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The significance of sub-threshold symptoms of anxiety in the etiology of bruxism

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Abstract

Bruxism is an oral parafunctional habit involving clenching and grinding of the teeth. It occurs mainly unconsciously, diurnally and/or nocturnally. It is considered an important contributory factor in the aetiology of myofacial pain (MFP) and temporomandibular disorders (TMD). The etiology of bruxism is considered to be multifactorial, involving physiological and psychological factors. The aim of the study was to examine the relationship between the sub-threshold symptoms of anxiety and bruxism using a spectrum model. Firstly, levels of anxiety and stress were determined using the Spielberger State Trait Anxiety Inventory (STAI) and the Kessler-10 (K-10). Secondly, a tooth wear score was determined by means of a clinical examination, intra-oral photographs and dental casts. Thirdly, bruxism was rated on an ordinal scale according to specified bruxism criteria. A dualistic trend in the relationship between sub-threshold symptoms of anxiety, stress and bruxism was observed in the results. In approximately half of the subjects with higher than average anxiety and stress scores, bruxism behaviour was found. This indicates the possibility of two groups with separate relationships. The dentist could play a role in recognizing that a patient may be experiencing stress or anxiety, expressed through bruxing behaviour and refer the patient for therapy or counselling. An understanding of the psychological factors involved in the etiology of bruxism could encourage a more holistic approach to the treatment of patients with signs of bruxism.

Keywords: bruxism; anxiety; spectrum model; myofacial pain; temporomandibular disorders; sub-threshold.

The relationship between the soma and the psyche has been the focus of considerable research. While anxiety and stress can be physiologically manifested in different ways, individuals tend to show response-specific reactions (Nevid, Rathus, & Greene, 2003), for example, hyperactivity of the masseter muscles and consequent bruxism. The inclusion of physiological symptoms of bruxism in the Diagnostic and Statistical Manual for mental disorders 5th ed (DSM-V) as part of the criteria for the diagnoses of anxiety-based disorders was recommended (Bracha, Ralston, Williams, Yamashita, & Bracha, 2005).

Bruxism is a mainly unconscious, oral parafunctional habit involving clenching and grinding of the teeth which occurs diurnally and/or nocturnally (Antonio, Pierro, &

Maia, 2006). A large variation in the prevalence estimate of bruxism in the general adult population exists in the literature ranging from 10% (Lobbezoo, Van der Zaag, & Naeije, 2006) to 100% (Abrahamsen, 2005). Bruxism is considered an important contributory factor in the etiology of myofascial pain (MFP) and temporomandibular disorders (TMD) (Lobbezoo, Van der Zaag, Visscher, & Naeije, 2004).

To date different criteria have been used for the diagnosis of bruxism, for example, whether the subject had been diagnosed with bruxism; experienced TMJ sensitivity, MFP, clenching, grinding, headaches; record of nights per week in which clenching and grinding occurs (Baba, Haketa, Clark, & Ohyama, 2004; Johansson, Haraldson, Omar, Kiliaridis, & Carlsson, 1993; Khan, Young, & Daley, 1998; Ohayon, Li, & Guilleminault, 2001; Pergamalian, Rudy, Zaki, & Greco, 2003; K. Ahlberg et al., 2005; Balatsouras, Kaberos, Psaltakos, Papaliakos, & Economou, 2004).

According to the spectrum model, subtle prodromal, atypical and subclinical (sub-threshold) symptoms of anxiety can be measured on a continuum, which could play a role in the occurrence of a parafunctional habit like bruxism (Manfredini, Bandettini di Poggio, Cantini, Dell'Osso, & Bosco, 2004). The dimensional approach used in the Spectrum model provides information on sub-threshold (subclinical) symptoms that facilitates early diagnosis and treatment. This approach was therefore considered appropriate in this study since the identification of sub-threshold symptoms of anxiety and stress in the aetiology of bruxism could likewise be beneficial. The spectrum approach focuses on signs symptoms and behaviours persisting through a person's lifespan.

It was found that patients with tooth-wear due to bruxism and chronic MFP presented significantly more trait anxiety than controls (Velly, Gornitsky, & Philippe, 2003). In one study it was found that anamnestically diagnosed bruxism is not only associated with a transitory state of anxiety, but also with certain psychopathologic symptoms of the anxiety spectra (Manfredini, Landi, Romagnoli, & Bosco, 2004). Research results support the view that anxiety state is a prominent factor involved in the development of bruxism in children (Monaco, Ciammella, Marci, Pirro, & Giannoni, 2002).

It should be noted that while this study focuses on the relation between anxiety and bruxism other psychological traits can contribute to bruxism. Research results showed a positive association between the incidence of bruxism, stress and Type A behaviour (Hicks, Conti, & Bragg, 1990; Pierce, Chrisman, M.E., & J.M., 1995). A significantly higher mood psychopathology score (mostly sub-threshold symptoms) on the Mood Spectrum Self-report (MOODS-SR) was found in bruxers (Manfredini, Ciapparelli, Dell'Osso, & Bosco, 2005).

Since bruxism has been considered a response to stress (J. Ahlberg et al., 2002; Bader & Lavigne, 2000) and an anxiety response to environmental stress (Lobbezoo

et al., 2004), by addressing the individual's "stress sensitivity" and enabling the person to handle stressors more effectively, the severity of bruxing behaviour could possibly be reduced.

The treatment of bruxism could thus be complimented by therapy or counselling which focuses on addressing the sub-threshold symptoms of anxiety as either a contributory factor in the aetiopathogenesis of the condition or as a comorbid variable which could have a negative effect on treatment. This is in line with the multidisciplinary dental discipline, oral kinesiology (Lobbezoo et al., 2004).

Methods

Aim

The aim of the study was to examine the relationship between the sub-threshold symptoms of anxiety and bruxism using a spectrum model. The research problem can therefore be formulated as follows: Are sub-threshold symptoms of anxiety related to bruxing behaviour? To attain the aim of this study the sub-threshold symptoms of anxiety were measured by three scales (Spielberger State Trait Anxiety Inventory (STAI) and the Kessler-10 scale). Bruxism was measured by patient self-report and standard dental criteria.

Sample/participants

Students and patients of the Oral Health Centre (UWC) were informed about the research project. Volunteers were accepted on grounds of certain inclusion and exclusion criteria. Inclusion criteria: Good health; Age 18-50; Own teeth; Five or seven teeth per quadrant (excluding wisdom teeth). Exclusion criteria: Partial dentures; More than two teeth missing per quadrant (excluding wisdom teeth); On antidepressants, tranquilizers or sleeping pills; Presence of serious malocclusion. All participants completed an informed consent form. Personal information was kept strictly confidential and all data related to participants was coded to mask their identity.

Measuring instruments

Subjects were requested to complete:- (1) a questionnaire on demographic information and bruxing behaviour, (2) the English version of the state - trait anxiety inventory (STAI) and (3) the Kessler-10 (K-10).

Demographic variables required were as follows: - age, gender, marital status. For the purpose of this study, an individual was considered to be a bruxer if the following criteria were met:-

A score greater than or equal to 1 on either the mean of 6 anterior or 8 posterior maxillary or mandibular teeth, or mean of the 4 canines, plus 2 of the following:-

1. A previous diagnosis of bruxism by a dentist.

2. Sounds of clenching or grinding reported by a family member or bed partner (Manfredini, Landi et al., 2004; Ohayon et al., 2001; Pergamalian et al., 2003).
3. Reporting of jaw muscle pain or fatigue on awakening (Manfredini, Landi et al., 2004; Ohayon et al., 2001; Pergamalian et al., 2003).

The term “sub-threshold” in the context of the spectrum model refers to subtle, sub clinical symptoms and behavioural patterns associated with anxiety, where the severity of the symptoms do not warrant diagnosis as a disorder (Manfredini, Bandettini di Poggio et al., 2004). The spectrum model complements the categorical approach and provides a unitary view of anxiety disorders (Cassano et al., 1997), since it broadens the knowledge of the clinical implications of pro-dromal, co-occurring and residual symptomatology (Beroccal et al., 2006). The purpose of this study was to examine the relationship between sub-threshold symptoms of anxiety and bruxism using the following measuring instruments:

The well-known State -Trait Anxiety Inventory (STAI) allows differentiation between state and trait anxiety rated on a 4-point Likert scale (Spielberger, 1983). State anxiety refers to an individual’s anxiety score in a specific situation, while trait anxiety refers to a general tendency to be anxious. This self-report test consists of 40 items (2 domains of 20 items each), takes 10 minutes to complete and has been compiled for a 6th grade reading level.

The Kessler Psychological Distress Scale (K-10) is a simple, brief and valid standard screening tool for determining the level of anxiety and depressive symptoms experienced by an individual in the preceding four-week period. It is considered a moderately reliable instrument (Dept of Human Services, 2006).

Procedure

The “bruxism score” was derived from a questionnaire based on demographic details and signs of bruxism and rated on an ordinal scale (1 = never to 4 = almost always), because all individuals display signs of bruxism (Abrahamsen, 2005). This “bruxism score” was then related to the trait and state anxiety scores and the Kessler -10 scores. One of the properties of the ordinal bruxism scale is that a person with a very low continuous score is likely to have a low probability of bruxism and vice versa.

Tooth wear facets on dental casts (Orthoplaster) produced from alginate impressions (Blueprint® cremix, Dentsply, De Trey) were identified using a microscope (Nikon HFX-II) with a 10X magnification. Intra-oral photographs confirmed the findings on the dental casts. An ordinal scale for grading severity of occlusal wear was used to allocate tooth wear scores (Abrahamsen, 2005; Johansson, Omar et al., 1993; Pigno, Hatch, Rodrigues-Garcia, Sakai, & Rugh, 2001) (Refer to Table 1).

The tooth wear scoring was completed by two raters and the inter-rater reliability was determined by re-scoring 10 randomly selected dental casts 10-14 days after the first scoring. Descriptive statistics were used to show the concordance for the inter- and intra-rater agreement and Stem and Leaf Diagrams were constructed of the number of exact concordances over the maxilla, mandible and complete dentition specimens. The intra-rater concordance rate (70.4%) for rater B was the most reliable and therefore rater B's scoring was used in the study.

The tooth wear score was compared to the three psychological tests, namely, state anxiety, trait anxiety and K-10.

Research design / Statistics

For statistical analysis, an exploratory and correlational design was used in this study to determine whether relationships exist between psychological and physiological variables by means of regression analysis using scatter plots ($p < 0.05$). The Kruskal-Wallis test was performed. A Spearman Rank Correlation Matrix was constructed and all the relationships were investigated graphically (refer to scatter plots in Figure 1 and 2) to see the presence of possible unusual observations (outliers). This correlation matrix contained 56 Spearman Rank correlations.

Results

Twenty nine participants (mainly students, mean age of 24.3 years, male to female ratio of 8 : 21) met the inclusion criteria for the study. Twelve participants reported a previous diagnosis of bruxism by a dentist; 19 reported jaw muscle pain or fatigue on awakening; and 18 indicated that sounds of clenching or grinding were reported by a family member or bed partner.

The results showed that while higher state; trait anxiety and Kessler 10 scores corresponded with a higher bruxism score in certain subjects, in others the higher scores did not correspond to a higher bruxism score. Although the p -values ($p > 0.05$) between the bruxism score and the anxiety and stress scores were not statistically significant in this study, the scatter plots showed V-formations (Figure 1, Figure 2) which indicate the possibility of a dualistic trend. This raises the possibility of sub-populations each with its own regression.

According to the Spearman Rank Order Correlation Matrix, the relationship between tooth wear score and the state anxiety; trait anxiety; and K-10 scores differed as follows: A significant negative correlation was found between tooth wear and the K-10 score (-0.387) ($p < 0.05$). A positive relation was found between tooth wear and the state anxiety scores (0.397) ($p < 0.5$). There was a significant correlation between temporomandibular joint (TMJ) sensitivity and a high bruxism score ($p < 0.05$).

Discussion

The purpose of this study was to examine the relationship between sub-threshold symptoms of anxiety and bruxism. A strong positive correlation was observed between the K-10 and trait anxiety scores. This is to be expected since the two tests measure general distress and anxiety, respectively, over the previous four-week period. A negative trend was evident when trait and state anxiety scores were compared, indicating that subjects with higher trait anxiety scores were less anxious in the state anxiety test. A negative trend was also observed between K-10 and state anxiety. The state anxiety test measures anxiety in a specific situation, therefore one could expect a weaker relation between the state anxiety and bruxism than between both the trait anxiety and K-10 and bruxism. The dualistic character of the sample is confirmed by the relationship between K-10 and bruxism and the strong positive correlation between the K-10 and trait anxiety scores.

The significant correlation found between TMJ sensitivity and bruxism confirms other findings (Kampe, Tagdae, Bader, Edman, & Karlsson, 1997). Research (Manfredini, Cantini, Romagnoli, & Bosco, 2003) confirms the existence of a strong association between bruxism and TMD, particularly between bruxism and myofascial pain (MFP). Noting the association between bruxism and TMD in the study is important because the recognition of the role of sub-threshold symptoms of anxiety and stress in the etiology of bruxism also has an impact on treatment of symptoms of TMD such as MFP and TMJ sensitivity. Studies indicating improvement in TMD symptoms such as MFP by means of psychological intervention (De Laat, Stappaerts, & Papy, 2003; Kalamir, Pollard, Vitiello, & Bonello, 2006, 2007; Morishige, Yatani, & Hirokawa, 2006) confirm the clinical importance of the findings of this study.

The negative correlation found between tooth wear and trait anxiety as well as the K-10 score could possibly be due to the relatively young average age (24.3) of the participants, the fact that they were mostly dentistry students and the relatively small sample size. Da Silva, Oakley, Hemmings, Newman, & Watkins, (1997) also used the STAI on a larger sample and found that higher tooth wear scores corresponded with higher trait anxiety than controls.

In this study tooth wear was shown to be a pathognomonic sign of bruxism, but it cannot be considered a definite indicator of bruxism. Tooth wear is time-related; depends on the degree and frequency of bruxism plus other additional factors that complicate the association between tooth wear and bruxism. Only a slight increase in the maxilla and mandible mean tooth wear scores was observed in subjects with a high "bruxism score" and TMJ sensitivity. This was also confirmed in a different study (Pergamalian et al., 2003), where tooth wear was not significantly correlated with bruxism or TMJ pain. The absence of tooth wear does not signify the absence of bruxism and as a result tooth wear cannot be used as sole indicator for the diagnosis of bruxism. Therefore the "bruxism score" was determined separately from the tooth wear score in this study.

The diagnosis of bruxism is complicated by the fact that different criteria are used for diagnosis, which could possibly explain the large variation in the prevalence estimate in the adult population. Therefore, in this study bruxism was rated on an ordinal scale and a definite diagnosis was not made. A relationship between bruxism and anxiety tendency was observed, which could be valuable in terms of prevention of both the detrimental effects of bruxism in respect of tooth wear and TMD as well as the diagnosis of anxiety with respect to physiological symptoms.

The importance of recognizing the close relationship between the soma and psyche was examined in this study. The results indicated a correlation between anxiety and bruxism. Anxiety and stress was physiologically manifested as bruxism in certain individuals. Approximately half of individuals with above average anxiety and stress scores expressed their anxiety and stress in their masticatory muscles, resulting in bruxing behaviour. A further study using a larger sample is required to determine the statistical significance of these findings.

The results indicated that stress was experienced differently by different subjects. While masticatory muscle tension could be an indication of stress in certain individuals, stress could be manifested differently in others. The principle of individual response specificity could explain why certain individuals clench or grind their teeth as a response to stress and others do not (Nevid et al., 2003).

The results found in this study confirm findings of several studies (Manfredini, Landi et al., 2004; Monaco et al., 2002; Moulton, 1955; Thaller, Rosen, & Saltzman, 1967; Velly et al., 2003) indicating a possible link between anxiety and bruxism. Psychological factors therefore play a possible role in the etiology of bruxism.

It should be noted that the results of this study pertain to a population of mostly dentistry students and that generalization of the results should be done with care. Studies on broader samples should be conducted to confirm the associations observed in this study.

Conclusion

The results can be summarized as follows:-

- A possible dualistic relation between sub-threshold symptoms of anxiety, stress and bruxism was observed. Anxiety and stress can be physiologically expressed in different ways.
- The recommendation by Bracha *et al* (2005) pertaining to the inclusion of physiological symptoms of bruxism in the (DSM-V) as part of the criteria for the diagnoses of anxiety-based disorders, is supported.
- Use of a Spectrum approach in determining sub-threshold symptoms of anxiety was found to be useful, since sub-clinical symptoms of anxiety (as measured in the STAI and K10 tests) are related to bruxism in the study.

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Table 1. An Ordinal scale for grading severity of tooth wear (Abrahamsen, 2005; Johansson, Omar et al., 1993; Pigno et al., 2001)

Score	Criteria
0	No visible facets in the enamel. Occlusal/incisal morphology intact.
1	Marked wear facets in the enamel. Occlusal/incisal morphology altered.
2	Wear into the dentin. The dentine exposed occlusally/incisally on adjacent tooth surface. Occlusal/incisal morphology changed in shape with height reduction of the crown.
3	Extensive wear into the dentin. Larger dentin area (>2mm ²) exposed occlusally/incisally on adjacent tooth surface. Occlusal/incisal morphology totally lost or generally. Substantial loss of crown height.
4	Wear into secondary dentin (verified by photographs).

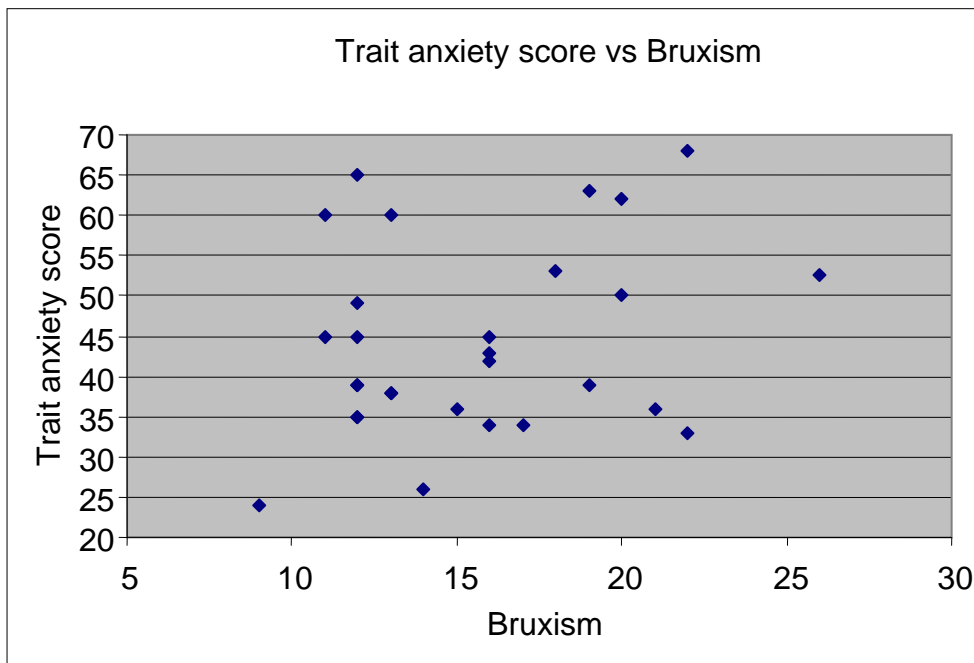


Figure 1. A scatter plot indicating the relation between the trait anxiety scores and the bruxism score.

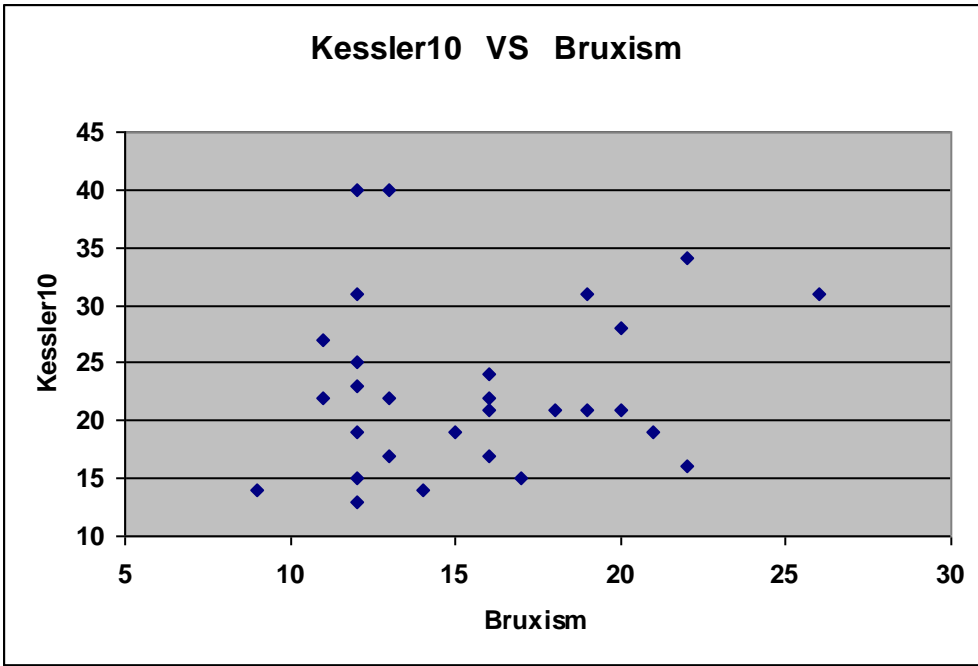


Figure 2. A scatter plot indicating the relation between the Kessler 10 score and the bruxism score.