

# The Impact of Stress on the Functions of the Dento-Maxillary Apparatus

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## Abstract

Stress is a complex psychosocial phenomenon that occurs as a result of having to cope with requirements, tasks, situations perceived as difficult, painful or of great importance. The aim of the study was to assess stress in a young population from Cluj-Napoca and establish a correlation between stress and its impact on the oral cavity. The study was observational, analytical, cohort, and retrospective. It involved 105 young students of both sexes (17 males, 88 females) between 21 and 42 years of age. The average age of the subjects was 24.32 years. The study found a strong association between increased levels of stress and the occurrence of xerostomia, muscle pain in the masticatory muscles, sleep and awake bruxism.

**Keywords:** stress; bruxism; dento-maxillary apparatus; functions.

## 1. Introduction

Stress is a complex psychosocial phenomenon that occurs as a result of confrontation with requirements, tasks, situations perceived as difficult, painful or of great importance. The stress reaction causes morphological changes throughout the body, in most situations based on neuro-endocrine changes [1,2]. These phenomena disrupt the entire body, including the dento-maxillary apparatus. Recent literature in the field identifies multiple alterations in different structures, secondary to exposure to prolonged stress [3,4,5]. Early identification of these manifestations of stress allows limiting the effects and recovering the morphological and functional integrity. So, it is essential for the dentist to establish an early, complete and complex diagnosis and devise a treatment plan locally and systemically. Interclinical collaboration and psychotherapy support are welcomed in order to limit the consequences of stress exposure. The aim of the study was to assess stress in a young population of Cluj-Napoca and establish a correlation between stress levels and its impact on the oral cavity.

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## 2. Material and method

The type of study was observational, analytical, cohort, and retrospective.

The research studied a health phenomenon in the presence of risk factors for the oral health. The level of stress was the studied health phenomenon, and the main risk factors were: changes in swallowing and sense of taste, xerostomia, digestive disorders, as well as various oral pathologies associated with an increased level of stress (gingivitis, ulcero-necrotic gingivitis, stomatitis, oral herpes, bruxism, painful episodes in the morning at the level of the masticatory muscles or in the temporomandibular joint (TMJ) [6]. The study included 105 volunteers, students of "Iuliu Hațieganu" University of Medicine and Pharmacy in Cluj-Napoca. The inclusion criteria were: clinically healthy people without associated pathologies. The exclusion criteria were: treatments with anxiolytics and antidepressants in progress, musculoskeletal and systemic bone pathologies, surgery on TMJ, history of accidents in the bones of the face and orthognathic surgery. The method used for evaluation and investigation was a questionnaire form, with an average of 8-10 minutes time to fill in. The subjects enrolled in the study were informed about the outline of the study and its objectives. The study was conducted in April-May 2020, during lockdown. The period had been stressful for students due to the need to quickly adapt to online learning using different platforms and to isolation and deprivation of social interaction. The online inquiry form was distributed to the group of dental students in Cluj-Napoca via Facebook. The questionnaire was structured in 3 sections and was submitted anonymously. The first section consisted of the demographic data of the enrolled subjects: gender, age, background. The second section, including 32 questions, aimed at determining the individual stress levels by quantitative scoring (from 1-4 for each question, where 1=never and 4=always). For increased accuracy, the answers were anonymous and limited to the last 2 months (respectively March, April 2020). Our stress test was based on the stress test introduced and validated in 1998 by Tom Hindle, published in the book entitled "How to Reduce Stress", Dorling Kindersley Limited Publishing House, London, UK. Six of the included questions were amended in order to be relevant for the target population: the word 'work', meaning job, was replaced by 'faculty', and the word 'work', meaning work done at the workplace, was replaced by the 'learning', representing the students' task [7]. The stress score was calculated by summing up all the points from each question and comparing them with the evaluation scale of the questionnaire published by the author.

**Table 1:** Stress assessment scale (after Tim Hindle 1998) [7].

Severity	Score
Normal	32-64
Moderate	65-94
Severe	95-128

The third section included 12 questions specific to diseases of the dento-maxillary apparatus: disorders of the swallowing function, disturbance of the sense of taste, xerostomia, gingivitis (including ulcero-necrotic gingivitis), stomatitis, oral herpes, disease of the oral mucous membranes (by gastric acidity or gastro-

esophageal reflux), dental wear, sleep and awake bruxism, muscle and temporomandibular joint (TMJ) pain. The answers were considered positive when they recorded the presence of at least one episode of pathology in the aforementioned time. The data obtained after completing the questionnaires was transferred from the Google Forms format to the Microsoft Excel program. For statistical analysis, the IBM SPSS Statistics 2020 ([www.ibm.com/analytics/spss-statistics-software](http://www.ibm.com/analytics/spss-statistics-software)) program was used. The tests used were: the Fisher test (to check the dispersion equality of two independent variables normally assigned), the square Hi test (non-parliamentary test that verifies if the observed distribution differs from the expected one) and the contingency tables. The chosen statistical significance threshold was  $p < 0.05$ .

### 3. Results

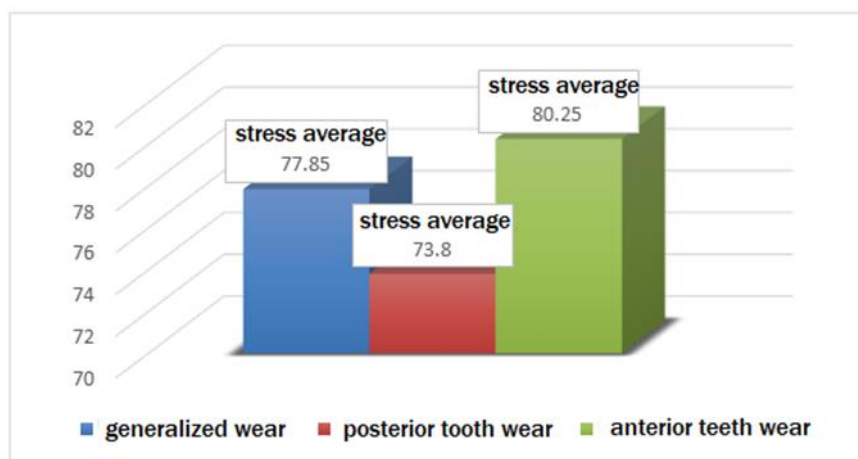
This study involved 105 young students of both sexes (17 males, 88 females) between 21 and 42 years of age. The average age of the subjects was 24.32 years. From the point of view of sex, female subjects prevailed (84%) over male subjects (16%). Of the total, 91 students, representing 86.7%, were from urban areas, and 14 (13.3%) from rural areas. The calculation of the individual score for stress assessment in accordance with the stress assessment scale proposed by Tom Hindle [7] indicated the following: 29 (27.6%) subjects had normal stress levels, 73 subjects (69.5%) had their stress levels at moderate intensity, and 3 subjects (2.86%) experienced severe stress. The comparison between the scores resulted from the stress questionnaire administered to each sex revealed an average score of 74.05 for women and a lower average score for men, namely 68.05. As concerns the correlation between background and individual stress score, the study revealed an average value of 71.78 in the case of people coming from rural areas and a value of 73.28 for people from urban areas. Table 2 sums up the data yielded by the answers to questions regarding the functionality of the dento-maxillary apparatus:

**Table 2:** The results of the questionnaire on the functionality of the dento-maxillary apparatus.

No. Crt.	Pathology	Percentage
1	Feeling of dry mouth (xerostomia)	69,52%
2	Aphthous stomatitis	68,57%
3	Digestive disorders	63,80%
4	Pain in TMJ	60,95%
5	Pain in the masticatory muscles	52,38%
6	Nocturnal bruxism	49,52%
7	Diurnal bruxism	43,80%
8	Oral herpetic diseases	35,23%
9	Swallowing disorders	33,33%
10	Gingivitis or Ulcero-necrotic gingivitis	19,04%
11	Disorders of the sense of taste	6,66%

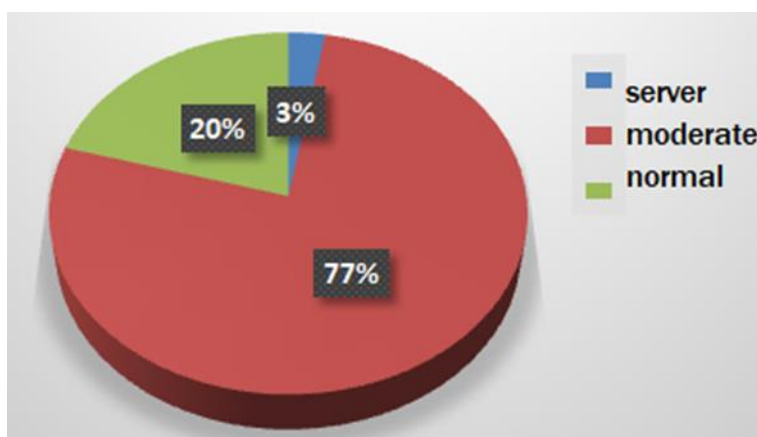
The presence or absence of pathological dental wear facets in the group of enrolled students was also analyzed depending on the area where they predominated: 7 students had generalized wear facets on all teeth, 5 students displayed wear only on the posterior teeth, 27 only on the anterior teeth, and the rest did not evince the respective oral pathology. Dental wear can be caused by the presence of dento-maxillary anomalies, but also by any intense occlusal contact carried out outside the mastication period [8].

Of the total subjects whose average score yielded by the questionnaires was calculated, 37% (only those who had dental wear facets) displayed a statistically significant correlation ( $p=0.03$ ) between the increased stress levels and the incidence of dental wear with previous localization. The results were detailed in Figure 1.



**Figure 1:** Comparison diagram of stress environments depending on the dental wear location

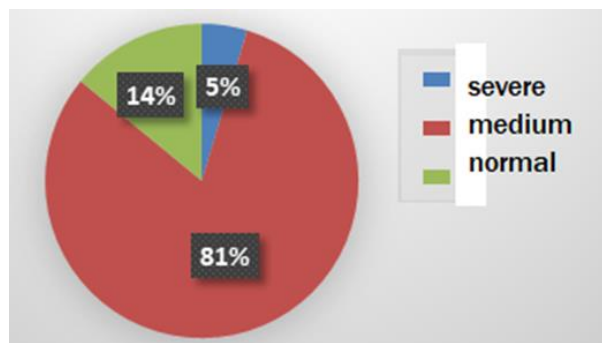
The most common oral condition was xerostomia, present in 73 subjects included in the study at least once during the evaluation period. According to the analysis, xerostomia affected mainly females. From the affected subjects, 86.3% were women and the rest 13.7% men. The correlation between dry mouth and the subjects' stress level was also analyzed. The results were detailed in Figure 2.



**Figure 2:** Correlation between the presence of xerostomia among study subjects and stress level.

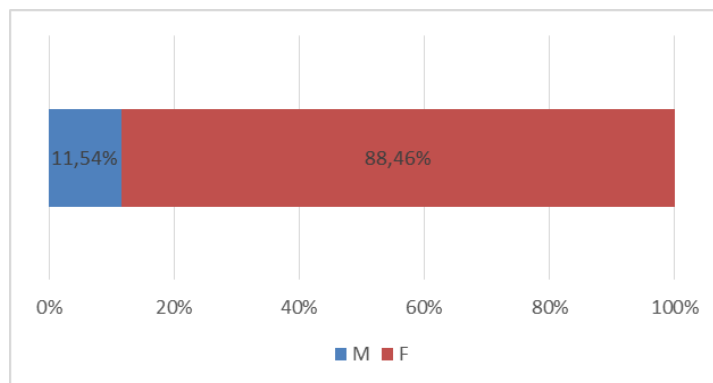
The presence of aphthous stomatitis, occurring at least once in the oral cavity, and the stress level of those who experienced this condition during the respective period, indicated an average score of 73.34. Digestive disorders, manifested by gastric acidity or gastroesophageal reflux, were found in 63.80% of the subjects and earned a third place ranking among the most common diseases with oral involvement. In order to evaluate the correlation between a possible increased level of stress and this condition, the stress level of the subjects who presented at least once one of the aforementioned manifestations was calculated as a percentage. Of the total number of subjects who experienced digestive disorders, 59 were females and 8 males.

It is common knowledge that with the occurrence of stressful situations the number and intensity of bruxism episodes increases, generating negative effects on the TMJ and the entire dento-maxillary apparatus. The pain in the TMJ and its correlation with the stress level can be found in Figure 3.



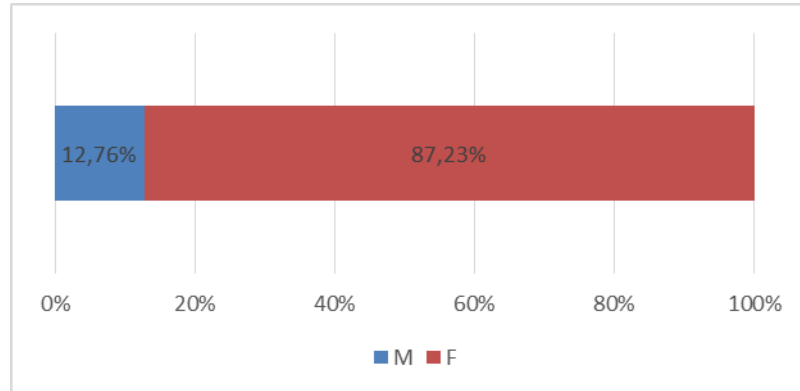
**Figure 3:** Pain in the TMJ and stress level.

The present study analyzed the presence of sleep bruxism, characterized by grinding teeth during the night, and awake bruxism, manifested by abnormal tangles of the dental units outside the masticatory cycle. This mode of nervous discharge causes early dental wear and pain in the local muscles and TMJ. Sleep bruxism occurred in 49.52% of the patients and was on the 6th place in the hierarchy of the most common oral manifestations of stress assessed in this study. Being a pathology frequently correlated with the level of stress, the incidence of this variable depended on gender [9]. The results of our study tipped the balance in favor of the female sex, which earned the majority percentage. The results were detailed in Figure 4.



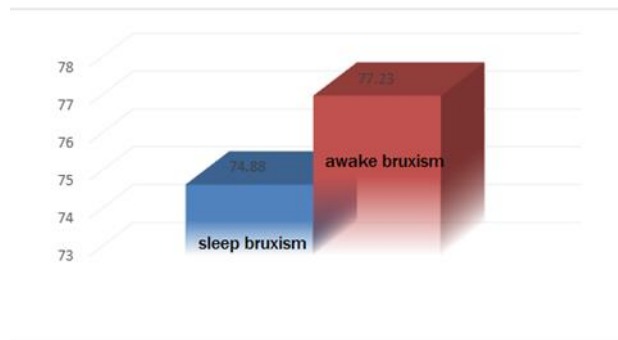
**Figure 4:** Correlation between the presence of sleep bruxism and its incidence depending on gender.

On the other hand, awake bruxism was present in 43.80% of the subjects, ranking immediately after the nocturnal one.



**Figure 5:** Correlation between the presence of awake bruxism and its incidence by gender.

By comparing stress environment for both pathologies, the study revealed that chronic stress determined more occurrences of awake than sleep bruxism in the studied group.



**Figure 6:** Comparison diagram of the calculated stress averages for subjects who showed bruxism.

Herpetic diseases can also be triggered by decrease in immunity against the background of stress. Of the total number of subjects, 37 manifested this oral condition during the study; 29 (78.4%) were females and 8 (21.6%) males. Thus, the incidence of aphthous stomatitis was higher among women.

In the aforementioned ranking, swallowing disorders held the 9th place. 17% of the subjects with this disease displayed severe levels of stress, while 77% of those with swallowing disorders exhibited an average level of stress.

Among the various processes of local immunity inhibition triggered by chronic stress, dental plaque is among the first signs that appear in the oral cavity and can cause the alteration of the functions of the dento-maxillary apparatus over time. Responses to the presence of gingivitis included responses to the existence of at least one episode of UNG during the study period. The correlation between gingivitis/UNG, present in 19.04% of the subjects, and the stress level of the subjects indicated a score of 90, namely the presence of severe stress among

the subjects with this pathology. The least common manifestation, with a percentage of 6.66% of the total, was the loss/alteration of the sense of taste. The sample in the present study was mostly represented by subjects aged 22-25 years (81%), which justifies the low frequency of this oral pathology. On the other hand, immunity suppressed by a chronic exposure to stress can cause recurrent local infections, resulting in the loss or alteration of the sense of taste. Following the results yielded by the analysis of the stress levels correlated with each pathology apart, we were able to determine the percentage of people with moderate and severe levels of stress: the range of 65-94 points, namely 95-128. Of the total subjects, 72% were included in one of these two categories. The impact of severe stress on the dento-maxillary apparatus led to the appearance of the following conditions: gingivitis /UNG (10%), pain in the TMJ (5%), aphthous stomatitis and awake bruxism (4%), swallowing disorders (6%), pain in the masticatory muscles (6%), sleep bruxism (6%), digestive disorders and xerostomia (3%), and oral herpetic diseases (5%) Following the statistical tests, numerical values of p were obtained for each parameter that was previously analyzed from a descriptive point of view. The value of the correlation-phi coefficient was also specified and the final results were detailed in Table 3.

**Table 3:** Correlation between stress levels and the presence of the studied manifestations.

Parameters	Correlation coefficient (phi)	P
Digestive disorders	0,290	0,018
Herpetic diseases	0,248	0,106
Awake bruxism	0,266	0,005
Sleep bruxism	0,318	0,003
Pain in the TMJ	0,290	0,018
Muscle pain	0,279	0,008
Gingivitis/UNG	0,312	0,048
Aphthous stomatitis	0,241	0,174
Swallowing disorders	0,204	0,093
Disorders of the sense of taste	0,095	0,506
Xerostomia	0,351	0,003

According to the aforementioned results, we were able to determine a statistically significant correlation between stress level and: xerostomia, awake and sleep bruxism, pain in the masticatory muscles, digestive disorders, pain in TMJ and gingivitis (including UNG); the correlation between the subjects' stress levels and herpetic diseases, aphthous stomatitis, swallowing disorders, and sense of taste alterations was statistically insignificant.

#### 4. Discussions

The place of residence has an impact on individual stress levels. The urban environment, crowded, polluted, exposed to high levels of noise, exacerbates stress directly, or indirectly the body's response to stress.

The present study analyzed the impact of stress on the functions of the dento-maxillary apparatus, to be more specific it showed that there was a correlation between stress level and certain oral conditions.

The data yielded by the study regarding the prevalence of xerostomia in men and women revealed the same results as a study conducted by Al-Dwairi Z, Lynch E in 2014 on a group of 136 subjects. The majority reported the perception of dry mouth (females 76.1%, males 24.9%) [10].

A more recent study published in 2017 by 6 Brazilian authors described the same results as our study, namely that xerostomia was prevalent among women. Their result was 83.3% females and 16.7% males out of a total of 61 patients (as compared to 86.3% females in our study) [11].

The increased incidence of aphthous stomatitis in patients with moderate and severe levels of stress (74%) was also correctly estimated in agreement with various studies in the literature in the field. One of these studies, recently published in February 2020, analyzed the correlation between the psycho-emotional state of the patient and the prevalence of aphthous stomatitis. The stress levels of 71.67% of patients with aphthous stomatitis ranged from medium to severe [12].

However, in contrast with the literature in the field, the prevalence of gingivitis in our studied group was lower than in other published studies, having the p value very close to the chosen significant threshold, more precisely  $p=0,048$ . A study on professional athletes with age similar to the present group (18-39 years), revealed that 41.4% of the total 352 subjects displayed clinical signs of gingivitis [13].

For a long time, researchers had been looking to gain in-depth knowledge of the risks and factors associated with bruxism. In this respect, sensitivity to stress, perception of stress, as well as the features of personality were studied in much more detail. In a study on subjects with bruxism, published by Ella B in 2017, he found a statistically significant high association between bruxism and stress ( $p<0,001$ ), without differentiating the two known types of bruxism. The data on the incidence of sleep and awake bruxism published in our study were also statistically significant and showed a higher frequency in women. The hypothesis was also supported by Huhtela OS, who together with other authors, in 2016, demonstrated that 21% of women and 12.5% of men (33.5% of the total subjects) showed nocturnal bruxism out of the total 4.403 studied subjects [14].

The occurrence of pain in the masticatory muscles induced by chronic stress was debated in other studies, one of which coordinated by two American researchers, who demonstrated the impact that emotional manifestations can have on the masticatory muscles [15,16]. In this study, a statistically high test value of  $p=0.008$  was obtained.

Although there were subjects in the studied group who had swallowing disorders, disorders of the sense of taste,



oral herpetic diseases or aphthous stomatitis, the association between stress levels and these variables was not supported from a statistical point of view.

The limitation of our study would be the number of subjects. Our sample was limited to “Iuliu Hatieganu” University of Medicine and Pharmacy students. In order to obtain clearer results, future studies are needed and should include a larger number and variety of subjects.

## 5. Conclusions

The present research indicates a directly proportional correlation between increased stress levels and the disruption of the functionality of the dento-maxillary apparatus. The study proves a strong association between increased stress levels and occurrence of xerostomia, muscle pain in the masticatory muscles, sleep and awake bruxism. Women are more intensely affected by stress, also recording higher stress scores and a higher frequency of stress manifestations. In contrast, prolonged stress can only be an enabling factor in the occurrence of gingivitis, pain in the temporo-mandibular joint and digestive disorders. Herpetic disorders, aphthous stomatitis, swallowing disorders and sense of taste can be influenced by stress, but a relationship of direct proportionality between them has not been proven, further studies being necessary to accurately identify the role of stress in their occurrence.

## 6. Disclosure

The author reports no conflicts of interest in this work.

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