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The relationship between tooth loss and psychological factors

H. Roohafza[1], P. Afghari[2], A. Hassanzadeh Keshteli[3], A. Vali[4], M. Shirani[4], P. Adibi[3] and H. Afshar[5]

[1]Isfahan Cardiovascular Research Centre, Isfahan University of Medical Sciences, Isfahan, Iran; [2]Department of Oral and Maxillofacial Radiology, Dental Faculty, Isfahan(khorasgan) branch, Islamic Azad University, Isfahan, Iran; [3]Integrative Functional Gastroenterology Research Center, Isfahan University of Medical Sciences, Iran; [4]Department of Endodontic, Dental Faculty, Isfahan University of Medical Sciences, Isfahan, Iran; [5]Psychosomatic Research Centre, Isfahan University of Medical Sciences, Iran

Objectives: Limited evidence is available regarding mutual interactions between psychological factors and tooth loss. This study aimed to investigate the association between these two issues. ***Method:*** In this 2011cross-sectional study we obtained data from 4,585 adults who had completed information in 20 counties across Isfahan province, Iran, regarding tooth loss and psychological factors (depression, anxiety and stress level). To analyse the data ANOVA and multiple ordinal regression were applied. ***Results****:* After adjusting socio demographic factors, the association between depression (OR 1.23; 95%CI=1.01,1.49), anxiety (OR 1.19; 95%CI=1.03,1.38), and high stress level (OR 95%CI=1.19; 1.01,1.39) remained significant. ***Conclusion:*** We confirm the interaction between psychological factors and tooth loss, but recommend further studies on a national Iranian population.

Key words: *tooth loss, stress, depression, anxiety, Iran*

Introduction

Tooth loss is an age-related issue linked to oral health and considered an important factor in general health. In many developing countries life expectancy has recently increased, increasing the population of the middle-aged and older adults and age-related issues such as tooth loss. Edentulism can have critical effect on many aspects of quality of life including chewing, speaking, smiling, laughter, self-image, social relations, type of nutrition and gastrointestinal disorders (Gerritsen *et al*., 2010; Okoje *et al*., 2010). The prevalence of Iranian edentulism reportedly ranges from 0.3% in 3-5-year-olds to 70.7% in the over 65s (Hessari *et al*., 2008; Khazaei *et al*., 2012).

Many studies have probed the risk factors related to tooth loss including psychological factors, cultural issues, education**,** nutrition and income. These factors are as important as oral and systemic variables such as periodontitis, cardiovascular disease, stroke, obesity and diabetes in losing teeth (Khazaei *et al*., 2012; Offenbacher *et al*., 2012). The findings of some studies indicate that social and psychological variables such as negative life events, depression, needing help from others, stress, anxiety and low self-efficacy are all associated with tooth loss (Casanova-Rosado *et al*., 2005; Okoro *et al*., 2012). Also related to oral health are socieconomic status, chronic stress, method of coping and gender (Atieh, 2008; Okoro *et al*., 2012). Getting used to one's edentulousness is itself a stressful condition and how people get along with their stressors is worth attention. Accordingly, susceptibility to tooth loss could be due to different psychological factors. All the points cited above suggest that tooth loss can cause a significant change in one's life (Okoje *et al*., 2010; Papadaki and Anastassiadou, 2012).

Materials and Methods

The current study was conducted as part of the community-based Iranian 2011 Study of the Epidemiology of Psychological, Alimentary Health and Nutrition (SEPAHAN) project designed to evaluate the epidemiological aspects of functional gastrointestinal disorders and their association with lifestyle and psychological determinants (Adibi et al., 2012).

The population of this cross-sectional study was selected from four million people in 20 counties across Isfahan province. Convenience sampling by geographical region was performed in proportion to the number of participants in each county in Isfahan province. The questionnaires were given to the participants in their home or workplace to be answered in their leisure time.

To enhance the accuracy of data collected and improve the response rate, data were collected in two phases. An initial self-administered questionnaire identified participants' demographics (age, gender, educational status and marital status) and life style including nutritional habits and dietary intakes. A second questionnaire collected information regarding gastrointestinal function and psychological features. The questionnaires were returned in sealed envelopes ensuring anonymity and confidentially. Participation was completely optional.

The Regional Bioethics Committee of IUMS scientifically and ethically approved the study protocol (project numbers 189069, 189082 and 189086). The protocol was explained to participants and written consent was obtained from all the participants.

Correspondence to: Dr Hamid Afshar, Psychosomatic Research Centre, Isfahan University of Medical Sciences, Isfahan, Iran.
Email: afshar@med.mui.ac.ir

Tooth loss as a consequence of poor oral health was assessed by questions regarding number of tooth lost and the presence of edentulism. Tooth loss was classified as: none lost; 6 or fewer teeth lost; more than 6 lost teeth; or edentulous (Khazaei *et al*., 2013).

The Hospital Anxiety and Depression Scale (HADS) rated depression and anxiety through a 14 items questionnaire: 7 regarding depression (α=0.84) and 7 for anxiety (α=0.82) with each question having 4 responses (0-3) giving possible ranges of 0-21 with higher scores indicating greater anxiety or depression. Clinical levels of anxiety and depression were scores ≥11 (Montazeri *et al*., 2003a; Zigmond and Snaith 1983).

The General Health Questionnaire (GHQ-12), a well-established screening tool in assessing psychological stress was used as there is evidence that it is a consistent and reliable instrument for use in general population studies (Goldberg and Hillier 1979; Montazeri *et al*., 2003b). The 12 items are rated on a 4-point scale scored: 0, less or no more than usual; 1, fairly or much more than usual – giving a possible range of 0-12 points with scores ≥4 identified as high stress.

Continuous variables were reported as means with standard deviations and ANOVA compared means between the groups. Also pairwise comparisons between groups were performed using Bonferroni post-hoc test. Qualitative variables were expressed as frequency and χ^2 tests compared frequencies. Multiple ordinal regressions were applied to find the associations between tooth loss and depression, anxiety and stress level with adjustments for demographic variables. Odds ratios were reported with 95% confidence intervals. Dependent variables included dichotomised levels of depression, anxiety and stress level. The independent variable was tooth loss, and adjusting variables were age, gender, marital and educational status. SPSS v15 was used for analysis. The critical value for statistical significance in all analyses was p=0.05.

Results

A total of 4,585 individuals were invited to participate with a response rate of 86.2%. The socio-demographic characteristics of the subjects are summarised in Table 1 complete with pairwise comparisons between groups. Those with depression, anxiety and high level stress reported higher prevalence of tooth loss.

As indicated in Table 2, multiple ordinal regression analysis after adjusting for age and gender (model 1), indicated the statistically significant relationship between depression, anxiety and high stress level with tooth loss. After controlling for age, gender, marital status and educational level, the relationship between tooth loss and each of depression, anxiety, and high stress level continued to be significant in the model (model 2).

Table 1. Demographic and psychological characteristics according to degree of tooth loss (n=4,585)

Variable	*Tooth loss*								*p*
	a, No tooth loss n=1,514		*b, 6 or fewer teeth lost n=2,685*		*c, More than 6 teeth lost n=309*		*d, Complete edentulism n=77*		
	n	%	n	%	n	%	n	%	
Demographic									
Male	519	25.8 ^{bcd}	1,233	61.3 ^{acd}	193	9.6 ^{abd}	65	3.2 ^{abc}	**<0.001**
Female	995	38.6	1,452	56.4	116	4.5	12	0.5	
Non-graduate	417	21.9 ^{cd}	1,204	63.2 ^{cd}	223	11.7 ^{abd}	62	3.3 ^{abc}	**<0.001**
Graduate	1,068	41.5	1,417	55.0	78	3.0	13	0.5	
Unmarried	417	49.3 ^{d}	409	48.3 ^{cd}	14	1.7 ^{bd}	6	0.7 ^{abc}	**<0.001**
Married	1,062	29.2	2,221	61.0	290	8.0	70	1.9	
Psychological									
No depression	1,112	34.8 ^{d}	1,842	57.7 ^{cd}	193	6.0 ^{bd}	48	1.5 ^{abc}	**<0.001**
With depression	378	29.3	775	60.2	109	8.5	26	2.0	
No anxiety	1,308	33.9 ^{d}	2,239	58.1 ^{cd}	242	6.3 ^{bd}	65	1.7 ^{abc}	**0.003**
With anxiety	180	28.5	382	60.5	60	9.5	9	1.4	
Low stress	1,156	33.7 ^{b}	1,996	58.2 ^{ad}	215	6.3 ^{d}	60	1.8 ^{bc}	**0.030**
High stress	322	31.3	614	59.6	84	8.2	10	1.0	
Mean age, yrs (sd)	33.2	7.5 ^{bcd}	37.3	7.6 ^{acd}	43.5	6.7 ^{abd}	47.3	6.8 ^{abc}	**<0.001**

a, b, c and d are letters assigned to the tooth loss categories. Superscript letters identify those categories with significant differences.

Table 2. Logistic Regression Analysis for psychological variables with tooth loss

	Crude			*Model 1*			*Model 2*		
	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*
Presence of anxiety	1.31	1.11, 1.56	**<0.001**	1.49	1.23, 1.79	**<0.001**	1.23	1.01, 1.49	**0.038**
Presence of depression	1.32	1.16, 1.50	**<0.001**	1.34	1.16, 1.55	**<0.001**	1.19	1.03, 1.38	**0.020**
High stress level	1.12	0.98, 1.29	<0.103	1.27	1.09, 1.48	**<0.002**	1.19	1.01, 1.39	**0.033**

Model 1 is age and gender adjusted; Model 2 is age, gender, marital status and educational level adjusted

Discussion

In this cross-sectional community-based study the prevalence of tooth loss was found to be prevalent among the sample and associated with depression, anxiety and high stress level. Various prevalence rates of tooth loss have been reported around the world (Medina-Solis *et al*., 2006; Müller *et al*., 2007; Musacchio *et al*., 2007) with the less educated more likely to have lost more teeth (Burt *et al*., 1990). Unlike several other studies, the results of our study indicated that males are more subject to tooth loss and edentulism (Hessari *et al*., 2008; Okoro *et al*., 2005; Müller *et al*., 2007). It has been noted that women's greater emphasis on aesthetics could be linked to higher rates of edentulism (Khazaei *et al*., 2013). Many research studies show that tooth loss and edentulism are positively correlated with age as in this study (Edman *et al*., 2012; Müller *et al*., 2007; Renvert *et al*., 2013) conceivably because a major risk factor in this respect is the prevalence of periodontitis which increases with age (Müller *et al*., 2013).

Life satisfaction and happiness correlate with self-reported oral health status and behaviour (Dumitrescu *et al*., 2010) and adults with depression are more likely not to use oral health services (Okoro *et al*., 2012). The same study found adults with anxiety and depression were more likely to have tooth loss. A 2009 study indicated that the psychological factors are associated with developing periodontal disease (Chiou *et al*., 2010) though another the following year found no association between susceptibility to depression and etiology or severity of periodontitis (Ababneh *et al*., 2010).

Many recent studies identify relationships between tooth loss and psychological variables such as depression, anxiety, loneliness, negative life events, life satisfaction and personality (Casanova-Rosado *et al*., 2005). Fewer have reported biological and/or behavioural pathway relationships between depression or anxiety and oral disease (Genco *et al*., 1999; Sanders *et al*., 2007), including a direct biological mechanism which modifies the immune response, regulates responses to periodontopathic bacteria, changes the gingival circulation and produces endocrinological disturbances all of which result in the development of periodontal disease (Breivik *et al*., 1996; Peruzzo *et al*., 2007).

Periodontitis is one of the main causes of tooth loss especially among the people in the developing countries. Various factors such as age, gender, education, psychological factors, smoking and infection affect this disease (Borrell and Papapanou 2005; Clarke and Hirsch 1995). Moreover, psychological factors indirectly affect the unhealthy oral-health related behaviours such as smoking, tooth brushing and dental visit frequencies through the associations of individual risk behaviours with various psychological traits including self-esteem, optimism, depression and stress, which all mediate attachment loss and finally tooth loss (Dumitrescu *et al*., 2010).

Tooth loss correlates with loss of self-confidence and people with tooth loss pay special attention to their appearance, trying to hide their tooth loss - it seems that they lose part of their identity with loss of teeth (Macgregor *et al*., 1997). Moreover, coping with tooth loss can be anxiety-producing which itself grows in a vicious circle between psychological factors and tooth loss.

The present study has its limitations: reliance on self-reported data, absence of clinical examination of oral health, the limited range of psychological variables considered in this study and the use of convenience sampling (chosen for its simplicity and cost-effectiveness). We suggest that further studies be carried out using samples more representative of the population. Also the generalisability of the findings may be limited by sampling from a single province.

In conclusion, this study found a positive correlation between psychological factors and tooth loss which increased with the level of stress. We suggest further studies using samples more representative of the population.

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References

Ababneh, K.T., Al Shaar, M.B. and Taani, D.Q. (2012): Depressive symptoms in relation to periodontal health in a Jordanian sample. *International Journal of Dental Hygiene* **8**, 16-21.

Adibi, P., Keshteli, A.H., Esmaillzadeh, A, Afshar, H., Roohafza, H., Bagherian-Sararoudi, R., Daghaghzadeh, H., Soltanian, N., Feinle-Bisset, C., Boyce, P. and Talley, N.J. (2012): The study on the epidemiology of psychological, alimentary health and nutrition (SEPAHAN): Overview of methodology. *Journal of Research in Medical Sciences* **17**, S291-S297.

Atieh, M.A. (2008): Tooth loss among Saudi adolescents: social and behavioural risk factors. *International Dental Journal* **58**,103-108.

Borrell, L.N. and Papapanou, P.N. (2005): Analytical epidemiology of periodontitis. *Journal of Clinical Periodontology* **32** Suppl 6, 132-158.

Breivik, T., Thrane, P.S., Murison, R. and Gjermo, P. (1996): Emotional stress effects on immunity, gingivitis and periodontitis. *European Journal of Oral Science* **104**, 327-334.

Burt, B.A., Ismail, A. I., Morrison, E.C. and Beltran, E. D. (1990): Risk factors for tooth loss over a 28-year period. *Journal of Dental Research*, **69**, 1126-1130.

Casanova-Rosado, J.F., Medina-Solis, C.E., Vallejos-Sanchez, A.A., Casanova-Rosado, A.J., Maupome, G. and Avila-Burgos, L. (2005): Lifestyle and psychosocial factors associated with tooth loss in Mexican adolescents and young adults. *Journal of Contemporary Dental Practice* **15**, 70-77.

Chiou, L.J., Yang, Y.H., Hung, H.C., Tsai, C.C., Shieh, T.Y., Wu, Y.M., Wang, W.C. and Hsu, T.C. (2010): The association of psychosocial factors and smoking with periodontal health in a community population. *Journal of Periodontal Research* **45**,16-22.

Clarke, N.G. and Hirsch, R.S. (1995): Personal risk factors for generalized periodontitis. *Journal of Clinical Periodontology* **22**, 136-145.

Dumitrescu, A.L., Kawamura, M., Dogaru, B.C. and Dogaru, C.D. (2010): Relation of achievement motives, satisfaction with life, happiness and oral health in Romanian university students. *Oral Health Prevention* **8**,15-22.

Edman, K., Ohrn, K., Holmlund, A., Nordstrom, B., Hedin, M. and Hellberg, D. (2012): Comparison of oral status in an adult population 35-75 year of age in the county of Dalarna, Sweden in 1983 and 2008. *Swedish Dental Journal*. **36**, 61-70.

Genco, R.J., Ho, A.W., Grossi, S.G., Dunford, R.G. and Tedesco, L.A. (1999): Relationship of stress, distress and inadequate coping behaviors to periodontal disease. *Journal of Periodontology* **70**, 711-723.

Gerritsen, A.E., Allen, P.F., Witter, D.J., Bronkhorst, E.M. and Creugers, N.H. (2010): Tooth loss and oral health-related quality of life: a systematic review and meta-analysis. *Health Quality of Life Outcomes* **8**, 126.

Goldberg, D.P. and Hillier, V.F. (1979): A scaled version of the General Health Questionnaire. *Psychological Medicine* **9**,139-145.

Hessari, H., Vehkalahti, M.M., Eghbal, M.J. and Murtomaa, H. (2008): Tooth loss and prosthodontic rehabilitation among 35- to 44-year-old Iranians. *Journal of Oral Rehabilitation* **35**, 245-251.

Khazaei, S., Firouzei, M.S., Sadeghpour, S., Jahangiri, P., Savabi, O., Keshteli, A.H. and Adibi, P. (2012): Edentulism and tooth loss in Iran: SEPAHAN Systematic Review No. 6. *International Journal of Preventive Medicine* **3**, S42-47.

Khazaei, S., Keshteli, A.H., Feizi, A., Savabi, O. and Adibi, P. (2013): Epidemiology and risk factors of tooth loss among Iranian adults: finding from a large community based study. *BioMed Research International* **2013**, 1-8.

Macgregor, I.D., Regis, D. and Balding , J. (1997): Self-concept and dental health behaviours in adolescents. *Journal of Clinical Periodontol*ogy **24**, 335-339.

Medina-Solis, C.E., Perez-Nunez, R., Maupome, G. and Casanova-Rosado, J.F. (2006): Edentulism among Mexican adults aged 35 years and older and associated factors. *American Journal of Public Health* **96**, 1578-1581.

Montazeri, A., Harirchi, A.M., Shariati, M., Garmaroudi, G., Ebadi, M. and Fateh, A. (2003b): The 12-item General Health Questionnaire (GHQ-12): translation and validation study of the Iranian version. *Health Quality of Life Outcomes* **1**, 66.

Montazeri, A., Vahdaninia, M., Ebrahimi, M. and Jarvandi, S. (2003a): The Hospital Anxiety and Depression Scale (HADS): translation and validation study of the Iranian version. *Health Quality of Life Outcomes* **1**, 14.

Müller, F., Naharro, M. and Carlsson, G.E. (2007): What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? *Clinical Oral Implants Research* **18** Suppl 3, 2-14.

Müller, S., Eickholz, P., Reitmeir, P. and Eger, T. (2013) : Long-term tooth loss in periodontally compromised but treated patients according to the type of prosthodontic treatment. A retrospective study. *Journal of Oral Rehabilitation* **40**, 358–367.

Musacchio, E., Perissinotto, E., Binotto, P., Sartori. L., Silva-Netto, F., Zambon, S. Manzato, E., Corti, M.C., Baggio, G. and Crepaldi, G. (2007): Tooth loss in the elderly and its association with nutritional status, socio-economic and lifestyle factors. *Acta Odontologica Scandinavica* **65**,78-86.

Offenbacher, S., Barros, S.P., Altarawneh, S., Beck, J.D. and Loewy, Z.G. (2012): Impact of tooth loss on oral and systemic health. *General Dentistry* **60**, 494-500.

Okoje, V.N., Dosumu, O.O., Alonge, T.O. and Onyeaso, C. (2012): Tooth loss: are the patients prepared? *Nigerian Journal of Clinical Practice* **15**,172-175.

Okoro, C.A., Balluz, L.S., Eke, P.I., Ajani, U.A., Strine, T.W., Town, M., Mensah ,G.A. and Mokdad, A.H. (2005): Tooth loss and heart disease: findings from the behavioral risk factor surveillance system. *American Journal of Preventive Medicine* **29** suppl. 1, 50-56.

Okoro, C.A., Strine, T.W., Eke, P.I., Dhingra, S.S. and Balluz, L.S. (2012): The association between depression and anxiety and use of oral health services and tooth loss. *Community Dentistry and Oral Epidemiology* **40**, 134-144.

Papadaki, E. and Anastassiadou, V. (2012): Elderly complete denture wearers: a social approach to tooth loss. *Gerodontology* **29**, e721-727.

Peruzzo, D.C., Benatti, B.B., Ambrosano, G.M., Nogueira-Filho, G.R., Sallum, E.A., Casati, M.Z. and Nociti, FH. Jr. (2007): A systematic review of stress and psychological factors as possible risk factors for periodontal disease. *Journal of Periodontology* **78**, 1491-1504.

Renvert, S., Persson, R.E. and Persson, G.R. (2013): Tooth loss and periodontitis in older individuals. Results from the Swedish national study on aging and care. *Journal of Periodontology* **84**, 1134–1144.

Sanders, A.E., Slade, G.D., Turrell, G., Spencer, A.J. and Marcenes, W. (2007): Does psychological stress mediate social deprivation in tooth loss? *Journal of Dental Research* **86**,1166-1170.

Zigmond, A.S. and Snaith, R.P. (1983): The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica* **67**, 361-370.