Stomatologija, Baltic Dental and Maxillofacial Journal, 18: 75-9, 2016

Stress experience and effect on self-perceived oral health status among high school students

Kristina Arman[*], *Adelė Petruninaitė*[*], *Rūta Grigalauskienė*[*], *Eglė Slabšinskienė*[*]

SUMMARY

Objectives. Stress is a common phenomenon in our society. Several studies indicate that stress has an adverse effect on oral condition. The aim of this study was to evaluate the relationship between stress and self-perceived oral health status among high school students population.

Material and methods. A cross-sectional design was applied to the study, and a simple random sampling method was used to draw a representative sample of 200 15 to 19-year-old students from Šiauliai Didždvaris gymnasium. This study was based on annonymous self-reported questionaries about self-perceived oral and systemic conditions. The interdependence of characteristics was evaluated by chi-square (χ^2) and ANOVA criteria.

Results. 171 participants (85.5%) expierenced stress. 22.5% of the interviewees answered that they have symptoms of the gastroesophageal reflux disease (GERD), 22.5% – bruxism signs, 71.5% – dental decay, 59.5% – gum problems. Increased stress level was related with more frequent bruxism signs. The difference between groups was statistically significant (χ^2=13,444; p=0,009).

Conclusions. The prevalence of stress among high school students is high. This study demonstrates that increased stress level might be a risk indicator and have negative outcome to oral health.

Key words: stress, bruxism, dental decay, periodontal diseases, gastroesophageal reflux disease.

INTRODUCTION

A word "stress" is often used in nowadays to describe one's emotional state. Stress is a state of the body (and mind) in which the demands of the situation surpass one's resources available to cope with those demands (1). According to Selye stress involves a biological strain of an organism, which is caused by various somatic and/or mental stimuli (2). Exposures to chronic stress are considered to be toxic because they are most likely to result in long-term or permanent changes in the emotional, physiological, and behavioral responses that influence susceptibility to and course of disease (3).

The role of mental and psychosocial factors in oral diseases has been proved in several studies. Morse *et al.* in their study found different bacteria levels under stress and relaxation conditions which support the concept that stress may contribute to dental caries (4). Ray *et al.* suggest that stress might be associated with periodontal disease through physiologic and behavioral mechanisms (5). Rosania *et al.* in their study concluded that stress has an impact to periodontal disease, despite patients dental hygiene (6). The strong relationship exists between stress and necrotizing ulcerative gingivitis (NUG). Stress-related corticosteroid hormones are thought to alter T4/T8 lymphocyte ratios and may cause the decreased neutrophilic chemotaxis and phagocytic response. Stress-related epinephrine may result in localised ischemia, which predisposes the gingiva to NUG (7, 8).

In many studies were proved that there is a strong relationship between stress and bruxism. The prevalence of bruxism in the general population varies from 15% to 23%. Bruxism is considered as the most harmful parafunctional activity to the stomatognathic system (9). It might lead to abnormal tooth wear, hypermobility of teeth, tooth hypersensitivity and damage to periodontal tissues, temporamandibular joints and muscles (9, 10). When humans are exposed to

[*]*Department of Preventive and Pediatric Dentistry, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania*

Kristina Arman, Department of Preventive and Pediatric Dentistry, Medical Academy, Lithuanian University of Health Sciences, J. Lukšos-Daumanto 6, 50106 Kaunas, Lithuania.
E-mail address: armankristinaa@gmail.com

psychological stressors, the hypothalamic-pituitary-adrenal (HPA) axis and the sympathoadrenal medullary (SAM) system are activated causing abnormal and increased muscle activity (11).

Psychosocial and environmental stressors are the major risk factors in the pathogenesis of different diseases of gastrointestinal tract (12). Gastroesophageal reflux disease (GERD) is one of the most prevalent gastrointestinal disorders (13). According to Locke *et al.* in the USA, at least 20% of adults experience heartburn once a week and the prevalence of heartburn symptoms in children is 1.8–8.2% (14). GERD refers to the digestive dysfunction in which gastric and duodenum contents seep upward from the stomach to the esophagus and oral cavity (13). Endogenous acids are the main reason of dental erosion. Majority of studies reported that GERD was associated with at least 20-30% of patients with tooth erosion (15).

The aim of this study was to evaluate the relationship between stress and self- perceived oral health status among high school students population.

MATERIAL AND METHODS

Ethical considerations

The study was approved by the Lithuanian University of Health Sciences Kaunas Regional Biomedical Research Ethics Committee on 29 October 2014 (No. BEC-BH(B)-99). All respondents have written an agreement to participate in this study. Written informed consent was also obtained from the parents of participants who were under 18-year-old.

Study design

This was a cross-sectional study based on annonymous interviews using a structured questionnaire. It was conducted between 20/11/2014 and 10/12/2014 among 15 to 19-year-old adolescents. A simple random sampling method was used to draw a representative sample of 200 adolescents, Lithuania is divided into 10 administrative units, which centers are the major cities. To select one city from the ten was used a random number table. Consecutive number from 1 to 10 was assigned next to each city. The list of random numbers was formed using a random number table, it was selected 1 random number from the random number table which determined that study sample should be collected in Šiauliai city. The same strategy was applied to select the particular gymnasium from the all gymnasium schools located in Šiauliai city. According this methodology study was conducted in Šiauliai Didždvaris gymnasium.

A purpose-designed self-reported questionnaire was used in this study and addressed the following:

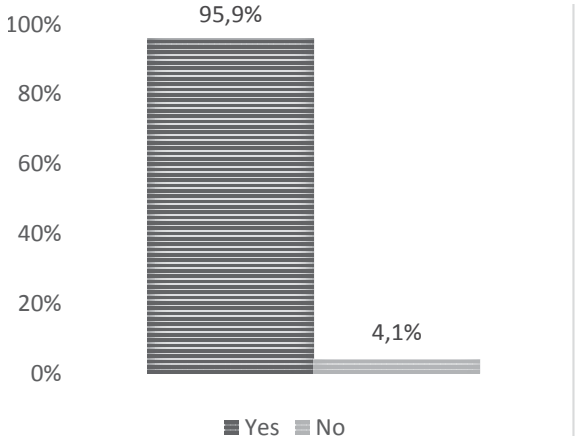

Fig. 1. Stress distribution among respondents with bruxism (χ^2=13.444; p=0.009)

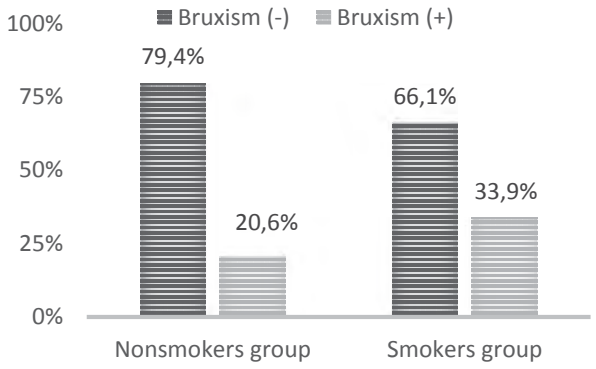

Fig. 2. Bruxism prevalence among respondents in smokers and nonsmokers (χ^2=3.996; p=0.046)

(1) socio-demographic factors (age, gender); (2) self-perceived oral health status (tooth decay, filled teeth, extracted teeth, gingival conditions: gum bleeding, pain, ulcerations, colour changes); (3) oral health habits (toothbrushing, flossing, mouthrinse); (4) systemic conditions (stress, GERD, bruxism) and (5) smoking (yes/no). In the introduction of the questionnaire the definitions of the stress, GERD, dental decay, bruxism and gum diseases were provided. Also all possible symptoms of each condition were listed. Regarding stress experience participants were also asked to describe their stress intensity and allocate themselves into 10 stress intensity levels: Level 1 – do not experience stress at all; levels from 2 to 4 – light stress; levels from 5 to 7 – moderate stress; levels from 8 to 10 – high stress. The response rate in present study reached 59.5%.

Pilot study of the questionnaire was performed prior the study. The questionnaire was additionally administrated for a 20 participants who were not included in the final sample. Corrections to the questionnaire were made according to the comments presented by the participants. Validation of the ques-

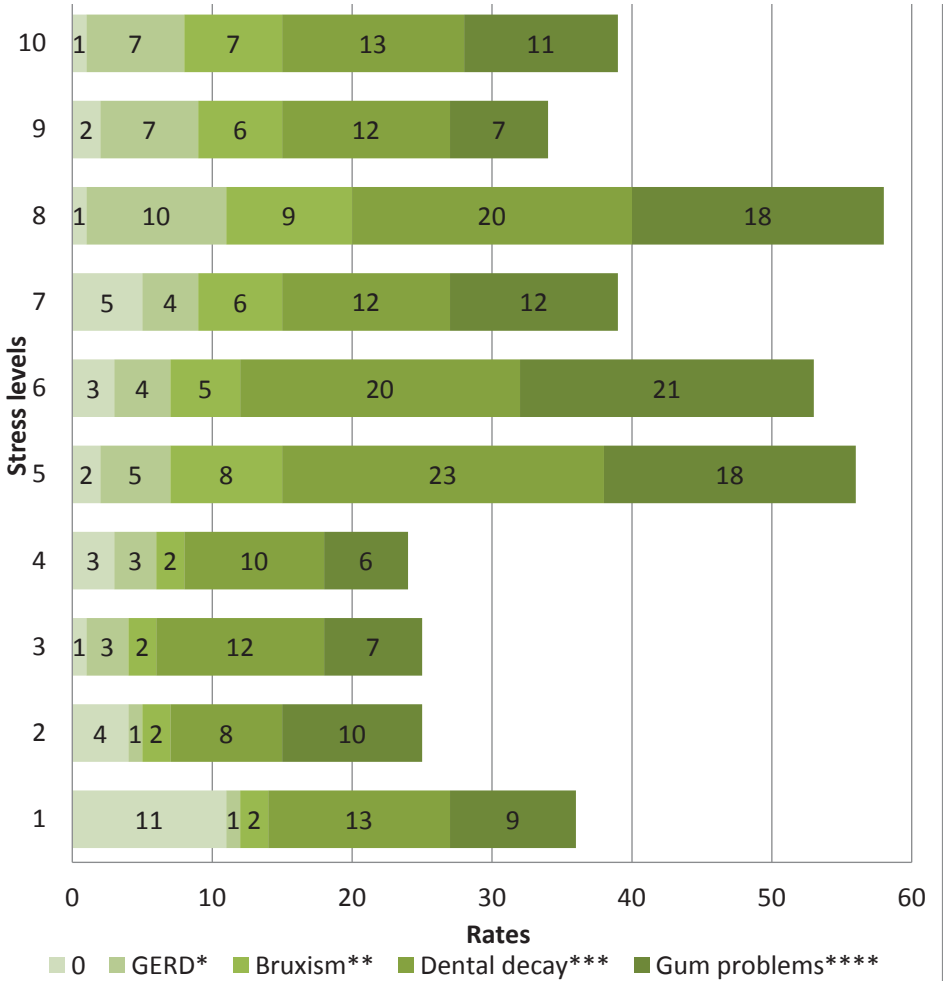

Fig. 3. Relationship between stress an oral/systemic conditions ($^{*}\chi^2$=24.618; p=0.003. $^{**}\chi^2$=12.157; p=0.002. $^{***}\chi^2$ =11.247; p=0.004. $^{****}\chi^2$ =11.483; p=0.003)

tionnaire was performed through the assessment of content validity. Content validity was examined in order to assess the extent to which a questionnaire measures what it is intended to measure.

Statistical analysis

Statistical data analysis was performed using SPSS 22.0 (Statistical Package for the Social Sciences for Windows). Descriptive statistics was used on all variables. Comparisons among study variables were done using ANOVA and χ^2 test was used to determine the differences. The threshold for statistical significance was set at $P<0.05$.

RESULTS

There were interviewed 200 students from Šiauliai Didždvaris gymnasium. 63% (126) of study participants were girls and 37% (74) were boys. Study participants were 15- to 19-years-old students, mean age was 17-year-old. 22.5% of all participants had symptoms of GERD, 24.5% bruxism, 71.5% dental decay and 59.5% gum diseases.

171 students positively answered that they suffer from stress. The prevalence of stress between boys and girls were almost the same: 83.8% and 86.5% respectively. Almost a half of the participants have answered that they experience stress few times per week (45.6%).

In our study was found that stress prevalence is almost the same among students with GERD, bruxism or gum problems: 97.8%, 95.9% and 92.4% respectively. Figure 1 shows the percentage of stress distribution among respondents with bruxism, only in this group was detected statistically significant association.

59 students were smokers of all 200 respondents. There were a statistically significant association between students with bruxism in smokers and nonsmokers group (Figure 2). In smokers group bruxism prevalence was 33.9% versus 20.6% in nonsmokers group. Likewise in nonsmokers group were more respondents who didn‘t have bruxism symptoms (79.4 % versus 66.1%).

As shown in Figure 3, the prevalence of oral or/and systemic conditions increases with higher stress level. Participants who do not experience stress at all, stated that they do not have any oral or systemic conditions and this number in the first level is much higher than in higher stress levels, also these participants experience less GERD and bruxism symptoms. The prevalence of GERD and bruxism is higher in higher stress levels. Dental decay and gum problems are prevalent in all stress levels. But higher number of these conditions are seen in moderate and high stress levels. As we can see, the bigger quantity of oral and systemic conditions are in moderate stress level.

DISCUSSION

The present study shows that high school students often experience stress due to difficult study, exams or other causes. Also conflicts with friends or parents may cause stress.

The results of the present study show that stress have an association with oral health status. In the present study 95.9% respondents with bruxism experience stress and a statistically significant association was detected too. In several studies were researched the association between sleep bruxism (SB) and GERD. Different factors, such as occlusal interferences, medication, sleep disorders, stress, anxiety, and esophageal acidification, may be related to the mechanisms of sleep bruxism. Interestingly, many of these factors are common to both GERD and sleep bruxism. Some authors concluded that SB is prevalent in individuals with GERD and that GERD is strongly associated with SB (13). Miyawaki *et al.* in their study found that at least 50% of the jaw muscle activity during sleep were associated with saliva swallowing (17). It is clear from the present study that bruxism as well as GERD is more prevalent with higher stress level.

97.8% respondents with GERD experienced stress and with higher stress level GERD frequency increased. Naliboff *et al.* in their study found that chronic stress significantly predicts increased heartburn symptoms (16). So stress could contribute in GERD etiopathogenesis. Still other lifestyle factors also have influence on the development of this condition, which were not included in this study. However, in the present study the young participants age might be a factor why no statistical significant difference was observed between stress and GERD.

In this study we found that there is an association between bruxism and smoking. There were more respondents who had bruxism in smokers group. In one study it was found a possible association between tobacco use and bruxism among middle-aged adults. The authors of that study concluded that nicotine dependence may be a significant predisposing factor of bruxism (18). The same authors in another study found that weekly bruxers were more than two times more likely to report heavy smoking than never bruxers: smoking increases levels of nicotine and dopamine release, which is strongly associated with bruxism (19). However, there is a limited number of studies and future studies are needed to prove the relationship between bruxism and smoking.

The prevalence of dental decay is also higher with greater stress level. According our results tooth decay is common in all stress level groups. Psychological factors such as stress and anxiety are associated with decreased salivary flow (20, 21). Low salivary flow determines the occurrence of dental caries. Lack of saliva predisposes the development of atypical or unusual dental decay such as cervical, incisal or in cusps tips, as well as radicular lesions (22). This study show that stress might contribute to tooth decay and be one of the dental caries risk indicators. However, other factors such as plaque control, sugar consumption, systemic diseases are important and we can not state that only stress has a strong impact to dental caries development.

In this study was found that stress also may have a negative effect on periodontal tissues. 92.4% of all respondents with periodontal conditions experienced stress. Gum problems are more prevalent in moderate stress level group. Studies also showed a positive relationship between stress and periodontal conditions (23). In other studies were found that stress and depression may be associated with periodontal destruction through behavioral and physiological mechanisms. In addition, oral care neglect during periods of stress and depression was associated with periodontal attachment loss and missing teeth (5,6). Stress leads to activation of the hypothalamic-pituitaryadrenal axis and induce significant increases in salivary cortisol levels (5). The higher hydrocortisone concentration significantly upregulates expression of Matrix Metalloproteinases (MMP-1, -2, -7, and -11) and Tissue Inhibitor of Matrix Metalloproteinases (TIMP-1) in human gingival fibroblasts, which may contribute to the increased periodontal breakdown (24). However, no statistical difference between stress and gum problems was obsreved in the present study, and a young participant age could be the reason why no association was observed.

The results of this study show that stress has a relationship with poor self-perceived oral health status and may induce oral conditions. But this study reflects stress related oral conditions prevalence in very small population of adolescents and there is a need of objective evaluation of the oral health status.

CONCLUSIONS

It can be concluded that the prevalence of stress among high school students is high. This study demonstrates that increased stress level might be a risk indicator of bruxism. However, further studies are needed to cofirm the present findings and relate them with objective oral health evaluation.

REFERENCES

1. Grippoa AJ, Scottia MAL. Stress and Neuroinflammation. In Halaris A, Leonard BE, editors. Inflammation in Psyciatry. Basel, Karger; 2015. p. 20–32.
2. Wieckiewicz M, Paradowska-Stolarz A, Wieckiewicz W.

Psychosocial Aspects of Bruxism: The Most Paramount Factor Influencing Teeth Grinding. BioMed Research International 2014, Article ID 469187.
3. Cohen S, Deverts DJ, Miller GE. Psychological stress and disease. JAMA 2007; 298 (14): 1685-1687.
4. Genco RJ, Ho AW, Grossi SG, Dunford RG, Tedesco LA. Relationship of Stress, Distress and Inadequate Coping Behaviors to Periodontal Disease. Journal of Periodontology 1999; 70(7): 711-723.
5. Ray B, Kaur J, Anand SC, Jacobs R. Salivary Stress Markers, Stress and Periodontitis: A Pilot Study. Journal of Periodontology 2011; 82 (2): 287-292.
6. Rosania AE, Low KG, McCormick CM, Rosania DA. Stress, Depression, Cortisol and Periodontal Disease. Journal of Periodontology 2009; 80(2): 260-266.
7. Neville BW, Damm DD, Allen CM, Bouquot J. Oral and Maxillofacial Pathology, 3rd edition, Saunders. 2008. p.202.
8. Carranza's. Clinical Periodontology. 11th edition, Saunders. 2012. p.286.
9. Vale do A., Cardoso CL, Díaz-Serrano K. Behavioral Problems and Emotional Stress in Children with Bruxism. Brazilian Dental Journal 2013; 23(3): 246-251.
10. Giraki M, Schneider Ch, Schäfer R, Singh P, Franz M, Raab W, et al.. Correlation between stress, stress-coping and current sleep bruxism. Head and Face Medicine 2010; 6(2).
11. Abekura H, Tsuboi M, Okura T, Kagawa K, Sadamori S, Akagawa Y. Association between sleep bruxism and stress sensitivity in an experimental psychological stress task. Biomedical Research 2011; 32(6): 395-399.
12. Konturek PC, Brzozowski T, Konturek SJ. Stress and the Gut: Pathophysiology, Clinical Consequences, Diagnostic Approach and Treatment Options. Journal of Physiology and Pharmacology 2011; 62(6): 591-599.
13. Mengatto CM, Dalberto CS, Scheeren B, Silva de Barros SG. Association between sleep bruxism and gastroesophageal reflux disease. The Journal of Prosthetic Dentistry 2013; 110(5): 349-355.
14. Sakaguchi K, Yagi T, Maeda A, Nagayama K, Uehara S, Sakoguchi YS, et al. Association of problem behavior with sleep problems and gastroesophageal reflux symptoms. Pediatrics International 2014; 56: 24-30.
15. Ranjitkar S, Smales RJ, Kaidonis JA. Oral manifestations of gastroesophageal reflux disease. Journal of Gastroenterology and Hepatology 2012; 27: 21-27.
16. Naliboff BD, Mayer M, Fass R, Fitzgerald LZ, Chang L, Bolus R, et al. The effect of life stress on symptoms of heartburn. Psychosom Med 2004; 66: 426–434.
17. Miyawaki S, Tanimoto Y, Araki Y, Katayama A, Imai M, Takano-Yamamoto T. Relationships among nocturnal jaw muscle activities, decreased esophageal pH, and sleep positions. American Journal of Orthodontics and Dentofacial Orthopedics 2004; 126(5): 615-619.
18. Rintakoski K, Ahlberg J, Hublin C, Broms U, Madden PAF, Könönen M, et al. Bruxism Is Associated With Nicotine Dependence: A Nationwide Finnish Twin Cohort Study. Nicotine & Tobacco Research 2010; 12(12): 1254–1260.
19. Rintakoski K, Ahlberg J, C. Hublin C, Broms U, Madden PAF, Könönen M, et al. Tobacco use and reported bruxism in young adults: A nationwide Finnish Twin Cohort Study. Nicotine & Tobacco Research 2010; 12(6): 679-683.
20. Queiroz CS, Hayacibara MF, Tabchoury CPM, Marcondes FK, Cury JA. Relationship between stressful situations, salivary flw rate and oral volatile sulfur-containing compounds. European Journal of Oral Sciences 2002; 110:337-340.
21. Hugo FN, Hilgert JB, Corso S, Padilha DMP, Bozzetti MC, Bandeira DR, et al. Association of chronic stress, depression symptoms and cortisol with low saliva flow in a sample of south-Brazilians aged 50 years and older. Gerodontology 2008; 25: 18–25.
22. Mese H, Matsuo R. Salivary secretion, taste and hyposalivation. Journal of Oral Rehabilitation 2007; 34(10): 711-723.
23. Peruzzo DC, Benatti BB, Ambrosano GMB, Nogueira-Filho GR, Sallum EA, Casati MZ, et al. A Systematic Review of Stress and Psychological Factors as Possible Risk Factors for Periodontal Disease. Journal of Periodontology 2007; 78(8): 1491-1504
24. Cury PR, Arau´jo VC, Canavez F, Furuse C, Arau´jo NS. Hydrocortisone Affects the Expression of Matrix Metalloproteinases (MMP-1, -2, -3, -7, and -11) and Tissue Inhibitor of Matrix Metalloproteinases (TIMP-1) in Human Gingival Fibroblasts. Journal of Periodontology 2007; 78(7): 1309-1315.

Received: 05 06 2015
Accepted for publishing: 26 09 2016