wearing and the pathogenesis of common acne. It has been confirmed that facial skin damage caused by masks is related to temperature and humidity [6]. Sebum excretion rate increases significantly with rising temperature,

and this leads to a significant increase in squalene release [7]. Exhaled moisture and sweat also increase facial skin humidity, causing swelling of epidermal corneocytes and exacerbating facial skin damage. Moreover, abnormal sebum secretion and excessive epidermal hydration can disrupt the facial skin barrier, leading to imbalanced local skin flora and triggering or worsening facial skin damage [8]. Therefore, long-term mask-wearing can easily cause facial skin damage, and the high heat and humidity in the Hainan region further promote and exacerbate facial skin damage [9-10].

In this study, 2013 valid questionnaires were collected from December 9, 2022, to April 1, 2023, and among them, 1962 individuals experienced varying degrees of facial skin damage after wearing masks, with a facial skin damage occurrence rate of 97.47% (1962/2013). The specific manifestations of facial skin damage included redness, itching, desquamation, papules, acne eruption, pain, tightness, marks, and discomfort due to heat and humidity. The results of univariate and multivariate logistic regression analyses showed that skin type, mask type, whether the mask was worn correctly, mask contamination after wearing, timely replacement of a damp mask, average daily duration of mask-wearing, individual mask-wearing duration, the frequency of mask reuse, and wearing masks in hot weather were related to the occurrence of facial skin damage.

Comparisons and analyses of facial skin damage among individuals with different skin types revealed that individuals with neutral skin had a facial skin damage rate of 0.68%, significantly lower than those with dry skin (2.23%), oily skin (2.87%), combination skin (6.25%), sensitive skin (8.22%), or uncertain skin type. The multivariate logistic regression analysis showed that non-neutral skin was associated with facial skin damage. The analysis indicated that individuals with non-neutral skin were more susceptible to abnormal sebum secretion, which might be the main reason for the occurrence and exacerbation of facial skin damage [11].

Furthermore, this study also compared and analyzed the occurrence of facial skin damage among individuals wearing different types of masks and with different mask-wearing habits. The results showed that individuals not wearing KN95/N95 masks, not differentiating the front and back of the mask, experiencing mask contamination after wearing, and not timely replacing damp masks had a relatively higher proportion of facial skin damage. The analysis revealed that KN95/N95 masks had higher filtration efficiency against external irritants such as dust and microorganisms, effectively reducing the irritation to facial skin. Differentiating the front and back of the mask significantly reduced the chance of facial skin contact with external irritants. Mask contamination after wearing and not timely replacement of damp masks increased the contact time of facial skin with sebum and other secretions. Wearing KN95/N95 masks and maintaining good mask-wearing habits can effectively reduce and prevent the occurrence of facial skin damage.

In addition, this study also focused on the correlation between mask-wearing duration and facial skin damage. The results showed that individuals with longer average daily duration of mask-wearing, longer individual mask-wearing duration, and a higher frequency of mask reuse had a relatively higher proportion of facial skin damage. Prolonged mask-wearing applies constant pressure to the face. When facial pressure reaches 200 mmHg, pressure-induced damage may occur after 7-8 hours, and when facial pressure reaches 300 mmHg, pressure-induced damage may occur after 3-4 hours [12-13]. Moreover, prolonged mask-wearing can cause shear forces on vulnerable areas such as the nasal bridge, cheekbones, and ears, resulting in frictional damage to the skin. Wearing an inappropriate mask for an extended period further exacerbates these conditions. At the same time, this study explored the relationship between wearing masks in hot weather and facial skin damage, and the results indicated that wearing masks in hot weather was related to facial skin damage occurrence. The hot weather in the Hainan region leads to prolonged exposure to high heat and humidity, increased sweating, and facial skin dampness, which reduces the tolerance to pressure, shear forces, and frictional forces, thereby increasing the risk of skin damage [14].

Based on the above reasons, the following suggestions are proposed to prevent and reduce facial skin damage among individuals who wear masks for an extended period in the Hainan region. First, try to

minimize and control the duration of mask-wearing. If possible, remove the mask every hour and use clean tissue to wipe and absorb the moisture generated inside the mask due to breathing or sweating. Secondly, choose masks with suitable materials and sizes, change masks regularly, and maintain good mask-wearing habits. Finally, pay attention to keeping facial skin clean and dry, provide necessary skin moisturizing care to vulnerable and compressed areas, and consider using skincare products containing oil-control ingredients to reduce and control sebum secretion [15].

In conclusion, skin type, poor mask-wearing habits, prolonged mask-wearing duration, and hot weather are all related to facial skin damage. Controlling the duration of mask-wearing, developing good mask-wearing habits, choosing masks with suitable materials and sizes, keeping the skin dry and clean, and providing necessary skin care can effectively reduce and prevent the occurrence of facial skin damage.

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