



# The Evaluation of the Levels of Salivary Cortisol (C<sub>21</sub> H<sub>30</sub>O<sub>5</sub>) and Dental Anxiety in the Case of Some Patients with Bruxism

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**Abstract.** *Dental anxiety as well as fear provokes physical, cognitive, emotional and behavioural responses in an individual. Because there is a lack of information in the specialised literature regarding dental anxiety and bruxism, the present study's goal was to evaluate the degree of dental anxiety at the level of dental concerns in the case of patients with bruxism in the context of the main dental procedures. It was also aimed for highlighting the efficiency of "tell-show-do" techniques and behavioural control in dental anxiety management in patients with bruxism. The correct evaluation of the patient and identifying the source and level of anxiety will allow the dentist to choose an adequate approach towards the patients, so that their visit to the dentist may have a positive outlook. Because of the fact that in the specialized literature was suggested that nocturnal bruxism is correlated with higher psychological perceived stress levels and salivary cortisol, the aim of this study was to highlight if there are any connexions between the utilisation of occlusal splints for muscle relaxation and behavioural control techniques in the context of lowering the levels of salivary cortisol.*

**Keywords:** *dental anxiety, dental concerns, bruxism, "tell-show-do" technique, behavioural control technique, occlusal splints, salivary cortisol.*

## 1. Introduction

The aetiology of nocturnal bruxism is considered multifactorial, being linked to several factors, like sleep disorders, genetic polymorphisms, exogenic factors, medicine intake, the use of certain substances and psychosocial behaviours [1].

According to specialised literature, it was attributed to this parafunction an increased frequency in the age interval between 19 and 44 years old, with the specification there are no essential differences between men and women [2].

Nocturnal bruxism was defined as an activity of the masticatory muscles which occurs during sleep. This activity of the masticatory muscles may be: rhythmic (phasic) or non-rhythmic (tonic) [3]. The signs and symptoms specific to nocturnal bruxism are represented by: the attrition of dental surfaces, pain and / or hypertrophy of the masticatory muscles, morning pain in the cephalic region, dysfunctions of the temporomandibular joint [4].

Because bruxism is probably the result of emotional tension and psychological disorders which force the subject to answer with a prolonged contraction of the masticatory muscles [5], it should be noted that some personality traits may be at the foundation of bruxism-related behaviour. Furthermore, high levels of anxiety and phobias have been reported in relation to bruxism [6].

The initial interaction between dentist and patient may reveal the presence of anxiety, fear and dental phobia. Generally speaking, dental anxiety may be managed through psychotherapeutic interventions, pharmacological interventions or through a combination of both, depending on the dentist's experience, the degree of dental anxiety, patient's characteristics and clinical situations [7].

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Occlusal splints have been frequently used as efficient treatment for nocturnal bruxism in order to protect the teeth by the deterioration caused by muscle contractions or for reducing orofacial pain, if present [8].

Cortisol belongs to the glucocorticosteroids hormones group and is a major steroid hormone secreted by the fascicular zone of the suprarenal cortex. Cortisol is spread in all bodily fluids: urine, plasma and saliva. Cortisol is responsible for important processes in the human body, like glucose production and the activation of anti-inflammatory processes. [9] Clinical studies have shown that when people are subjected to stress, the hypothalamic–pituitary–adrenal axis is activated, leading to a rise in cortical secretion. Based on this, several studies have utilised modifications of the levels of salivary cortisol as an indicator of stress, anxiety and depression. [10] During stressful situations, there is a growth of cortisol levels, the so-called stress hormone.

This study's goal is to highlight the relation between bruxism, the degree of dental anxiety behavioural techniques for reducing dental anxiety, occlusal splints and levels of salivary cortisol.

## 2. Materials and methods

The study group was comprised of 40 subjects diagnosed with bruxism (men and women), ages between 19 and 35 years old. It was further split in two groups: the group of patients diagnosed with nocturnal bruxism – comprised of 30 male and female patients, and the group of patients diagnosed with diurnal bruxism – comprised of 10 male and female patients. The criteria of exclusion from the study have been the following: patients with neuronal disorders, patients which underwent orthognathic surgical treatments, patients which underwent surgical treatments of the temporomandibular joint, patients who smoke, suprarenal gland insufficiency, pregnant women, women who take oral contraceptives, asthmatic patients which undergo steroid-based treatments, people with xerostomia, people which undergo treatments with antihistamine beta-blockers, anticholinergics, anti-Parkinson's agents, antidepressants or antipsychotic drugs, diuretics and sedatives.

In order to highlight bruxism, the patients that took part in the study answered a 6-item questionnaire, each item having a “yes” or “no” answer variant [11]. The patients were asked to choose the answers only if they consider their habit to be sufficiently frequent to be relevant from a clinical point of view (meaning more frequent than 3 times a week and / or for several hours a day). Patients included in the bruxism category have answered positively to at least two of the following 6 items:

1. Has anybody heard you grinding your teeth at night?
2. Have you ever felt your jaws tired or aching when waking up in the morning?
3. Have you ever felt teeth or gum pain when waking up in the morning?
4. Do you ever get temporal headaches when waking up in the morning?
5. Are you ever aware of grinding your teeth during daytime?
6. Are you ever aware of clenching your teeth during daytime?

The evaluation of dental anxiety levels has been realized by utilizing Corah's Dental Anxiety Scale, Revised (DAS-R). In order to evaluate the level of concern / unrest of patients in the context of main therapeutic procedures, a list of dental procedures was given (26 items) in which the people in question ranked their concern on a proposed scale (low, moderate, high).

In order to assess dental anxiety management and the degree of dental concerns, the “tell-show-do” technique was used, as well as the technique of behavioural control. The “tell-show-do” technique involved verbal explanations of the procedures in phrases adequate to the level of development of the patient (tell); demonstrations for the patient, with visual, auditory, olfactory and tactile aspects of the procedure in a controlled environment from a risk point of view (show); and finally, without deflecting from the explanation and demonstration, finalizing the procedure (do). The “tell-show-do” technique is utilized with communication abilities (verbal and nonverbal) and positive reinforcement of the desired behaviour [12]. The behavioural control technique implies the ability of the patient to signal the dentist at any time when he wants the dental procedure stopped by raising the left hand. The specific signal



was chosen before beginning the treatment. The dentist stopped the procedure as agreed upon. The levels of concern / unrest of patients the context of main therapeutic procedures was repeated after the use of the dental anxiety management techniques described prior.

For the evaluation of the levels of salivary cortisol it was utilised a enzyme-linked immunosorbent assay (ELISA).

The occlusal splints have been realised through the CAD-CAM technology, following specific stages:

The research design went through the following steps:

- The completion of the self-evaluating questionnaire for bruxism by all the people that participated in the study;
- The completion of the questionnaire for the evaluation of the degree for dental anxiety by all the people that participated in the study - Corah's Dental Anxiety Scale, Revised (DAS-R);
- Determining the levels of salivary cortisol in all of the participants in the study: the collection of samples, the keeping of samples and the analysis of the saliva has been realised according to the manufacturer's indications;
- The application of behavioural techniques for management of dental anxiety to all the participants in the study;
- The making of occlusal splints for only half of the participants in the study, for which high levels of salivary cortisol have been registered;
- The revaluation of the degree of dental in all participants in the study after 3 weeks;
- The revaluation of salivary cortisol in all participants in the study after 3 weeks, in the same manner as at the beginning.

The collected data have been centralised and processed in MS Microsoft Excel 2016.

### 3. Results and discussions

During the study, 75% of the patients have presented nocturnal bruxism, while 25% of them have presented diurnal bruxism. The level of dental anxiety shown by the patients participating in the study has been distributed as follows: moderate anxiety – 20%, high anxiety – 55%, severe anxiety / phobia – 25%.

Table number 1 holds the percentual distribution of the degree of unrest / anxiety corresponding to dental treatments. A high percentage of dental concerns has been observed in the following: "injection – dental anaesthesia" (100%); "not being able to stop the dentist" (98%); "the sound / vibration of the drill" (95%); "gagging, for example during impressions of the mouth" (95%); "fear of being injured" (95%); "not enough information about procedures" (83%); "I don't like feeling confined or not in control" (80%); "not feeling free to ask questions" (75%) and "I am embarrassed about the condition of my mouth" (75%).

**Table 1.** Percentage distribution of dental concerns assessment corresponding to dental procedures

DENTAL CONCERNS ASSESSMENT	Low	Moderate	High
1.Sound or vibration of the drill	0%	5%	95%
2.Not being numb enough	45%	30%	25%
3.Dislike the numb feeling	48%	29%	23%
4.Injection	0%	0%	100%
5.Probing to assess gum disease	25%	25%	50%
6.The sound or feel of scraping during teeth cleaning	30%	20%	50%
7.Gagging, for example during impressions of the mouth	0%	5%	95%
8.X-rays	50%	20%	30%
9.Rubber dam	34%	21%	45%
10.Jaw gets tired	15%	35%	50%
11.Cold air hurts teeth	22%	40%	38%
12.Not enough information about procedures	7%	10%	83%
13.Root canal treatment	20%	40%	40%

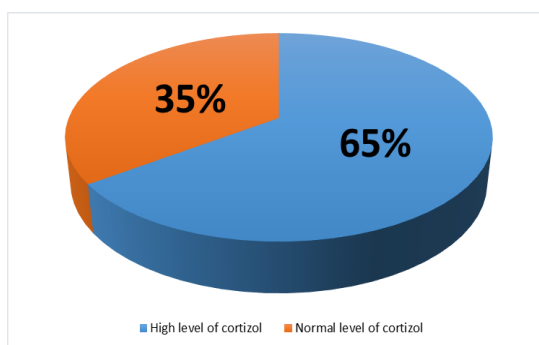


14.Extraction	45%	25%	30%
15.Fear of being injured	1%	4%	95%
16.Panic attacks	65%	20%	15%
17.Not being able to stop the dentist	1%	1%	98%
18.Not feeling free to ask questions	5%	20%	75%
19.Not being listened to or taken seriously	45%	30%	25%
20.Being criticized, put down, or lectured to	50%	27%	23%
21.Smells in the dental office	73%	17%	10%
22.I am worried that I may need a lot of dental treatment	37%	20%	43%
23.I am worried about the cost of the dental treatment I may need	29%	31%	40%
24.I am worried about the number of appointments and the time that will be required for necessary appointments and treatment; time away from work, or the need for childcare or transportation	42%	28%	30%
25.I am embarrassed about the condition of my mouth	10%	15%	75%
26.I don't like feeling confined or not in control	5%	15%	80%

Table number 2 shows the value of p using the t-test function in order to highlight any possible significant statistical difference between risen dental anxiety levels in the initial check-up of the patient and after the use of the “tell-show-do” technique and the behavioural control technique as management of dental concerns.

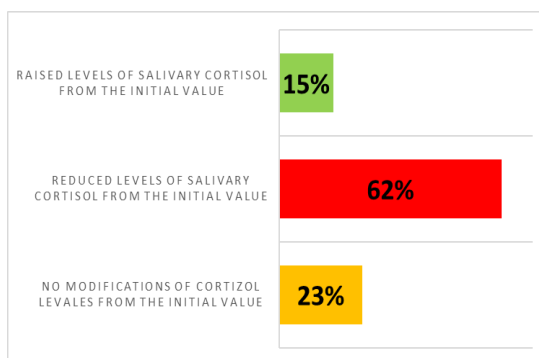
**Table 2.** The results obtained by calculating the value of p through t-testing ms microsoft excel 2016

t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	Variable 2
Mean	20.923077	12.615385
Variance	135.19385	76.246154
Observations	26	26
Pooled Variance	105.72	
Hypothesized Mean Difference	0	
df	50	
t Stat	2.9132215	
P(T<=t) one-tail	0.0026679	
t Critical one-tail	1.675905	
P(T<=t) two-tail	0.0053357	
t Critical two-tail	2.0085591	



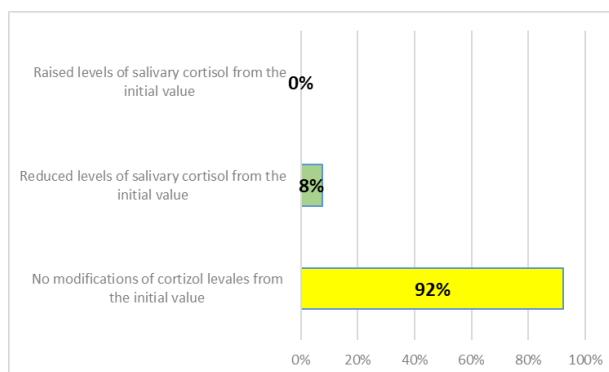
**Graphic 1.** The percentual distribution of the lot according to salivary cortisol levels

According to the study, it was observed that 65% of participants have presented high levels of salivary cortisol, while 35% presented no modifications of the salivary cortisol levels.



**Graphic 2.** The percentual distribution of the group of patients after 3 weeks of wearing occlusal splints, in accordance with the levels of salivary cortisol

In the context of determining the levels of salivary cortisol, it was observed that after 3 weeks of wearing the occlusal splints, the levels of salivary cortisol were reduced in 62% of the patients, in 23% of the patients there were no modifications from the initial value determined before wearing the occlusal splints, while in 15% of the patients it was observed a rise in the levels of salivary cortisol in contrast to the initial values registered before wearing the occlusal splints.



**Graphic 3.** The percentual distribution of the group of patients for which was administered only behavioural therapy in the dental office, according to the levels of salivary cortisol

After the analysis of the obtained data, the following results have been obtained in regards to the percentual distribution in a group of patients for whom only behavioural therapy had been administered in the dental office, according to the levels of salivary cortisol: 92% have shown unmodified cortisol values in contrast to initial observed values, 8% of the patients have shown a decrease in the levels of salivary cortisol. No patient partaking in the group of patients who have been administered behavioural therapy in the dental office have presented a rise in the levels of salivary cortisol.

Because there is a lack of information in specialised literature regarding dental anxiety and bruxism, through the present study we aimed to evaluate the degree of dental anxiety and the level of dental concerns in patients with bruxism in the context of the main dental procedures. Also, we wanted to highlight the “tell-show-do” technique and behavioural control technique in managing dental concerns in patients with bruxism.

Diurnal bruxism occurs during daytime, mainly as a clenching [13], while nocturnal bruxism is a stereotype movement of a grinding-like activity [14] and is mainly related to sleep.





According to several studies, the prevalence of bruxism varies from 7% to 58% [15]. Carvalho and colab. reported the fact that 50% of police officers either diurnal or nocturnal bruxism [16]. Kuttilla and colab. [17] reported the occurrence of diurnal bruxism without symptoms in a study based on population is of 7.3%.

In this study, 75% of patients presented nocturnal bruxism while 25% presented diurnal bruxism. According to a study by Glaros and colab. [18] the greater frequency was met in the case of diurnal bruxism contrary to nocturnal bruxism – a contrary conclusion to the one obtained by the present study.

In regards to associating bruxism and dental fear, studies in the area led to results which highlighted the fact that people with bruxism a degree of dental anxiety significantly greater [19]. Winocur and colab. have demonstrated a significant association between bruxism and dental anxiety [20].

The level of dental anxiety met in the patients with bruxism who took part in the study has been distributed as follows: moderate anxiety – 20%, high anxiety – 55%, severe anxiety / phobia – 25%. It is shown that the highest percentage is represented by those who, according to the results, presented a high level of dental anxiety.

In regards to the level of concern / unrest of patients in the context of the main dental procedures, a risen level dental concerns has been observed in the case of the following: “injection – dental anaesthesia” (100%); “not being able to stop the dentist” (98%); “the sound / vibration of the drill” (95%); “gagging, for example during impressions of the mouth” (95%); “fear of being injured” (95%); “not enough information about procedures” (83%); “I don't like feeling confined or not in control” (80%); “not feeling free to ask questions” (75%) and “I am embarrassed about the condition of my mouth” (75%). The highest level of unrest / anxiety was recorded by the injection – dental anaesthesia.

Dental anxiety, as well as fear, provokes physical, cognitive, emotional and behavioural responses in an individual. Anxiety is commonly related to the pain stimulus and increased perception of pain; thus, these patients show a risen level of pain which lasts longer; furthermore, they exaggerate the memory for pain [21]. A study conducted by Costello [22] that 21.2% of patients presented a slight to intense fear, while 4.9% have presented a phobia level to injections, physicians, dentists and hospitals. The general fear for injections / anaesthetic dental punctures, including injection pain and the physical trauma specific to the anaesthetic puncture are the most common dimensions related to the fear of dental injection [23].

A person's fear of the dentist may influence his satisfaction for scheduling appointments for dental treatments and it also reflects the presence in the dental offices [24].

Dental anxiety may be managed through psychotherapeutic interventions, pharmacological interventions or through a combination of both, according to the level of dental anxiety, patient's characteristics and clinical situations [7].

The correct evaluation of the patient and identification of the source and level of anxiety may allow the dentist to decide an adequate treatment plan. Although bruxism may lead to dental attrition, pain and muscular fatigue and in some severe cases may even compromise oral functions like chewing, phonation and swallowing, it is extremely important that patients come to see the dentist. In this sense is necessary the evaluation of dental anxiety levels in patients with bruxism in order to manage it, so that these patients' visit to the dentist may have a positive outlook.

A good dentist – patient relationship is crucial for managing anxiety. Communication strategies are very important. There should always be two-way communication [25].

Behavioural modification is based on the principles of learning, in what is concerning classical conditioning or operant conditioning, as well as on social learning. Its goal is to change unwanted behaviour in certain situations through learning. These strategies involve relaxing together through guided images or the adjuvant use of physiological monitoring through biofeedback, hypnosis, acupuncture, distraction, positive reinforcement, stop-signalling and treatments based on exposure like systematic desensitization, “tell-show-do” and modelling [7].



The “tell-show-do” technique is a behaviour modelling technique which reduces uncertainty and raises predictability in the clinical environment [26].

Behavioural control implies giving the chance to the patient to feel that he is in control of the procedure and treatment. The technique of behavioural control implies the ability of the patient to signal the dentist the moment in which he wants the dental procedure stopped. The specific signal is to be agreed upon before the beginning of the treatment. The dentist must stop the procedure as agreed. The patients can also be given mirrors to follow the procedure, so that they feel in control [27].

In the present study, for the patients with a high level of dental concern / anxiety was used: the “tell-show-do” technique and the behavioural control techniques. The evaluation of the levels of concern / unrest of the patients in the context of main therapeutic procedures was repeated after using these dental anxiety management techniques.

According to the statistical analysis, the value for  $p$  obtained ( $p < 0.05$ ) has shown the fact that there is a significant statistical difference between the high level of dental anxiety during the patient’s initial check-up and after the usage of the “tell-show-do” technique and the behavioural control techniques as management as dental concerns management tools.

According to the study, it was observed that most participants – 65% have presented high levels of salivary cortisol, while 35% of participants have presented no modifications in the levels of salivary cortisol. Previous studies have evaluated the relation between bruxism and perceived stress by the estimation of stress-related biomarkers (cortisol and  $\alpha$ -amylase) found in saliva and reported that patients afflicted with bruxism have shown higher levels of cortisol than normal individuals. In return, the salivary  $\alpha$ -amylase levels haven’t been significantly different in patients with bruxism in relation to normal individuals. These results suggest that nocturnal bruxism has been correlated to higher levels of perceived psychological stress and salivary cortisol [28]. Another study done by Miletic and colab. [29] has shown that patients diagnosed with nocturnal bruxism show higher levels of salivary cortisol.

The present study has shown a percentual drop of salivary cortisol levels in the majority of patients who have been administered occlusal splints for muscle relaxations (3 weeks after the application of the occlusal splints) – 62%. Even so, it was observed that 23% of the patients in this group have shown no modification in the levels of salivary cortisol in comparison to the initial value registered before wearing the occlusal splints. Even more so, in 15% of the participants included in the group of those wearing the occlusal splints was registered a rise in the levels of salivary cortisol in confronts to the initial value registered before wearing the occlusal splints.

In the present, physical therapy is used for treating this affection, and the used methods most commonly used are the transcutaneous neuromuscular stimulation, neuromuscular electrical stimulation, cryotherapy, echography, infrared therapy, kinetotherapy, massage therapy, acupuncture, low laser level therapy (LLLT) the use of occlusal splints [30]. According to Solberg and colab. [31], an occlusal splint reduces muscular activity and provides a greater comfort to the patient. The usage of occlusal splints seems to reduce the grinding of the teeth, masticatory muscle activity and orofacial pain [32]. Although occlusal splints are used on a large scale for treating bruxism, a specific strategy for curing this affection hasn’t yet been established.

According to the results obtained in this study, in the group of patients to which only behavioural therapy has been administered in the dental office, was highlighted the fact that 92% of the patients have shown unmodified values in cortisol levels in contrast to the initial registered value, while 8% of them have shown a decrease of salivary cortisol levels. No patients parting in the group submitted to behavioural therapy in the dental office have reported a rise in the levels of salivary cortisol in contrast to the initial registered value. Cortisol is a hormone secreted by the suprarenal glands and is a documented marker for the “fight or flight” response in humans. For this reason, cortisol was used as a marker for stress as well as anxiety for over 5 decades [33]. In stomatology, salivary cortisol has been utilized in measuring the role of stress in the anxiety determined by dental treatment in both adults and children [34].



The situations which involve pain, anxiety and acute trauma of the tissues raise the activity of the hypothalamic–pituitary–adrenal axis which in turn raises the secretion of cortisol. Dental stimuli are capable of inducing anxiety [35].

Brand [36] evaluated anxiety and cortisol secretion before dental treatments, but found a correlation between dental anxiety and urinary cortisol. Krueger and colab. [37] have investigate the usage of the Dental Anxiety Scale in neuroendocrine changes in dental fear in two points in time along an educational session and a periodontal treatment session. In patients with high levels of anxiety a significant increase in the levels of salivary cortisol was present in contrast with patients with low levels of dental anxiety during the educational session. Nevertheless, the groups did not differ significantly in regards to the levels of salivary cortisol during the treatment session.

During the present study, was highlighted the fact that after using behavioural techniques the levels of dental anxiety dropped, but the levels of cortisol did not register significant drops, on the contrary, in the majority of patients it stayed the same as in the first determination.

#### 4. Conclusions

Most of the patients that reported bruxism show high levels of dental anxiety. It was observed that a high level of concern specific to dental procedures, injection (dental anaesthesia) being the main reason in this sense, reported in all cases. In order of frequency, this was followed by dental concern provoked by the inability of stopping the dentist. In the context of dental anxiety management, using the “tell-show-do” technique and the behavioural control technique will significantly reduce the levels concerns related to dental procedures.

The majority of patients affected with bruxism have reported a risen level of salivary cortisol. The making of occlusal splints for muscle relaxation helps in lowering the levels of salivary cortisol. Although behavioural control techniques led to a decrease in dental anxiety, their sole utilisation has not led to a decrease of salivary cortisol levels before the dental treatment of patients with bruxism, even though he took part in several sessions of dental treatment.

#### References

1. BERTAZZO-SILVEIRA, E., KRUGER, C.M., PORTO DE TOLEDO, I., et al. Association between sleep bruxism and alcohol, caffeine, tobacco, and drug abuse: a systematic review. *J Am Dent Assoc.* 2016;147(11):859–866e854.
2. OKSENBERG, A., ARON, S.E., Sleep bruxism related to obstructive sleep apnea: the effect of continuous positive airway pressure. *Sleep Med.* 2003; 3:513-515.
3. LOBBEZOO, F., AHLBERG, J., RAPHAEL, K.G., et al. International consensus on the assessment of bruxism: report of a work in progress. *J Oral Rehabil.* 2018;45:837-844.
4. KOYANO, K., TSUKIYAMA, Y., ICHIKI, R., KUWATA, T., Assessment of bruxism in the clinic. *J Oral Rehabil.* 2008;35(7):495-508.
5. MANFREDINI, D, LOBBEZOO, F., Role of psycho-social factors in the etiology of bruxism. *J. Orofac Pain* 2009;23:153-66.
6. BELLINI, M., MARINI, I., CHECCHI, V., PELLICIONI, G.A., GATTO, M.R., Self-assessed bruxism and phobic symptomatology. *Minerva Stomatol* 2011; 60:93-103.
7. APPUKUTTAN, D.P., Strategies to manage patients with dental anxiety and dental phobia: literature review. *Clin Cosmet Investig Dent.* 2016;8:35–50. [PMC free article] [PubMed] [Google Scholar]
8. HARADA, T., ICHIKI, R., TSUKIYAMA, Y., KOYANO, K., The effect of oral splint devices on sleep bruxism: a 6-week observation with an ambulatory electromyographic recording device. *J Oral Rehabil.* 2006;33:482–488. [PubMed] [Google Scholar]
9. GUGLIELMOTTO, M., GILIBERTO, L., TAMAGNO, E., TABATON, M., Oxidative stress mediates the pathogenic effect of different Alzheimer's disease risk factors. *Front Aging Neurosci.* 2010;2:3. [PMC free article] [PubMed] [Google Scholar]





10. VEDHARA, K., MILES, J., BENNETT, P., PLUMMER, S., TALLON, D., BROOKS, E., et al. An investigation into the relationship between salivary cortisol, stress, anxiety and depression. *Biol Psychol.* 2003;62:89–96. [PubMed] [Google Scholar]
11. MONTERO, J., GOMEZ-POLO, C., Personality traits and dental anxiety in self-reported bruxism. A cross-sectional study. *Journal of Dentistry.* <http://dx.doi.org/10.1016/j.jdent.2017.07.002>
12. ALLEN, K.D., STANLEY, R.T., McPHERSON, K., Evaluation of behavior management technology dissemination in pediatric dentistry. *Pediatr Dent.* 1990;12(2):79–82. [PubMed] [Google Scholar]
13. LAVIGNE, G.J., HUYNH, N., KATO, T., et al. Genesis of sleep bruxism: motor and autonomic-cardiac interactions. *Archives of Oral Biology.* 2007;52(4):381–384. [PubMed] [Google Scholar] [Reflist]
14. \*\*\*American Academy of Sleep Medicine. *International Classification of Sleep Disorders.* 2nd edition. Westchester, NY, USA: American Academy of Sleep Medicine; 2005. [Google Scholar] [Reflist]
15. RAO, S.K., BHAT, M., DAVID, J., Work, stress, and diurnal bruxism: a pilot study among information technology professionals in Bangalore city, India. *Int J Dent.* 2011;2011:650489. [PMC free article] [PubMed] [Google Scholar]
16. CARVALHO, ALDA, CURY, A.A.D.B., GARCIA, R.C.M.R., Prevalence of bruxism and emotional stress and the association between them in Brazilian police officers. *Brazilian Oral Research.* 2008;22(1):31–35. [PubMed] [Google Scholar] [Reflist]
17. KUTTILA, S.J., KUTTILA, M.H., NIEMI, P.M., LE BELL, Y.B., ALANEN, P.J., SUONPÄÄ JT. Secondary otalgia in an adult population. *Archives of Otolaryngology—Head and Neck Surgery.* 2001;127(4):401–405. [PubMed] [Google Scholar] [Reflist]
18. GLAROS, A.G., Incidence of diurnal and nocturnal bruxism. *J Prosthet Dent.* 1981;45:545–549.
19. COOLIDGE, T., CHAMBERS, M.A., GARCIA, L.J., HEATON, L.J., COLDWELL, S.E., Psychometric properties of Spanish-language adult dental fear measures. *BMC Oral Health.* 2008; 8:15.
20. WINOCUR, E., UZIEL, N., LISHA, T., GOLDSMITH, C., ELI, I., Self-reported bruxism – associations with perceived stress, motivation for control, dental anxiety and gagging. *J Oral Rehabil* 2011;38:3-11.
21. AL ABSI, M., ROKKE, P.D., Can anxiety help us tolerate pain? *Pain.* 1991;46(1):43–51. [PubMed] [Google Scholar] [Reflist]
22. COSTELLO, C.G., Fear and phobias in women: A community study. *J Abnorm Psychol* 1982;91:280-6. Back to cited text no. 14 [PUBMED]
23. MILGROM, P., COLDWELL, S.E., GETZ, T., WEINSTEIN, P., RAMSAY, D.S., Four dimensions of fear of dental injections. *J Am Dent Assoc* 1997;128:756-66. Back to cited text no. 5
24. VIGNARAJAH, S., Oral health knowledge and behaviour and barriers to dental attendance of schoolchildren and adolescents in the Caribbean island of Antigua. *Int Dent J* 1997;47:167-72. Back to cited text no. 20
25. MARCI, C.D., HAM, J., MORAN, E., ORR, S.P., Physiologic correlates of perceived therapist empathy and social-emotional process during psychotherapy. *J Nerv Ment Dis.* 2007;195(2):103–111.
26. \*\*\*American Academy of Pediatric Dentistry Special issue: Proceedings of the conference on behavior management for the pediatric dental patient. *Pediatr Dent.* 2004;26(2):110–183. [PubMed] [Google Scholar] [Reflist]
27. ARMFIELD, J.M., HEATON, L.J., Management of fear and anxiety in the dental clinic: a review. *Aust Dent J.* 2013;58(4):390–407. [PubMed] [Google Scholar] [Reflist]
28. KARAKOULAKI, S., TORTOPIDIS, D., ANDREADIS, D., KOIDIS, P., Relationship between sleep bruxism and stress determined by saliva biomarkers. *Int J Prosthodont.* 2015;28:467–74. [PubMed] [Google Scholar]



- 29.MILETIC, A., LAZIC, Z., TODOROVIC, A., DJORDJEVIC, I., POPOVIC, D., LAZIĆ, V., Stress Assessment in Patients with Clinically Diagnosed Sleep Bruxism. 2017 [Google Scholar]
- 30.TSUKIYAMA, Y., BABA, K., CLARK, G.T., An evidence-based assessment of occlusal adjustment as a treatment for temporo-mandibular disorders. *J Prosthet Dent.* 2001;86(1):57–66.
- 31.SOLBERG, W.K., CLARCK, G.T., RUGH, J.D., Nocturnal electromyographic evaluation of bruxism patients undergoing short term splint therapy. *J Oral Rehabil.* 2007;2:215–23.
- 32.McLEAN, L., CHISLETT, M., KEIT, M., MURPHY, M., WALTON, P., The effect of head position, electrode site, movement and smoothing window in the determination of a reliable maximum voluntary activation of the upper trapezius muscle. *J ElectromiogramKinesiol.* 2003;13(2):169–80.
- 33.HELLHAMMER, D.H., WÜST, S., KUDIŁKA, B.M., Salivary cortisol as a biomarker in stress research. *Psych-oneuro endocrinology*2009;34:163-71.
- 34.KANEGANE, K., PENHA, S.S., MUNHOZ, C.D., ROCHA, R.G., Dental anxiety and salivary cortisol levels before urgent dental care. *J Oral Sci* 2009;51:515-20.
- 35.OOSTERINK, F.M., DE JONGH, A., AARTMAN, I.H., (2008) What are people afraid of during dental treatment? Anxiety-provoking capacity of 67 stimuli characteristic of the dental setting. *Eur J Oral Sci* 116, 44-51.
- 36.BRAND, H.S., (1999) Anxiety and cortisol excretion correlate prior to dental treatment. *Int Dent J* 49, 330-336.
- 37.KRUEGER, T.H., HELLER, H.W., HAUFFA, B.P., HAAKE, P., EXTON, M.S., SCHEDLOWSKI, M., (2005) The dental anxiety scale and effects of dental fear on salivary cortisol. *Percept Mot Skills* 100, 109-117.

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