Difference in the occurrence and intensification symptoms of stomatognathic system between women and men in medical staff working with patients infected with COVID-19

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Abstract

Background. One of the groups most exposed to potentially harmful effects of the current pandemic on physical and mental health is medical personnel, in particular those working directly with patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or suffering from coronavirus disease 2019 (COVID-19).

Objectives. The response of the body to a persisting threat, constant contact with dying people and frequent deaths of patients is chronic stress syndrome. Its symptoms may take the form of psychosomatic or somatic reactions. The aim of the study was to determine the effect of stress on the severity of temporomandibular syndrome (TMD) in medical personnel.

Materials and methods. The study included a group of 160 people – 120 women and 40 men aged 35–60 years, working at the hospital wards as doctors, nurses and support staff, directly with patients infected with SARS-CoV-2 and suffering from COVID-19. The research was conducted in the form of a cross-sectional survey with the use of anonymous questionnaire. The final questionnaire was developed based on the tools commonly used for TMD, bruxism, anxiety, and depression assessment – 8Q/TMD and the Patient Health Questionnaire-8 (PHQ-8).

Results. After checking the significance of differences in responses to individual questions among men and women and applying the Bonferroni correction for multiple comparisons, Fisher's test and p-values for individual responses, an increase in pathological reactions was shown. The results showed that the COVID-19 pandemic has caused significant adverse effects on the psychoemotional status and causes or aggravates TMD symptoms.

Conclusions. The aggravation of the psychoemotional status caused by the COVID-19 pandemic can result in intensification of TMD symptoms and other symptoms in the stomatognathic system in medical staff working with patients infected with COVID-19.

Key words: psychosomatic disorders, temporomandibular disorders, orofacial pain, COVID-19, SARS-CoV-2

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Background

For several months, the scientific world has been dominated by research on severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. Many publications concern various aspects of the impact of this virus on the human body and its psychophysical impact on humans. The virulence and ease of SARS-CoV-2 transmission, the lack of specific treatment methods, insufficient availability of health services, and the lack of a vaccine or an effective drug for treatment pose a very high risk to the functioning of people and force radical changes in everyday life.[1–6] One of the groups most exposed to potentially harmful effects on physical and mental health is the medical personnel, in particular those working directly with patients infected with SARS-CoV-2 and suffering from coronavirus disease 2019 (COVID-19). This applies to doctors, nurses as well as auxiliary staff necessary for the proper functioning of a hospital.

The response of the body to a persistent threat, constant contact with dying people and frequent deaths of patients is chronic stress syndrome. Its symptoms may take a form of psychosomatic or somatic reactions. The typical psychological response is stress, anxiety, increased nervous tension, vegetative neurosis, or depression. All these reactions have a large impact on the stomatognathic system and may manifest as the onset or intensification of dysfunction. Pain associated with temporomandibular disorders (TMD) can affect the daily activities, physical and psychosocial functioning, and quality of life of those affected.[7–15]

Objectives

The aim of the study was to determine the effect of chronic stress in medical staff working directly with patients infected with COVID-19, and to determine the difference in the occurrence and severity of symptoms in the stomatognathic system in women and men from the medical staff working with patients infected with COVID-19 and the occurrence or severity of TMD.

Materials and methods

The study was conducted before an effective COVID-19 vaccine was developed. The study included a group of 160 people – 120 women and 40 men aged 35–60 years, working at the hospital wards as doctors, nurses and support staff, directly with patients infected with SARS-CoV-2 and suffering from COVID-19. The research was conducted in the form of a cross-sectional survey with the use of anonymous questionnaire. The final questionnaire was developed based on the tools commonly used for TMD, bruxism, anxiety, and depression assessment – 8Q/TMD, and the Patient Health Questionnaire-8 (PHQ-8). People qualified for the study declared in a separate statement that in the period before the pandemic they had no symptoms related to TMD.

Anxiety and depression

The PHQ-8 is a screening tool used for assessing anxiety and depression. The severity of symptoms is rated on a scale from 0 to 3, where 0 means no symptoms and 3 means maximum severity. The score is the sum of the 8 items. The total score for this questionnaire ranges from 0 to 24 points and condition of the patient is typically rated using the following cutoff points (according to the standard of this questionnaire): a PHQ-8 cutoff point ≥10. The cutoff point for this survey is 10 points. It is a scale that determines the appearance of pathological changes and is a parametric measure for this questionnaire for all studies with its use (and therefore independent of the researcher). A score of 10 or greater is considered major depression and 20 or more – severe major depression.

The questions included in the PHQ-8 survey concerned the feeling of constant stress related to working with SARS-CoV-2-infected and COVID-19 patients, and the resulting possible psychological reactions: depression, helplessness, trouble sleeping, constant fatigue, eating disorders, trouble concentrating, and attention deficit hyperactivity disorder (ADHD).

The initial question in the questionnaire used in this study concerned gender. Then, the respondents answered whether in the last 2 weeks, in connection with work in the infectious diseases ward and work with patients infected with COVID-19, they:

1. felt little interest or pleasure in the activities;
2. felt depressed, helpless;
3. had trouble sleeping, drowsiness, the need to sleep longer;
4. felt constant fatigue, less energy;
5. experienced lack of appetite or increased appetite;
6. felt fear for themselves or their families;
7. had trouble concentrating on the things they were doing;
8. experienced slowness or hyperactivity in speaking or performing activities.

The following question was also asked: How often in the last 2 weeks did you experience stress related to working with patients infected with COVID-19: a) not at all; b) for a few days; c) throughout the entire period.

TMD screening

The 8Q/TMD questionnaire was used to collect the data, which is a reliable and acceptable tool for screening TMD status. The questionnaire has excellent negative predictive value and is considered an important screening tool. The questions in the 8Q/TMD questionnaire related to possible reactions to the psyche of the respondents

under extreme working conditions, the occurrence of ailments from the temporomandibular joints, tooth clenching and increased tension of the facial muscles, as well as general health. The severity of individual symptoms is assessed on a 4-point scale from 0 to 3, where 0 means no symptoms and and 3 means maximum severity. The respondents answered the following questions regarding the working conditions during the last 2 weeks, in connection with work in the infectious diseases ward and work with patients infected with COVID-19:

1. Have the working conditions influenced the feeling of stress?
2. Have the working conditions had an impact on overall health?
3. Did the working conditions affect the psyche?
4. Have the working conditions influenced relations with the environment, family and friends?
5. Have the working conditions influenced the sense of risk?
6. Have you experienced pain or increased tension in your facial muscles, temporomandibular joint discomfort or clenching of your teeth in the past?
7. Do the current working conditions affect the occurrence of these ailments?
8. Do the current working conditions affect the severity of these ailments?

The surveys were conducted 2 months after the commencement of work in closed wards with infected patients. Questionnaires assessed the last 2 weeks prior to receiving PHQ-8 and TMD-8, and were delivered in writing. The participants replied anonymously and voluntarily. Informed consent was obtained from all subjects as necessary, after presenting the study objectives.

The research was conducted in full compliance with the Declaration of Helsinki.

Statistical analyses

The analysis consisted in checking by means of the Fisher's test whether there was a statistically significant difference in the responses of men and women to individual questions. For this purpose, 2 × 4 tables were plotted, in which the lines contain information about gender, and the columns contain answers to individual questions: 0, 1, 2, and 3 for each of the questionnaires. Then, the tables were created for each answer separately to check if any of the genders answered 0, 1, 2, or 3 more often than the other.

There were 4 such 2 × 2 tables for each question, so when checking the significance of differences with the Fisher's test, the Bonferroni correction was applied by multiplying the p-values by 4. All tests were performed at the significance level of 0.05. Due to the fact that there were many more women who filled in the questionnaire, it was decided to present the data as percentage values. The proportion of people with specific symptoms was analyzed using Wald 95% confidence interval (Wald 95% CI).

Results

The obtained test results are given in Table 1,2. The analysis focused on the differences between women and men in the study. For each of the questions, it was checked whether there were statistically significant differences between men and women.

Analysis – PHQ-8

Question 1

There was a statistically significant difference between the studied women and men (Fisher's test, $p = 0.002$). The significance of differences in answers to particular questions among men and women was checked, and the Bonferroni correction was applied for multiple comparisons. Significantly more men answered "1" to the question about feeling little interest or pleasure in performing activities (Fisher's test, p-values for each answer: 1, 0.002, 1, and 0.290 for 0, 1, 2, and 3, respectively).

Question 2

There was a statistically significant difference between the studied women and men (Fisher's test, $p = 0.002$). Significantly more men answered "1" to the question about feeling depressed and helpless (Fisher's test, p-values for individual answers: 0.422, 0.007, 0.137, and 1 for 0, 1, 2, and 3, respectively).

Question 3

There was a statistically significant difference between the studied women and men (Fisher's test, $p < 0.001$). Significantly more men answered "0" and "1" to the question about perceived sleep problems, drowsiness and the need to sleep longer, significantly more women answered "3" to the same question (Fisher's test, p-values for individual answers: 0.014, <0.001, 0.914, and 0.010 for 0, 1, 2, and 3, respectively).

Question 4

There was a statistically significant difference between the studied women and men (Fisher's test, $p < 0.001$). Significantly more men answered "0" and "1" to the question about feeling constant fatigue and less energy, significantly more women answered "3" to the same question (Fisher's test, p-values for individual answers: 0.014, <0.001, 0.119, and <0.001 for 0, 1, 2, and 3, respectively).

Question 5

There was a statistically significant difference between the studied women and men (Fisher's test, $p < 0.001$).

Table 1. Statement of temporomandibular disorders (TMD) questionnaire (8Q/TMD questionnaire)

Statement of TMD questionnaire	Answer	Percentage of females [%]	Percentage of males [%]	p-value (Fisher's test)
1	0	0	0	1
	1	3.33	20	0.007
	2	13.33	20	1
	3	83.33	60	0.015
2	0	0	20	<0.001
	1	16.67	20	1
	2	20	20	1
	3	63.33	40	0.063
3	0	0	0	1
	1	0	10	0.014
	2	33.33	20	0.649
	3	66.67	70	1
4	0	0	0	1
	1	0	10	0.013
	2	33.33	40	1
	3	66.67	50	0.355
5	0	0	10	0.014
	1	3.33	30	<0.001
	2	16.67	0	0.016
	3	80	60	0.077
6	0	33.33	40	1
	1	20	30	0.786
	2	26.67	20	1
	3	20	10	0.914
7	0	20	40	0.077
	1	20	20	1
	2	20	10	0.914
	3	40	30	1
8	0	23.33	40	0.257
	1	23.33	10	0.290
	2	10	10	1
	3	43.33	40	1

Significantly more men answered "0" and "1" to the question about feeling lack of appetite or increased appetite, significantly more women answered "3" to the same question (Fisher's test, p-values for individual answers: <0.001, 0.002, 1, and <0.001 for 0, 1, 2, and 3, respectively).

Question 6

There was a statistically significant difference between the studied women and men (Fisher's test, p-value = 0.001). Significantly more men answered "2" to the question about feeling fear for themselves or their family, significantly more women answered "3" to the same question (Fisher's test, p-values for individual answers: 1, 0.433, 0.017, and 0.002 for 0, 1, 2, and 3, respectively).

Question 7

There was a statistically significant difference between the studied women and men (Fisher's test, $p < 0.001$). Significantly more men answered "1" to the question about experiencing problems with concentrating on the things performed, significantly more women answered "2" and "3" to the same question (Fisher's test, p-values for individual answers: 1, <0.001, <0.001, and 0.009 for 0, 1, 2, and 3, respectively).

Question 8

There was a statistically significant difference between the studied women and men (Fisher's test, $p < 0.001$).

Table 2. Statement of Patient Health Questionnaire-8 (PHQ-8) questionnaire

Statement of PHQ-8 questionnaire	Answer	Percentage of females [%]	Percentage of males [%]	p-value (Fisher's test)
1	0	10	10	1
	1	6.67	30	0.002
	2	60	50	1
	3	23.33	10	0.290
2	0	10	20	0.422
	1	3.33	20	0.007
	2	70	50	0.137
	3	16.67	10	1
3	0	0	10	0.014
	1	3.33	30	<0.001
	2	20	10	0.914
	3	76.67	50	0.010
4	0	0	10	0.014
	1	10	60	<0.001
	2	26.67	10	0.120
	3	63.33	20	<0.001
5	0	0	20	<0.001
	1	13.33	40	0.002
	2	30	30	1
	3	56.67	10	<0.001
6	0	0	0	1
	1	3.33	10	0.433
	2	10	30	0.017
	3	86.67	60	0.002
7	0	0	0	1
	1	10	70	<0.001
	2	55	20	0.001
	3	35	10	0.009
8	0	10	0	0.154
	1	13.33	70	<0.001
	2	48.33	30	0.182
	3	28.33	0	<0.001

Significantly more men answered "1" to the question about feeling slowed down or hyperactive in speaking or performing activities. Significantly more women answered "3" to the same question (Fisher's test, p-values for individual answers: 0.154, <0.001, 0.182, and <0.001 for 1, 2, and 3, respectively).

Analysis – TMD

How often have you experienced stress related to working with patients infected with COVID-19 over the last 2 weeks?

There was a statistically significant difference between the studied women and men (Fisher's test, $p < 0.001$). Significantly more men answered "1" to the question whether working conditions influenced the feeling of stress, significantly more women answered "3" to the same question (Fisher's test, p-values for individual answers: 1, 0.007, 1, and 0.016 for 0, 1, 2, and 3, respectively).

Whether working conditions had an impact on overall health

There was a statistically significant difference between the studied women and men (Fisher's test, $p < 0.001$). Significantly more men answered "0" when asked if working conditions had an impact on general health (Fisher's test, p-values for individual answers: <0.001, 1, 1, and 0.063 for 0, 1, 2, and 3, respectively).

Whether the working conditions had an influence on the psyche

There was a statistically significant difference between the studied women and men (Fisher's test, p = 0.003). Significantly more men answered "1" to the question whether the working conditions had an impact on their psyche (Fisher's test, p-values for individual answers: 1, 0.014, 0.649, and 1 for 0, 1, 2, and 3, respectively).

Whether the working conditions had an impact on relations with the environment, family and friends

There was a statistically significant difference between the studied women and men (Fisher's test, p = 0.003). Significantly more men answered "1" to the question whether working conditions had an impact on relations with the environment, family and friends (Fisher's test, p-values for individual answers: 1, 0.014, 1, and 0.355 for 0, 1, 2, and 3, respectively).

Whether working conditions had an influence on the sense of risk

There was a statistically significant difference between the studied women and men (Fisher's test, p < 0.001). Significantly more men answered "0" and "1" to the question whether working conditions influenced the sense of risk, significantly more women answered "2" (Fisher's test, p-values for individual answers: 0.014, <0.001, 0.016, and 0.077 for 0, 1, 2, and 3, respectively).

Have you had pain or excessive tension in your facial muscles, temporomandibular joint discomfort or clenching of your teeth in the past?

No statistically significant difference between the studied women and men was observed (Fisher's test, p = 0.275). The value of 0, i.e., no symptoms, was compared with values greater than 0, which meant the occurrence of symptoms of varying severity. Sixty-five percent of respondents indicated that in the past, they had experienced pain or increased tension in the facial muscles, with the Wald 95% CI: [57.6%; 72.4%] for complaints of the temporomandibular joints or clenching of the teeth. It is more than 50%, so we can say with 95% certainty that most people have suffered from the abovementioned ailments in the past.

Do the current working conditions influence the occurrence of these ailments?

No statistically significant difference between the studied women and men was detected (Fisher's test, p = 0.074). The value of 0, i.e., no symptoms, was compared with values greater than 0, which meant the occurrence of symptoms of varying severity. Seventy-five percent of respondents indicated that the current working conditions had an influence on the occurrence of the ailments (Wald 95% CI: [68.3%; 81.7%]). This is more than 50%, so we can say with 95% certainty that most people believe that the current working conditions have an influence on the occurrence of ailments.

Do the current working conditions exacerbate these ailments?

No statistically significant difference between the studied women and men was observed (Fisher's test, p = 0.122). The value of 0, i.e., no symptoms, was compared with values greater than 0, which meant the occurrence of symptoms of varying severity. Answering this question, 72.5% of people indicated that the current working conditions had an impact on the severity of the ailments (Wald 95% CI: [65.6%; 79.4%]). This is more than 50%, so we can say with 95% certainty that most people believe that the current working conditions have an influence on the severity of ailments.

Discussion

The genetic material of SARS-CoV-2 indicates that it belongs to a very large group of coronaviruses, most of which attack animals. However, some of them can cross the interspecies barrier. Today we know 7 coronaviruses attacking the human body. Three of them are very dangerous to humans: Middle East respiratory syndrome (MERS), SARS-CoV and its very close relative SARS-CoV-2; the remaining 4 only cause mild cold in humans. The SARS-CoV-2 has most likely crossed the bat–human barrier. It is not clear whether it needed an intermediate host – there are many indications that armored pangolins played this role.[16–18]

Relatively quickly, it was possible to elucidate the exact structure of SARS-CoV-2, and thanks to this, to learn, among other things, that it attacks human cells using its characteristic spikes (S proteins), by means of which it attaches to receptor proteins (ACE2) found in the membrane of human cells. Using these spikes, the virus penetrates ACE2, where it releases its genetic material, reproducing copies of SARS-CoV-2. The proteins to which the virus attaches are found in large amounts in the cells of the respiratory tract and lungs, hence the name responsible for the current SARS coronavirus pandemic (severe acute respiratory syndrome).

The SARS-CoV-2 spreads by droplets, thus when an infected person coughs, sneezes or talks, an aerosol with secretions from their upper respiratory tract and the virus present in it rises in the air. Due to the high virulence of SARS-CoV-2, even a small amount can lead to infection of the surrounding environment (e.g., workspace). An approach to spreading SARS infection that takes into account the phenomenon of clustering of problems during

a pandemic and the formation of feedbacks that multiply the stress to which healthcare workers are subjected is needed. It is a type of syndemic where there is aggregation and interaction of the SARS pandemic, comorbidities (often chronic), mental and behavioral problems, or health and environmental conditions. Overlapping each other, each of these factors strengthens.[19]

Medical personnel working with infected patients is aware of this persistent danger. Additionally, the lack of specific methods of treatment, insufficient availability of health services, the lack of a vaccine or an effective drug, constant contact with dying people, and frequent deaths of patients do not remain indifferent to the psychophysical state. A prolonged exposure to chronic stress disorder can exacerbate the symptoms of TMD or be a trigger of them. This, in turn, may additionally adversely affect the psychoemotional state of patients. Since both depression and TMD can be induced and aggravated by psychological factors, the differences in their incidence may result from psychological differences between the subjects. These factors can potentially modulate the psychoemotional state of participants, influence their coping strategies, and thus increase the incidence of both depression and TMD.

The influence of these factors is visible in the studied group of patients and reflected in the obtained results. There are no reports in the literature referring directly to such group of respondents. The obtained results correlate with the data provided in studies on people not directly related to the treatment of those infected with COVID-19. However, it is clearly visible that the intensification of TMD symptoms and depression is more frequent in healthcare workers. This is due to their greater awareness of the consequences of possible COVID-19 infection, overwork, and the direct and frequent sight of people dying from the infection.[3–7]

Apparently, anxiety and personal worries caused by the pandemic increased the incidence of TMD and depression. This is consistent with the results presented in the literature stating that anxiety, stress, coping strategies, and life catastrophes (i.e., events causing stress) can accelerate or prolong the symptoms of TMD and that psychosocial factors are associated with the occurrence of depression.[15–18] When the pandemic situation changed rapidly from one day to the next, uncertainty and fears about the present and the future were common, and in the study group, they were particularly intense and persistent. Under such conditions, the significant increase in the likelihood of TMD and depression is not surprising, even though medical personnel is used to dealing with extreme and stressful situations.

Limitations

The main problem encountered in this study is that no one has ever done this type of research in relation to COVID-19 SARS-CoV-2, based on the surveys we have selected. Obviously, these surveys have been widely used for many years, but there has been no research focused on the issues we raise. For this reason, there are no references to literature and no possibility of discussion. Thereby, the Limitations subsection was introduced into the text of the work, where the methodological difficulties resulting from this type of research are explained.

At the conceptual/theoretical level, correlational studies must at least try to examine the nomological network of stress-related symptoms by examining associations with antecedents, outcomes, mediators, or moderators. The current study mostly focused on describing the mean level and/or prevalence of symptoms in the sample. This type of analysis is too descriptive. The correlations between items from a questionnaire like the PHQ-8 are presumed to be explained by a common cause. Therefore, most studies in psychology regroup similar items into factors. Items are useful to make inferences about a concept and, ideally, should not be interpreted in isolation from one another. Exceptions are possible, but running multiple tests (based on highly correlated single-item scores) typically increase the likelihood of rejecting null hypothesis.

Conclusions

The results showed that the COVID-19 pandemic has caused significant adverse effects on the psychoemotional status and causes or aggravates TMD symptoms in medical staff working with patients infected with COVID-19, resulting in the intensification of TMD symptoms and thus leading to increased orofacial pain.

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