Original Article

Dentistry Section

Stress as an Aggravating Factor for Periodontal Diseases

LITTLE MAHENDRA, JAIDEEP MAHENDRA, RAVI DAVID AUSTIN, S. RAJASEKHAR, R. MYTHILI

ABSTRACT

Background and Objective: The aim of the research was to evaluate the association between stress, serum cortisol levels and chronic periodontitis in the police personnel of the Cuddalore District of the State of Tamil Nadu, India.

Study design: In this case-control study, 110 police personnel were grouped into the test (group 1 and group 2) and the control groups, depending on their probing pocket depth. The various groups were the control group (PPD ≤ 3 mm, n = 30), the test group 1 (at least four sites with PPD > 4mm and ≤6 mm, n = 40) and the test group 2 (at least four sites with PPD > 6 mm, n = 40).

Methodology: The clinical parameters such as the Silness Löe plaque index (PI), the sulcus bleeding index (SBI) and the clinical attachment levels were recorded. Stress was measured by using the occupational stress index (OSI). Blood samples were collected and the serum cortisol levels were determined by using ELISA.

Results: The mean plaque score and the sulcus bleeding index score were found to be significantly higher in the test groups as compared to those in the control group (< 0.001). The mean clinical attachment level, the occupational stress index score and the serum cortisol levels were found to be significantly higher in the test groups as compared to those in the control group (< 0.001). Pearson's Correlation showed a positive correlation between the clinical attachment level, the occupational stress index score and the serum cortisol levels only in the test groups.

Conclusion: These results suggest that stress can be an occupational risk factor for periodontal diseases because stress accompanied by altered oral hygiene habits causes the accumulation of plaque and obstructs the immunity of the person through the endocrinal connections.

Key Words: Serum cortisol & periodontal diseases, Stress & periodontitis, Cccupational stress & chronic periodontal diseases

INTRODUCTION

Periodontitis is a multi-factorial disease in which the host factors and the environmental factors play an important role [1]. Though bacterial plaque is a chief aetiological factor for periodontitis, it is widely accepted that periodontitis results from the interaction of the host's defense mechanisms with bacteria which accumulate on the tooth surface [2]. Stress being an important factor which governs the host defenses through the hypothalamic-pituitary-adrenal (HPA) axis [3], it has a command over the pathogenesis of periodontitis.

Lazarus [4] defines stress as, "An inharmonious fit between the person and the environment, one in which the person's resources are taxed or exceeded, forcing the person to struggle, usually in complex ways to cope." A reasonable amount of researches indicate the association of psychosocial stress, financial stress, occupational stress, distress, the negative impact of life-events and depression with periodontitis [5].

Stress can be viewed as a process with both psychological and physiological components [6] affecting the periodontium directly or indirectly. The direct route involves the alteration of the resistance of the periodontium to infection. The indirect route involves the psychological aspect of a person with health impairing behaviour like poor oral hygiene, smoking, alcohol consumption and poor nutritional intake [7].

Almost any type of stress, whether physical or neurogenic causes an immediate and marked increase in the adrenocorticotropin hormone (ACTH) secretion from the anterior pituitary gland followed within minutes by a greatly increased secretion of cortisol from the adrenal cortex. Cortisol stabilizes the lysosomal membranes, decreases the permeability of the capillaries, decreases both the migration of the white blood cells into the inflamed area and the phagocytosis of the damaged cells as well as it suppresses the immune system causing the lymphocyte reproduction to decrease markedly [8]. Various studies have shown substantial evidence of the correlation between stress and decreased immune functions like decreased NK-cell [9] and T-cell activity [10].

For years, the police profession has been ranked among the top five of the most stressful occupations. [11] The constant risk, uncertainty and tension which are inherent in law enforcement and the exposure to vast amounts of human suffering and violence can lead susceptible individuals to stress, anxiety, depression and alcoholism. Several studies which have been done all around the globe have demonstrated a positive relationship between stress and the police profession. [12], [13], [14] Although many studies have shown the relationship of the stress factors to periodontal diseases and the incidence of stress in the police personnel; a search in PubMed for studies relating to stress, police and periodontal disease, resulted in no articles with only one article providing information on the incidence of periodontitis in the police personnel. [15] Hence, in this study it was hypothesized that stress activates the hypothalamus-pituitary-adrenal axis with the hypersecretion of cortisol and leads to periodontitis in the police personnel. Thus, the aim of this study was to evaluate the association of stress, serum

cortisol levels and chronic periodontitis in the police personnel of Cuddalore district, India.

MATERIALS AND METHODS

Study Population and Sampling

All the police personnel who were aged 35-48 years, of Cuddalore district, India in the rank of head constable or in lower ranks formed the population for this case-control study. The 432 police personnel who volunteered for the study were provided with a socio-demographic sheet which consisted of questions about their social, demographic and general health status as well as their medication history. By analyzing the socio-demographic sheet, out of the 432 police personnel, 314 were selected by excluding the participants whose health status could interfere with the study eg., those who were taking corticosteroids or immunosuppressant drugs, those having Addison's disease or Cushing's syndrome, smokers, female participants who were pregnant or who were taking contraceptive pills at the time of the study.

Written consent for participation in the study was obtained from 314 eligible candidates for the study and 110 subjects were selected after the clinical periodontal examination. The ethical clearance committee of Annamalai University gave the approval for the conduct of the study. They were grouped into the test (group 1 and group 2) and the control groups by using the same criteria as was used in the study by Vettore et al [16]. The control group consisted of 30 participants with probing pocket depth (PPD) ≤ 3 mm, the test group 1 consisted of 40 participants with at least four sites with probing pocket depth (PPD) > 4mm and ≤ 6 mm, and the test group 2 consisted of 30 participants with at least four sites with probing pocket depth (PPD) > 6mm. All the groups had a Silness-Löe plaque index score of more than 1. All the subjects of the test (group 1 and group 2) and the control groups were subjected to cortisol analysis and psychological evaluation.

Clinical Examinations

The clinical examinations included the assessment of the oral hygiene status, gingival bleeding, probing pocket depth and the clinical attachment level. The Silness-Löe plaque index (PI) (modified) was used to assess the oral hygiene status in this study, which was similar to the method which was used in the study by Monteiro da Silva et al [7]. After using a disclosing solution, 4 surfaces of 3 teeth in each of the maxillary and the mandibular quadrants were examined for plaque and the mean plaque score was calculated [17]. The sulcus bleeding index was used to grade the gingival bleeding in this study, which was similar to that which was used in the study by Klages et al [18].

The clinical examinations which were performed for the evaluation of periodontitis were probing pocket depth (PPD) and clinical attachment level (CAL) by using William's periodontal probe (0.6 mm in diameter). The pocket depth of all the existing teeth was assessed except that of the root stumps; the periodontal probe was inserted into the periodontal pocket which was parallel to the long axis of the tooth. The calculation of CAL was done by using two measurements: (a) the distance from the free gingival margin (FGM) to the cemento-enamel junction (CEJ) and (b) the distance from the FMG to the bottom of the sulcus (probing pocket depth; PPD). The clinical attachment level (CAL) was calculated by subtracting the distance, FGM-CEJ from the probing pocket depth (PPD).

The Evaluation of Stress

All the 110 subjects of the case-control study were evaluated for stress by using the occupational stress index which was put forth by Srivastava A.K. and Singh, A.P., a psychological evaluation tool which was developed and validated for use in the Indian population [19].

The questionnaire was originally designed in English and it was modified to a bilingual one with questions in both the English and Tamil languages (Tamil- the official language of the State of Tamil Nadu, India), for a better understanding of the questions by the participants.

The questionnaire consisted of 46 questions which had to be answered by both the test and the control groups. Each question was rated on a 5-point scale. Out of the 46 questions, 28 were "True-keyed" and the rest of the 18, were "False-keyed." The questions in the questionnaire were related to almost all relevant components of the job life which could cause stress in some way or other, such as role over-load, role ambiguity, role conflict, group and political pressures, the responsibility for persons, under-participation, powerlessness, poor peer relationship, intrinsic impoverishment, low status, strenuous working conditions and unprofitability. The summation of the individual scores of all the 46 questions gave the occupational stress index score of each participant.

Cortisol Analysis

About 1 ml of blood was collected by venipuncture by using a sterile disposable syringe and a needle from the median cubital vein between 8:00-9:00 a.m., in accordance with the diurnal rhythm of cortisol secretion. [20] The blood was centrifuged and the serum was capped and stored for up to 5 days at 2-8°C, prior to its assaying. About 20 µl of serum was used to estimate the serum cortisol levels by using the Cortisol ELISA-kit. After the ELISA reaction, the quantitative *in vitro* value of the serum cortisol levels was determined by using an ELISA reader (microtiter plate reader) with its optical density being set at 450±10 nm. The value of cortisol was expressed in ng/ml.

Statistical Analysis

The data which was obtained from the study of the control group, the test group 1 and the test group 2 were analyzed by using the F- test (ANOVA), the Scheffe's multiple comparison test and Pearson's Correlation. ANOVA was used to compare the means of the variables between the three groups. The Scheffe's multiple comparison test was used to adjust the significance levels in ANOVA. Pearson's correlation was used to study the correlation between the variables in the different groups.

RESULTS

Age

The mean age in all the three groups was found to be around 40 years for the control group, it was 40.23 years, for the test group 1, it was 40.42 years and for the test group 2, it was 41.18 years, with standard deviations of 3.46 years, 3.54 years and 3.78 years respectively. This showed that all the groups were homogeneous in their ages and that there was no significant age difference between the groups.

Plaque

The mean plaque score ranged from 1.2 to 1.7 in the three groups which indicated that the oral hygiene status among the three groups

was fair. The mean plaque score of the control group, the test group 1 and the test group 2 were 1.19, 1.52 and 1.70 respectively. The ANOVA test revealed that the mean plaque score was different in all the three groups, which was statistically significant (p <0.001). The Scheffe's multiple comparison test indicated that the mean plaque score increased with an increase in the pocket depth. The control group had a lower mean plaque score as compared to the test group 1 and the test group 2. Further, the test group 1 had a lower mean plaque scores as compared to the test group 2.

The Sulcus Bleeding Index

The mean sulcus bleeding index score ranged from 0.9 to 2 in the three groups. The mean sulcus bleeding index score of the control group, the test group 1 and the test group 2 were 0.96, 1.62 and 2.00 respectively. The ANOVA test revealed that the mean sulcus bleeding index score was different in all the three groups, which was statistically significant (p<0.001). The Scheffe's multiple comparison test indicated that the mean sulcus bleeding index score increased with an increase in the pocket depth. The control group had a lower mean sulcus bleeding index score as compared to the test group 1 and test group 2. Further, the test group 1 had a lower mean sulcus bleeding index score as compared to the test group 2.

The Clinical Attachment Level

The mean clinical attachment level ranged from 2.7 to 5.9 mm in the three groups. The clinical attachment levels of the control group, the test group 1 and the test group 2 were 2.63, 4.68 and 5.92 respectively. The ANOVA test results revealed that the mean clinical attachment level was different in all the three groups which was statistically significant (p <0.001). The Scheffe's multiple comparison test indicated that the mean clinical attachment level increased with an increase in the pocket depth. The control group had a lower mean clinical attachment level as compared to the test group 1 and the test group 2. Further, the test group 1 had a lower mean clinical attachment level as compared to the test group 2 [Table/Fig 1].

The Occupational Stress Index

The mean occupational stress index score ranged from 79.5 to 158.2 in the three groups. The mean occupational stress index score of the control group, the test group 1 and the test group 2 were 79.53, 133.68 and 158.13 respectively. The ANOVA test results revealed that the mean occupational stress index score was different in all the three groups, which was statistically significant (p <0.001). The Scheffe's multiple comparison test indicated that the mean occupational stress index score increased with an increase in pocket depth. The control group had a lower mean occupational stress index score as compared to the test group 1 and the test group 2. Further, the test group 1 had a lower mean occupational stress index score as compared to the test group 2 [Table/Fig 2].

Serum Cortisol Levels

The mean serum cortisol level ranged from 125.6 to 212.4 in the three groups. The mean serum cortisol level of the control group, the test group 1 and the test group 2 were 125.67, 187.75 and 212.40 respectively. The ANOVA test results revealed that the mean serum cortisol level was different in all the three groups, which was statistically significant (p <0.001). The Scheffe's multiple comparison test indicated that the mean serum cortisol level increased with an increase in the pocket depth. The control group had a lower mean serum cortisol level as compared to the test group 1 and the test group 2. Further, the test group 1 had a lower mean serum cortisol level as compared to the test group 2 [Table/Fig 3].

The Relationship between the Occupational stress index score and the Clinical attachment level in the different groups: Pearson's correlation was used to study the correlation between the occupational stress index score and the clinical attachment

Group	Mean Clinical Attachment Level	Standard Deviation	ANOVA F-value	p-value	Scheffe's Multiple Comparison
Control	2.63	1.05	146.21	<0.001	Control vs Test 1 vs Test 2
Test group 1	4.68	0.63			
Test group 2	5.92	0.69			

[Table/Fig-1]: Mean and Standard Deviation of Clinical Attachment Level (CAL) in the Study Groups

Group	Mean Occupational Stress Index Score	Standard Deviation	ANOVA F-value	p-value	Scheffe's Multiple Comparison
Control	79.53	23.57	57.69	<0.001	Control vs Test 1 vs Test 2
Test group 1	133.68	33.23			
Test group 2	158.13	32.44			

[Table/Fig-2]: Mean and Standard Deviation of Occupational Stress Index Score in the Study Groups

Group	Mean Occupational Stress Index Score	Standard Deviation	ANOVA F-value	p-value	Scheffe's Multiple Comparison
Control	125.67	50.60	9.16	<0.001	Control vs Test 1 vs Test 2
Test group 1	187.75	97.84			
Test group 2	212.40	97.80			

[Table/Fig-3]: Mean and Standard Deviation of Serum Cortisol Level in the Study Groups

Group	Occupational stress index and Clinical attachment level	Occupational stress index and Serum cortisol level	Clinical attachment level and Serum cortisol level
Control	0.301	0.787**	0.217
Test group 1	0.614**	0.634**	0.457**
Test group 2	0.594**	0.785**	0.576**

[Table/Fig-4]: Pearson's Correlation between Clinical Attachment Level, Occupational Stress Index Score and Serum Cortisol Level in the Study Groups
**Correlation is significant at the 0.001 level (2-tailed)

level in the different groups, a significant positive relationship existed between the occupational stress index score and the serum cortisol levels in the test group 1 and the test group 2 i.e., whenever there was an increase in the occupational stress, the serum cortisol levels also increased simultaneously. However, there was no significant relationship between occupational stress and clinical attachment in the control group [Table/Fig 4].

The Relationship between the Occupational stress index score and the Serum cortisol levels in the different groups: Pearson's correlation revealed a significant positive relationship between the occupational stress index score and the serum cortisol levels in the control group, the test group 1 and the test group 2 i.e., whenever there was an increase in the occupational stress, the serum cortisol levels also increased simultaneously [Table/Fig 4].

The Relationship between the Clinical attachment level and the Serum cortisol levels in the different groups: Pearson's correlation revealed a significant positive relationship between the clinical attachment level and the serum cortisol levels in the test group 1 and the test group 2 i.e., whenever there was an increase in the clinical attachment level, the serum cortisol levels increased accordingly. However, there was no significant relationship between the clinical attachment level and the serum cortisol levels in the control group [Table/Fig 4].

DISCUSSION

The present case-control study was attempted to investigate the effects of the stress factors on the periodontal health of the police personnel in which potential confounding factors such as age, gender, smoking and systemic disease could be controlled.

The age group which was chosen for evaluation in this study was the adult group which was ranged from 35-48 years, as epidemiological studies have indicated that both the severity and the prevalence of chronic periodontitis were found to increase with an increase in age [21]. The mean age in the three groups was around 40 years, all the groups were homogeneous in their ages and there was no significant age difference between the groups. In this study, the subjects were grouped into two test groups and one control group. This method of grouping the sample into 2 study groups and 1 control group, which is also called as the 2:1 case-control match was similar to that in a study which was done by Vettore et al [16]. A 2:1 case-control ratio was chosen to increase the power and efficiency of the study. The occupational stress index was used to assess the occupational stress in the police personnel, as the same had been used previously to assess the police personnel in India by Mishra and Minum Shyam [19] and it was the questionnaire which was used extensively in India to measure occupational stress.

In the present study, the control group had a lower mean plaque score as compared to the test group 1 and the test group 2. Further, the test group 1 had a lower mean plaque score as compared to the test group 2. These findings were in accordance with the findings of the studies which were done by Deinzer et al, [22] who reported increased dental plaque accumulation and gingival inflammation in medical students who were under academic stress and with the findings of a study which was done by Kurer et al, [23] which showed an association between the mean depression scores and plaque. In contrast, a study by Monteiro da Silva et al [7] on perceived life events and stress did not correlate with the mean dental plaque.

In this study, the control group had a lower mean sulcus bleeding index score as compared to the test group 1 and the test group 2. Further, the test group 1 had a lower mean sulcus bleeding index core as compared to the test group 2. This was in harmony with the results of the study which was done by Klages et al [18], which correlated SBI and stress.

Psychosocial stress activates the hypothalamus to release the corticotrophin releasing hormone, which in turn stimulates the release of ACTH from the pituitary which results in the production of cortisol by the adrenal cortex, which in turn depresses immunity (6). Cortisol is closely associated with stress, as was suggested by Clemens Kirschbaum et al [24] and Francesco Tomei et al [25].

The present study showed a positive relationship between the serum cortisol levels and the occupational stress index score and the clinical attachment level in the test group 1 and the test group 2, the serum cortisol levels increased with an increase in the probing pocket depth. This finding was similar to the findings of Genco RJ et al [6]. In the present study, it was found that the test group 1 and test group 2 had higher mean clinical attachment levels as compared to the control group. Further, the test group 2 had a higher mean clinical attachment level as compared to the test group 1. These results were comparable with the findings of Linden et al [5] and Genco RJ et al [6].

The main strengths of this study were- first, an appropriate questionnaire was selected for the population which was under study. The occupational stress index which was put forth by Srivastava and Singh, being a tried and tested questionnaire to evaluate the occupational stress in India, was more appropriate for the mindset and the geographical region from where the sample was selected. Secondly, an appropriate population was selected to study the correlation between stress and periodontitis i.e. Police personnel, whose work has been ranked among the top five most stressful occupations [11].

The major limitation of present study was that though the effect of stress on the periodontium was measured, how the body responded to the stress – was not measured. The results of this case-control study suggested that stress was related to chronic periodontitis and the serum cortisol levels in the police personnel of Cuddalore district, Tamil Nadu, India. This study provides one more explanation for the prevalence of periodontitis in the police personnel [15].

It has to be borne in mind that the primary aetiology of the periodontal disease is the pathogenic bacterial plaque in a susceptible patient.

Stress can be a risk factor because with stress, the person's behavioural changes lead to altered oral hygiene habits, thus causing the accumulation of plaque on one hand and on the other hand it obstructs the immunity of the person through its endocrinal connections. Hence, if good oral hygiene is combined with regular periodontal check-ups, it can drastically reduce the effects of stress on the periodontium.

ACKNOWLEDGEMENTS

The authors are grateful to Mr. John William Felix, Lecturer-cum-Statistician, Department of Community Medicine, Annamalai University, for his help in the statistical analysis of the study data and Mr. Pradeep Kumar, IPS, Superintendent of Police, Cuddalore district, Tamil Nadu, India for granting permission to perform the study on the police personnel of Cuddalore district, Tamil Nadu, India.

REFERENCES

[1] Page RC, Offenbacher S, Schroeder HE, Seymour GJ, Kornman KS. Advances in the pathogenesis of periodontitis: summary of developments, clinical implications and future directions. *Periodontol* 2000. 1997; 14:216–48.
[2] Gemmell E, Marshall RI, Seymour GJ. Cytokines and prostaglandins in immune homeostasis and tissue destruction in periodontal disease. *Periodontol* 2000. 1997; 14:112–43.
[3] Tsigos C, Chrousos GP. Hypothalamic–pituitary–adrenal axis, neuroendocrine factors and stress. *J Psychosomatic Res*. 2002; 53:865– 871.
[4] Richard S. Lazarus. Puzzles in the study of daily hassles. *J Behavioral Med*. 1984; 7(4): 375-389
[5] Linden GJ, Mullally BH, Freeman R. Stress and the progression of periodontal disease. *J Clin Periodontol*. 1996; 23(7): 675-680.
[6] Reners M, Brecx M. Stress and periodontal disease. *Int J Dent Hyg*. 2007;5(4):199-204.
[7] Silva AM, Newman HN, Oakley DA, O'Leary R. Psychosocial factors, dental plaque levels and smoking in periodontitis patients. *J Clin Periodontol* 1998; 25(6):517-523.
[8] Guyton AC, Hall JE. Textbook of Medical Physiology, 11th ed. Philadelphia. W.B. Saunders Co. 2006: 952-954.
[9] Herbert TB, Cohen S. Stress and Immunity in Humans: A Meta-Analytic Review. *Psychosomatic Med* 1993; 55:364-379.
[10] Richard A. Young. Stress Proteins and Immunology. *Annual Rev of Imm* 1990; 8: 401-420.
[11] Dantzker M L. Police-related stress: A Critique for future research. *J Police and Criminal Psyc*. 1987; 3: 43-48.
[12] Lynch J. Burnout and engagement in probationary police officers: A scoping paper. *Australasian Centre for Policing Research Report*, 2007; 1-29.
[13] Thompson BM, Kirk A, Brown DF. Work based support, emotional exhaustion, and the spillover of work stress to the family environment: A study of policewomen. *Stress and Health*. 2005; 21(3): 199-207.
[14] Deschamps F, Paganon-Badinier I, Marchand AC, Merle C. Sources and Assessment of Occupational stress in the police. *J Occup Health* 2003; 45(6):358-364.
[15] Sánchez MM, Solís M, Maupomé G et al., Prevalence of and Risk Indicators for Chronic Periodontitis in Males from Campeche, Mexico. *Revista De Salud Pública* 2007; 9(3):388-398.
[16] Vettore M V, Leao AT, Monteiro da Silva AM, Quintanilha RS, Lamarca. The relationship of stress and anxiety with chronic periodontitis. *J Clin Periodontol* 2003; 30(5):394-402.
[17] WHO Oral Health Country/Area Profile Programme, Department of Noncommunicable Diseases Surveillance/ Oral Health, Silness-Löe Index. Availableat: http://www.whocollab.od.mah.se/expl/ohisiloe64.html/. Accessed January 24, 2009.
[18] Klages U, Weber AG, Wehrbein H. Approximal plaque and gingival sulcus bleeding in routine dental care patients: relation to life stress, somatization and depression. *J Clin Periodontol* 2005; 32: 575-582.
[19] Mishra PC Shyam M., Social Support and Job Involvement in Prison Officers. *J Indian Academy of Applied Psych* 2005; 31(1-2):7-11.
[20] Guyton AC, Hall JE. *Textbook of medical physiology,* 11th ed. (Fig77-7) Philadelphia: W.B. Saunders Co. 2006: 956.
[21] Greene JC. Periodontal Disease in India: Report of an Epidemiological Study. *J. Dent. Res* 1960; 39:302-312.
[22] Deinzer R, Rüttermann S, Möbes O, Herforth A. Increase in gingival inflammation under academic stress. *J Clin Periodontol* 1998; 25 (5):431-433.
[23] Kurer JR, Watts TL, Weinman J, Gower DB. The psychological mood of regular dental attenders in relation to oral hygiene behaviour and gingival health. *J Clin Periodontol*. 1995; 22(1):52-55.
[24] Clemens K, Jens CP, Aarthur AS et al. Persistent High Cortisol Responses to Repeated Psychological Stress in a Subpopulation of Healthy Men. *Psychosomatic Med* 1995; 57:468-474.
[25] Tomei F, Rosati M V, Ciarrocca M, et al. Plasma Cortisol Levels and Workers who are Exposed to Urban Pollutants. *Industrial Health* 2003, 41, 320-326.

AUTHOR(S):
1. Dr. Little Mahendra
2. Dr. Jaideep Mahendra
3. Dr. Ravi David Austin
4. Dr. S. Rajasekhar
5. Dr. R. Mythili

PARTICULARS OF CONTRIBUTORS:
1. Senior Lecturer, Department of Periodontics, Rajah Muthaiah Dental College and Hospital, Annamalai University, Annamalai Nagar 608002, India.
2. Professor, Department of Periodontics, Meenakshi Ammal Dental College and Hospital, Chennai 600095, India.
3. Principal, Rajah Muthaiah Dental College and Hospital, Annamalai University, Annamalai Nagar 608002, India..
4. Professor, Department of Periodontics, Rajah Muthaiah Dental College and Hospital, Annamalai University, Annamalai Nagar 608002, India.
5. Professor and Head, Department of Periodontics, Rajah Muthaiah Dental College and Hospital, Annamalai University, Annamalai Nagar 608002, India.

NAME, ADDRESS, TELEPHONE, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Jaideep Mahendra, MDS., Ph.D., PGDHM.,
X-1/1-2 SAF Games Village,
Koyambedu, Chennai-600 107,
Tamil Nadu, India.
Mobile No. +91- 9444963973
Fax No. +91-44-24343205
email: jaideep_m_23@yahoo.co.in

DECLARATION ON COMPETING INTERESTS:
No competing Interests.

Date of Submission: **Apr 04, 2011**
Date of Peer Review: **May 24, 2011**
Date of Acceptance: **May 27, 2011**
Date of Publishing: **Aug 08, 2011**