Effect of Academic Stress on Plaque and Gingival Health among Dental Students of Moradabad, India

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Abstract

Objective: Stress has an adverse effect on oral health and is a risk factor for plaque-associated diseases. The present study aims to assess the effect of academic stress on plaque and gingival health among dental students of Moradabad, India.

Methods: Fifty eligible dental students (age 18 - 22 years) undergoing university examinations participated in the study. Students were examined for plaque index (PlI) and gingival index (GI) scores during and after their examinations. Stress levels (using the DASS 21 questionnaire) and oral hygiene behavior were also assessed during and after university examinations and the data were subjected to statistical analysis.

Results: The average PlI and GI were 1.213 and 0.944, respectively, during examinations and 0.845 and 0.467, respectively, after examinations. The average stress scores were 15.66 and 9.94 during and after examinations, respectively. Eighty-eight percent of the students brushed once and 12% of the students brushed twice during the university examinations, whereas 76% brushed once and 24% of the students brushed twice after their examinations. Thirty-four percent of the subjects rated their thoroughness of brushing as good during university examinations whereas the percentage increased to 80% after the examinations. All the differences were found to be statistically significant.

Conclusion: Students appearing for the university examinations showed increased stress levels. Moreover, under conditions of stress, the students generally neglected their oral health care and adverse effects on their plaque and gingival scores were observed. Thus, it might be concluded that academic stress has an adverse effect on plaque levels and gingival status in students.

Key words: Stress, dental plaque, oral hygiene.

Introduction

An association between a sound mind and a healthy body has been assumed for centuries; however, it wasn't until Selye's classic work in 1930s and 1940s that a relationship was established (Boyapati and Wang, 2007). Anxiety, as well as other emotional or psychosocial stressors, produces well characterized neuroendocrine and biochemical changes in experimental animals. The physiological consequences of these stress-mediated changes have been shown to have significant adverse effects on the proper functioning of the immune system (Riley, 1981; Croiset *et al.*, 1990)

Physiological responses to emotional stressors have been shown to modulate the immune system in at least three different ways: through the autonomous nervous system pathway, through the release of hypothalamic and pituitary hormones, and through the release of neuropeptides (Ader *et al.*, 1990; Blalock, 1994; Kiecolt-Glaser and Glaser, 1995). Mental, physical and biological stress have an impact on the body's ability to resist disease, and a relationship has been demonstrated between stress and a number of diseases, including coronary heart disease and breast cancer (Cooper *et al.*, 1986). It has been reported that periodontal disease is more widespread and severe in those with higher levels of stress (Green *et al.*, 1986). Many researchers have reported stress as a risk factor of marginal periodontitis (Monteiro da Silva *et al.*, 1995; Breivek *et al.*, 1996, Deinzer *et al.*, 1999).

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The effect of psychological stress on salivary secretion has been reported in several studies. Matos-Gomes *et al.* (2010) reported a reduction in medical students' salivary flow rates and a consequent reduction in total protein concentrations during their final examinations. There are two proposed mechanisms for the action of stress on oral health; biological and behavioral. The biological mechanism emphasizes how stress and depression can reduce immune system function and facilitate inflammation (Glassman and Miller, 2007). The behavioral mechanism emphasizes that people suffering from stress and depression may increase poor health behaviors, such as smoking, drinking more frequently, consuming an unhealthy diet, irregular tooth brushing, irregular dental appointment attendance and neglect of oral hygiene. This leads to increased plaque accumulation, which is the primary etiological factor for periodontal disease, and decreased resistance of the periodontium to inflammatory breakdown (Perry *et al.*, 2007).

The general characteristics of a person in distress are being over-aroused, tense or unable to relax, touchy, easily upset or irritable, easily startled or fidgety, and demonstrating intolerance of any interruption or delay. Excessive stress results in an increased prevalence of psychological problems such as depression, anxiety, substance abuse and suicidal thoughts or actions (Arria *et al.*, 2009). Various studies around the globe have emphasized that students studying in medical and dental school courses experience higher stress levels (Sharifirad *et al.*, 2012). The possible inducers of stress in medical/dental students could be due to infrastructural factors such as unsatisfactory living conditions and inadequate library facilities, academic factors such as pressure of studies and frequent examinations, and interpersonal factors such as excessive competitive attitudes among students and fear of losing an academic term due to failure in examinations.

Only a few studies published during last three decades focus on the relationship between psychosocial factors and dental plaque (Cohen 1992; Vogel *et al.*, 1997; Deinzer *et al.*, 1998; Montero da Silva *et al.*, 1998) and only two of these directly assess the relationship between psychological stress and plaque accumulation (Deinzer *et al.*, 1998; Monteiro da Silva *et al.*, 1998). The present study was aimed at assessing the effect of academic stress on plaque and gingival health among dental students of Moradabad, India.

Materials and methods

All 100 dental students aged 18-22 years who had to appear for the university examination at our college were enrolled for participation in the study. Ethical approval was given by the Institutional Ethics Committee, Moradabad, before the start of the study. All students who gave informed consent for participation were clinically examined for plaque scores (PlI) using the Turesky-Gilmore modification of the Quigley-Hein Index (1970) and gingival scores (GI) using the gingival index of Löe and Silness (1963). Subjects who had plaque scores of more than 0.9 and gingival scores of more than 0.5 were excluded from the study. Students with systemic diseases or under medications or having malocclusions (such crowding, rotations) and smokers were not included in the study, reducing the sample size to 60 students. These subjects were not given any instructions regarding maintenance of oral hygiene and were allowed to continue with their routine oral hygiene practices. Ten days after the preliminary recording, students were re-examined for plaque and gingival scores to exclude those subjects who showed extreme changes in their scores. This was done to ensure the inclusion of subjects with similar rates of plaque accumulation and similar susceptibility to plaque-associated gingivitis. Ten students showed extreme changes in plaque and gingival scores and were excluded.

The final sample was comprised of 50 students (19 males and 31 females), mean age 19.72 years. These students were examined for plaque and gingival scores on the second to last day of the university examination. The stress level of the subjects was measured using a questionnaire - Depression, Anxiety and Stress Scale (DASS-21), which has been validated as a screening tool by many researchers in a variety of socio-demographic conditions in the Indian population. The scale of stress calculated by the DASS-21 corresponds closely to the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV) symptom criteria for generalized anxiety disorder (GAD), and measures nervous tension, difficulty relaxing and irritability. Absolute privacy and a mental comfort zone were maintained for each individual student while answering the questionnaire. To ensure anonymity, no questions about the names of students were included in the questionnaire. Subjects were assured that their answers would be held strictly confidential to help encourage complete and truthful self-reporting.

Oral hygiene behavior of the students was assessed through multiple choice questions about the frequency and self-perceived thoroughness of tooth brushing. The purpose of the study was conveyed to the students as being a part of the training program of a postgraduate student (examiner). Participation for clinical examination was voluntary and small financial incentives were given to the participants. After 20 days of vacation, subjects were re-assessed for plaque, gingival scores, stress levels and oral hygiene behavior. Students did not know about the exact timing of the second dental examination until this examination took place. The students were queried for any potential measures which could have an effect on plaque accumulation, such as antibiotic therapy or

professional oral hygiene measures during the study period so as to exclude such subjects from the study, but none was found.

The collected data were analyzed using SPSS version 16. During examination and post-examination data (mean scores) were analyzed by the Wilcoxon paired test; a level of 0.05 was considered significant. The frequency of tooth brushing during examination and after examination was analyzed using the Chi-square test.

Results

Average PlI and GI were 1.213 and 0.944, respectively, during university examinations and 0.845 and 0.467, respectively, after the examinations. The average stress scores were 15.66 during and 9.94 after the university examinations. A statistically significant difference was seen in the mean plaque, gingival and stress scores during exposure to university examinations. Eighty-eight percent of the students brushed once and 12% brushed twice during the university examinations, whereas 76% of the students brushed once and 24% brushed twice after the examinations. The difference was found to be statistically significant. Also, it was found that 34% of the subjects rated their thoroughness of brushing as good during university examinations, whereas the percentage increased to 80% after examinations, and a statistically significant difference was found (*Table1*).

In the score-wise distribution of plaque, it was found that the tooth surfaces without plaque during university examinations were 480 (17.14%) while there were 953 (34.03%) after the examinations; the difference was statistically significant (*Table 2*).

Discussion

The present study was conducted to assess the effect of academic stress on plaque and gingival health among dental students of Moradabad, India. Students who had to appear for the university examinations were included in the study, and the same group was followed after the examinations, unlike other previous studies wherein two groups of students were used as cases and controls (Deinzer *et al*., 2001). By using this design, we tried to overcome the influence of confounding factors. Assuming that students were under stress during the university examination period and were relaxed after the examinations, we followed the same group of students

Table 1. Comparison of plaque, gingival score, stress levels and oral hygiene behavior during and after university examinations

Variables		During University Examination	After University Examination	*p* - value
Average plaque score		1.213 ± 0.108	0.845 ± 0.061	0.0000*
Average gingival score		0.944 ± 0.241	0.467 ± 0.242	0.0000*
Average stress level		15.66 ± 6.10	9.94 ± 4.56	0.0000*
Frequency of brushing	**Once**	44 (88%)	38 (76%)	0.0000†
	Twice	6 (12%)	12 (24%)	0.0000†
Perceived thoroughness of brushing	**Good**	17 (34%)	40 (80%)	0.0000†
	Fair	31 (62%)	8 (16%)	0.0000†
	Poor	2 (4%)	2 (4%)	

*Wilcoxon test; †Chi square

Table 2. Distribution of surfaces with plaque according to scores during and after the university examinations

Plaque scores	During Examinations	After Examinations	*p* - value
Surfaces with score 0	480	953	< 0.0001*
Surfaces with score 1	1278	1214	= 0.331(NS)
Surfaces with score 2	858	565	< 0.0001*
Surfaces with score 3	81	6	< 0.0001*
Surfaces with scores 4 and 5	103	62	< 0.0001*

*Statistically significant

during and after examination. Furthermore, subjects showing extreme values for plaque and gingival scores were excluded from the study, assuming that they would have differences in the rate of plaque accumulation and susceptibility to plaque-associated gingivitis (Deinzer *et al.*, 1998).

It was found that there was a significant increase in the stress level of subjects during university examinations when compared with their post-examination stress level. This finding was in accordance with the observations in previous studies wherein increased stress level was observed among students during examination periods (Grandy *et al.*, 1985; Westerman *et al.*, 1993). The possible reasons may be that they have a fear of getting poor marks or low grades or failing in exams, and thus losing an academic term. Students who fail the examinations have the fear of re-appearing for examinations and must bear the expenses of additional examination fees. All these factors lead to stress among students during their university examinations.

In the present study, oral hygiene practices of the students were assessed during and after their university examinations. It was found that the frequency and thoroughness of tooth brushing by students was significantly less during the university examination when compared to afterwards. During university examinations students are under stress and depression; hence, they may be less enthusiastic in performing oral hygiene practices and show poor compliance with dental care. Our results agree with many researchers who have clearly demonstrated that there is a significant relationship between depression and oral health behavior (Salem and Hilow, 2012). It was reported that stress-induced neglect of oral hygiene increased plaque accumulation, which may be one of the mediators of the stress-periodontitis relationship (Deinzer *et al.,* 2001).

Patient self-reports cannot be considered valid indicators of actual spontaneous behavior, as they require alterations of behaviors to be conscious processes, which is not necessarily the case as they may alter the phenomenon they intend to assess by inducing behavioral reactivity. Hence, we have considered both self-reports and plaque accumulation as indicators of oral hygiene behavior. Plaque has been considered to be a reliable and valid outcome measure of oral hygiene behavior (Weinstein *et al.*, 1996; Borkowska *et al.*, 1998; Kay and Locker, 1998; Abegg *et al.*, 1999). The validity of this measure in the context of academic stress studies is underlined by several studies showing that if oral hygiene behavior is held constant (i.e., totally omitted), then academic stress has no effect on plaque accumulation (Deinzer *et al.*, 2000; Waschul *et al.*, 2003). Contrary to this, studies by Marcenes and Shelham (1992) reported a significant relationship between work stress and periodontal health status. Somer *et al.* (1993) also observed an increase in the plaque level during a stress period due to reduced salivary flow in the subjects. In the current study, it was found that the mean plaque scores were significantly greater during the university examination period when compared to after the examinations.

Moreover, the percentage of surfaces without plaque during examination was 17.14% and after examination was 34.03%; the difference was statistically significant. The increase in the plaque scores during university examinations was likely due to neglect of oral hygiene, as during stressful situations the students failed to clean their teeth as thoroughly as they do in their daily routine practice. Furthermore, the self-perceived thoroughness of oral hygiene was rated as good by 34% of the students during the university examinations, but the number increased to 80% after the examinations.

In the present study, an increase in gingival inflammation was seen among the students during their examinations. This result was in accordance with the study done by Salem and Hilow (2012), who found that there was a significant relationship between depressive symptoms and gingival disease. They observed that subjects highly susceptible to depression had more plaque accumulation, gingival inflammation and increased levels of IL-6 and cortisol in gingival crevicular fluid compared with normal controls. The increase could be explained either by the direct influence of stress on the immune system through release of stress hormones, or by the influence of plaque accumulation leading to gingival inflammation, both resulting in increased susceptibility to periodontal diseases.

Hugo *et al.* (2006) also showed that caregivers of people under physical or psychological stress, as well as those with the conditions themselves, were prone to elevated biofilm plaque levels and increased gingivitis.

There are several studies with contrary findings to our present study, but it should be noted that there were significant methodological differences between those studies and the present one. The results of the present study were in contrast to the findings of the study by Trombelli *et al.* (2005), who found no significant relationships between plaque-associated gingival inflammation and psychological variables. They conducted a randomized split mouth localized experimental gingivitis clinical trial among 96 individuals, mean age 23.9 years, wherein the subjects were asked to cease oral hygiene measures in experimental quadrants, and oral hygiene instructions were reinforced weekly in control quadrants. So, the plaque deposits cannot be regarded as representative of spontaneous oral hygiene behavior. The controlled nature of oral hygiene behavior in such experimental trials could explain the lack of stress effect on plaque accumulation. It was concluded that personality traits, social support and current levels of stress have limited impact on clinical parameters of

plaque accumulation and gingival inflammation during experimental gingivitis in young adults.

Castro *et al.* (2006) conducted a case-control study among 35 – 60-year-old individuals to investigate the association between periodontitis and life events, anxiety and depression. No significant association between periodontitis and psychological factors was found. The discrepancy in the results can be explained by the methodological differences in the selected sample; patients with periodontitis were included whereas in our study we included only healthy patients. Moreover, the retrospective nature of measuring the psychological factors, wherein they measured positive and negative life events during past 12 months, was different from our study, where the current state of anxiety and stress was measured.

Hence, in the present study plaque accumulation, gingival inflammation, patients' self-perceived thoroughness and frequency of tooth brushing and their stress levels were assessed during and after their university examinations. A significant difference was found in the measured variables in comparing the during-examination and post-examination scores. It was concluded that academic stress has an adverse effect on plaque level and gingival status of students. The worsening of the plaque and gingival scores is likely mostly due to neglect of oral hygiene. So, it is recommended that the students emphasize their oral hygiene maintenance during their examinations to avoid plaque-associated disease, as plaque is a major etiologic factor of periodontal diseases. Students should be informed about stress-hygiene relationships so that they can avoid stress-induced neglect, or at least compensate for it after stress termination.

The differences in PlI and GI scores between the during-examination period and the after-examination period were quite small, so it may be of limited clinical relevance. Further studies need to be conducted to strengthen the relation between academic stress and plaque accumulation and gingival status.

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