**Risk Factors Of Periodontal Diseases Among Yemeni Young Dental Patients**

Manal M. Al-Hajri \*, Abdoalbassed Mofudal\*\*, Alea a Al-Shami\*\* Laila Al-Surihy\*\*, Nusaibe M. Ali\*\*

**Absrtact:** Periodontal diseases are chronic infectious diseases that lead to the

inflammation of specialized tissues that surround and support the teeth. Many risk factors and risk indicators, associated with increased risk of periodontal disease, have been identified. Gender, age, education, tooth brushing habit, smoking, khat chewing and shamaa use were associated with periodontal status in Yemen. Accordingly, the aim of our study is to assess the prevalence and related risk factors for periodontal diseases among Yemeni young dental patients in the faculty of dentistry Sanaa university.

**Materials and Methods:** 735 patients (both males and females) and systemic free. Clinical examinations were performed including probing pocket depth, plaque index, gingival index and gingival recession.

**Results:** 110 Patients were less than 20 years and 9.1% healthy, 36.4% gingivitis, 22.7% generalized chronic periodontitis (GCP), 4.5% localized aggressive periodontitis (LAP), 27.3% generalized gingivitis with localized chronic periodontitis (LCP) and 0.0% generalized aggressive periodontitis (GAP). 625 Patients were more than 20 years and less than 29 years and 13.6% healthy, 8.7% gingivitis, 29.1% generalized chronic periodontitis (GCP), 2.7% localized aggressive periodontitis (LAP), 45.6% generalized gingivitis with localized chronic periodontitis (LCP) and 0.2% generalized aggressive periodontitis (GAP). Age, gender, education, tooth brushing habit, smoking, khat chewing and shamaa use habit were significantly (*P* ≤ 0.05) associated with periodontal status.

**Conclusion:** The study confirmed various socio‑demographic risk factors/indictors associated with increased risk of periodontitis among Yemeni young dental patients.

**Key words:** periodontal disease, prevalence, risk factors/indicators, khat, shama use

\* Associate Professor of Oral Medicine, Oral Diagnosis and Periodontology, Sanaa University.

\*\* Teaching Assistant of Oral Medicine, Oral Diagnosis Periodontology, Sana a University.

***Introduction:***

Periodontitis is a chronic infectious disease which results in biofilm formation on tooth and root surfaces and subsequent destruction of periodontal tissue because of an accelerated host response to pathogenic bacteria. Periodontitis is mostly promoted by microorganisms which are the primary cause for developing periodontitis ***(Schaudinn et al., 2009 and Socransky and Haffajee, 1992).*** Periodontitis is a multifactorial disease with the dental biofilm as an initiator but is influenced by various factors. These include subject characteristics, social and behavioral factors, systemic factors, genetic factors, tooth related factors, microbial structure of dental biofilm ***(Nunn, 2003).***

Periodontal diseases can be divided into two major groups: (a) Gingivitis –reversible gingival inflammation with no destruction of the periodontal supporting tissues. It is related to a nonspecific bacterial challenge; and b) periodontitis – gingival inflammation with destruction of the periodontal supporting tissues (periodontal ligament, cementum, and alveolar bone) related to some specific periodontal pathogens ***(Armitage, 1996).*** Chronic periodontitis is the most common type of destructive periodontal disease and shows a slowly progression pattern characterized by bursts of disease activity separated by quiescent periods of various durations. Aggressive periodontitis encompasses, rapidly progressive forms of periodontitis, often commencing during adolescence and early adulthood, hence classified as early‑onset periodontitis ***(Albandar, 2005)***.

A risk factor can be defined as an occurrence or characteristic that has been associated with the increased rate of a subsequently occurring disease. Risk factors may be modifiable or non-modifiable. Modifiable risk factors are usually environmental or behavioral in nature whereas non-modifiable risk factors are usually intrinsic to the individual and therefore not easily changed ***(Thomas, 2005).*** Socioeconomic status (SES) indicators (i.e., income, house hold and education), were included in the analyses of the previous studies which showed differences in periodontal health ***(Oliver et al., 1998; Locker and Leake, 1993)***.It can be clear that higher education individuals with more secure income showed better gingival health when compared with those individuals with lower educational level with insecure income ***(Department of Health Education and Welfare, 1966)***..

Hormonal fluctuations in the female patient may alter the status of periodontal health ***(Marcos et al., 2005).*** Such changes may occur during puberty, the menstrual cycle, pregnancy, or menopause. Numerous studies reported higher periodontal destruction among males compared to the female population ***(Genco,1996; Slade and Spencer, 1995)***. The reasons for these sex differences are not clear, but they are thought to be related to the ignorance of oral hygiene, which is usually observed among males ***(Slade and Spencer, 1995, Albandar and Kingman, 1999).***

There is accumulating evidence for a higher level of periodontal disease among smokers ***(Kubota et al., 2011 and Vouros et al., 2009).*** Tobacco smoking exerts a substantial destructive effect on the periodontal tissues and increases the rate of periodontal disease progression ***(Zini and Marcenes, 2011)***. Smokers with periodontal disease seem to show less signs of clinical inflammation and gingival bleeding compared to nonsmokers ***(Bergstr, 1990)***. That could be explained by the fact that nicotine exerts local vasoconstriction, reducing blood flow, edema, and clinical signs of inflammation ***(Jensen et al., 1991).*** Reduced bleeding on probing was further demonstrated in a study by ***Bergstrom & Bostrom, (2001)***.

The khat plant (Catha edulis Forsk) is a tree of the family Celastraceae that is frequently cultivated in certain areas of East Africa and the Arabian Peninsula ***(Hassan et al., 2007)***. The habit of khat chewing has prevailed for centuries among populations in the horn of east Africa and the Arabian peninsula including the Yemen. Fresh leaves of khat (Catha edulis Forsk) are customarily chewed to attain a state of stimulation ***(Kalix, 1984; Al-Meshal et al., 1985; Al-Bekairi et al., 1991).*** alkaloids structurally related to amphetamine are contained within the leaves of the khat plant. a high proportion of the adult population in Yemen chew khat on a daily basis for the pleasing mild stimulant effect ***(Hassan et al., 2007).***

In Yemen 90% of adult male chewed khat three to four hours daily. The number for females might be as high as 50% or even higher as young women took up the habit. A recent study for the World Bank estimated that 73% of women in Yemen chewed the khat leaf more or less frequently. Meanwhile, a staggering 15–20% of children under the age of 12 were also daily consumers. Women and men practiced the habit separately, while plucking the tender leaves from the branches and tucking them into the cheek, eventually forming a wad that could bulge almost to the size of a tennis ball ***(AL-Mugahed, 2008).*** There are no laws restricting its use, although the government discourages it. Traditionally, khat has been used as a socializing drug and this is still very much the case ***(Kirby, 2007)***.

***Reiner et al., (1996)*** revealed that Khat consumption may affect the periodontium particularly among younger individuals. Still, they did not display obviously the role of different variables of Khat, primarily, the duration and frequency of chewing. ***Alakhali, (2008)*** and ***Al-Hajri, (2013)*** demonstrated highly significant difference in the mean of gingival recession when comparing chewing side and non-chewing side .The difference was highly significant when the gingival recession on buccal surfaces was compared with others surfaces. ***AL-Sharabi, (2002.)*** showed that Khat consumption may affect the periodontal tissues. The study revealed that Khat chewing causes many lesions to the supporting structure of the teeth, namely gingivitis, periodontal pocket formation, gingival recession, tooth mobility and finally tooth mortality.

The aim of the present study is to evaluate the impact of a variety of risk indicators namely age (years), gender, education level, frequency of tooth cleaning and smoking. Shama use and khat chewing habits are also investigated.

***Materials and methods:***

735 patients (both males and females). All selected patients were healthy and free from any systemic disease that may affect the periodontium according to detailed questionnaire of dental modifications of the Cornell medical index ***(Kerr and Millard, 1965)***. Pregnant and lactating women should be excluded from the study. Clinical examinations were performed including probing pocket depth, plaque index, gingival index, clinical attachment level and gingival recession. All patients were selected from the outpatient department of periodontics, College of Dental Sciences Sana a university and the study was conducted over a period of one year (Mar 2014/Mar 2015).

Analysis results were subjected to statistical analysis. Mean values and standard deviation were calculated, and Chi‑square test was used for comparison. SPSS software, version 19 manufactured by IBM, Chicago Illinois USA corporation was used to perform the statistical analysis. A statistical value of <0.05 was deemed to be significant.

**Results**

The prevalence of periodontal diseases was 87.2% and of healthy was 12.8%. Periodontal diseases diagnosis and distribution according age groups of study participants are shown in Table(1):110 Patients were less than 20 years [9.1% healthy (H), 36.4% gingivitis (G), 22.7% generalized chronic periodontitis (GCP), 4.5% localized aggressive periodontitis (LAP), 27.3% generalized gingivitis with localized chronic periodontitis (G with LCP) and 0.0% generalized aggressive periodontitis (GAP)]. 625 Patients were more than 20 years and less than 29 years [13.6% healthy (H), 8.7% gingivitis (G), 29.1% generalized chronic periodontitis (GCP), 2.7% localized aggressive periodontitis (LAP), 45.6% generalized gingivitis with localized chronic periodontitis (G with LCP) and 0.2% generalized aggressive periodontitis (GAP)].

|  |  |
| --- | --- |
|  |  |
| Table (1) |  Diagnosis | Total | P value |
| H | G | GCP | LAP | G with LCP | GAP |
| Age | < 20 years |  | 10 | 40 | 25 | 5 | 30 | 0 | 110 |  |
|  | 9.1% | 36.4% | 22.7% | 4.5% | 27.3% | 0.0% | 100.0% |  |
| 20-29 years |  | 70 | 45 | 150 | 14 | 235 | 1 | 515 | .ooo\* |
|  | 13.6% | 8.7% | 29.1% | 2.7% | 45.6% | 0.2% | 100.0% |  |
| Total |  | 80 | 85 | 175 | 19 | 265 | 1 | 625 |  |
|  | 12.8% | 13.6% | 28.0% | 3.0% | 42.4% | 0.2% | 100.0% |  |

Gender, education level, tooth brushing habit, smoking, khat chewing and shamaa use habits were associated with periodontal status. Forward stepwise regression analysis showed a significant association of periodontitis with gender, tooth brushing habit, and khat chewing (Table 2).

|  |  |
| --- | --- |
|  **Diagnosis** |  |
| **Table (2)** |  |  | **healthy** | **G** | **GCP** | **LAP** | **GG with LCP** | **GAP** | **Total** | **P** |
| **Gender** | Male |  | 10(3.1%) | 55(17.2%) | 95(29.7%) | 15(4.7%) | 145(45.3%) | 0(0.0%) | 320(100.0%) |  |
| Female |  | 70(23.0%) | 30(9.8%) | 80(26.2%) | 4(1.3%) | 120(39.3%) | 1(0.3%) | 305(100.0%) |
| **Age** | < 20 years |  | 10(9.1%) | 40(36.4%) | 25(22.7%) | 5(4.5%) | 30(27.3%) | 0(0.0%) | 110(100.0%) | .000\* |
| 20-29 years |  | 70(13.6%) | 45(8.7%) | 150(29.1%) | 14(2.7%) | 235(45.6%) | 1(0.2%) | 515(100.0%) |
| **Education** | Less |  | 0(0.0%) | 40(17.8%) | 72(32.0%) | 12(5.3%) | 100(44.4%) | 1(0.4%) | 225(100.0%) | .000\* |
| High-school |  | 10(5.3%) | 30(16.0%) | 58(30.9%) | 5(2.7%) | 85(45.2%) | 0(0.0%) | 188(100.0%) |
| Higher |  | 70(33.0%) | 15(7.1%) | 45(21.2%) | 2(0.9%) | 80(37.7%) | 0(0.0%) | 212(100.0%) |
| **Brushing** | Non |  | 0(0.0%) | 37(16.8%) | 74(33.6%) | 9(4.1%) | 99(45.0%) | 1(0.5%) | 220(100.0%) | .000\* |
| Irregular |  | 10(4.3%) | 38(16.4%) | 78(33.6%) | 0(0.0%) | 106(45.7%) | 0(0.0%) | 232(100.0%) |
| Regular |  | 70(41.2%) | 10(5.9%) | 20(11.8%) | 10(5.9%) | 60(35.3%) | 0(0.0%) | 170(100.0%) |
| **Smoking** | No |  | 80(15.3%) | 67(12.8%) | 141(27.0%) | 19(3.6%) | 215(41.1%) | 1(0.2%) | 523(100.0%) | .000\* |
| Yes |  | 0(0.0%) | 18(18.4%) | 30(30.6%) | 0(0.0%) | 50(51.0%) | 0(0.0%) | 98(100.0%) |
| **Khat chewing** | No |  | 80(29.6%) | 25(9.3%) | 65(24.1%) | 5(1.9%) | 95(35.2%) | 0(0.0%) | 270(100.0%) | .000\* |
| Yes |  | 0(0.0%) | 60(17.1%) | 105(30.0%) | 14(4.0%) | 170(48.6%) | 1(0.3%) | 350(100.0%) |
| **Shamaa use** | No |  | 80(14.9%) | 72(13.4%) | 140(26.1%) | 14(2.6%) | 229(42.7%) | 1(0.2%) | 80(14.9%) | .000\* |
|  | Yes |  | 0(0.0%) | 13(16.0%) | 27(33.3%) | 5(6.2%) | 36(44.4%) | 0(0.0%) | 0(0.0%) |  |

Overview on Plaque index (PI), gingival index (GI), pocket depth (PD), gingival recession and clinical attachments level (CAL) means are shown in Table 3. This Table shows that the healthy group demonstrates the lowest values of all examined parameters, whereas the AgP group shows the highest values.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table (3)****Diagnosis** | **Plaque index** | **gingival index** | **pocket depth(mm)** | **Recession** | **CAL** |
|  | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD |
| **H** |  | .00 ± 0.000 | .00 ± 0.000 | .00 ± 0.000 | .00 ± 0.000 | .00 ± 0.000 |
| **G** |  | 1.09±.395 | 1.40±.430 | .882±1.0537 | .24±.752 | 1.12±1.166 |
| **CP** |  | 1.52±.448 | 1.27±.517 | 3.743±1.9605 | 4.17±2.007 | 7.91±3.302 |
| **LAP** |  | 1.90±.520 | 1.40±.289 | 7.333±.5774 | 5.67±.577 | 8 ±6.928 |
| **GG with LP** |  | 1.44±.541 | 1.25±.522 | 2.434±2.7814 | 2.79±1.683 | 5.23±2.530 |
| **GAP** |  | 1.00± .00 | 1.80± . | 7.368±4.1157 | 2.60±2.322 | 9±6.9 |

**Discussion**

The term risk factor refers to characteristic of personal behavior or lifestyle, an environmental exposure, or an inherited characteristic, which is known, on the basis of epidemiologic evidence, to be linked with a health-related condition” ***(Last, 1988)***. Risk factors are portion of the causal chain for a specific disease or can lead to host exposure to a disease ***(Beck, 1994).*** This study reports the status of the periodontium in the general young population attending a dental hospital for a self‑perceived periodontal problem or referred by a dentist. Prevalence of periodontal diseases is based on disease definition or diagnostic criteria.

The prevalence of chronic periodontitis was 70.4% (mostly localized chronic periodontitis 42.4%) more than expected. The prevalence of AgP was 3.2% within the range reported in the US African Americans (2.8%) ***(Albandar JM, Kingman, 1999)***. ***Taani*** (***1995)*** stated that deep pockets were found only in 0.29% of the study sample on Jordanian adolescents. A higher prevalence of AgP (6.0%) were reported in Iraq ***(Albandar, 1989)*** as well as in Brazil (5.5%) ***(Susin et al., 2005)***.

Most participants were 20-29 years old, probably reflecting the large proportion of young individuals that most came to periodontal clinic. The prevalence of gingivitis (13.6%) was lower than expected, possibly because most participants less educated or because of the strict exclusion criteria. Our results demonstrated that most aggressive and chronic periodontitis patients were males, which may be attributed to poor attitude to wards health and bad habits. Whereas more healthy patients were females, which may be attributed to non-chewers khat and non-smokers. Studies in the past have shown that females have a better periodontal status and a more positive dental health behavior compared to males. Moreover, most smokers in china were males and that might make clear the higher prevalence of severe periodontitis among males than females ***(Sakki et al., 1998).***

Lack of oral hygiene among Yemeni shows a high prevalence of chronic periodontitis, which adds a further dimension to the consideration of periodontitis among Yemeni’s young population. It proves that there is a direct relationship between oral hygiene and periodontitis ***(Qi Zhang1 et al., 2014)***. Moreover, ***Al-Kholani, (2010)*** found that the mean oral hygiene index of chewers was (2.12 ± 0.86) while that of non-chewers was (1.54 ± 1.12). Patients education in terms of oral health and how they effectively brush their teeth and use interdental aids will definitely reduce the morphological changes that are associated with such habit.

Our study clearly showed that most participants were non-smokers and non-shama user, more likely reflecting the large proportion of young individuals in the Yemeni population are non-smokers and non-shama users. Whereas most of them are khat chewers and most of chewers have generalized gingivitis with localized periodontitis (48.6%) related to teeth of chewer side found mainly as gingival recession. This is consistent with previous findings of ***Alakhali, (2008);*** ***Al-Hajri (2013) and Ali, (2007)*** who found that the mean values of gingival recession for chewing side more than non-chewing sides.

Healthy gingivae were observed among those who were non khat-chewers 80(29.6%). The prevalence of gingivitis was higher among those who were khat-chewers 60(17.1%) when compared to non khat-chewers 25(9.3%) with statistically significant difference. Moreover, the prevalence of periodontitis was higher among those who were khat-chewers 82.9% compared to non khat-chewers 61.2% with p-value less than 0,05. Results of this study revealed that khat is too harmful to the periodontium as 79.5%, 31.8% and 6.4 of chewers had gum bleeding, periodontal pockets and gum recession respectively, while 48.7%, 12% and 1.9% of non-chewers had gum bleeding, periodontal pockets and gum recession respectively (p<0.05).

The prevalence of gingivitis was higher among cigarette smokers 18.4% compared to nonsmokers 12.8%. Also the prevalence of periodontitis was highest 81.6% in those who are smokers when compared to nonsmokers patients (71.9%) with statistically significant difference with P-value also less than 0.05. The present study observed that shamma use seem to influence periodontal disease. The results of the present study sustain the need for further extensive screenings that could clarify the influence of individual and population risk indicators and also provide more relevant information on the prevalence of periodontitis.

When education levels were compared to periodontal status, our study showed a positive association between higher education levels and better periodontal status. This is in accordance with ***Richard et al., (2000)*** who identified education level also a strong indicator of periodontal status.

**Refernces:**

Alakhali, M. (2008). Tooth lost and gingival recession as a risk factor of khat chewing in Yemen. Cairo Dental journal, 2, pp. 171- 76.

Albandar, J. (1989). Prevalence of incipient radiographic periodontal lesions in relation to ethnic background and dental care provisions in young adults. Journal of Clinical Periodontology, 16(10), pp.625-9.

Albandar, J. and Kingman, A. (1999). Gingival Recession, Gingival Bleeding, and Dental Calculus in Adults 30 Years of Age and Older in the United States, 1988-1994. Journal of Periodontology, 70(1), pp.30-43.

Albandar, J. (2005). Epidemiology and Risk Factors of Periodontal Diseases. Dental Clinics of North America, 49(3), pp.517-532.

Al-Bekairi, A., Abulaban, F., Qureshi, S. and Shah, A. (1991). The toxicity of Catha edulis (khat). A review. Fitoterapia, LXII, pp.291–300.

Al-Hajri, M (2013). Apoptosis due to Kaht chewing analysed by p53expression in gingival tissue. Egyption dental Journal, 59(3).

Al-Meshal, I.A., Ageel, A.M., Parmer, N.S., Tariq, M. (1985). Catha edulis (Khat): use, abuse, and current status of scientific knowledge. Fitoterapia, 56, pp.131–52.

Al-Mugahed, L. (2008). Khat chewing in Yemen: turning over a new leaf. Bulletin of the World Health Organization, 86(10), pp.741-742.

AL-Sharabi, A. (2002). Oral and para-oral lesions caused by takhazeen alqat (chewing). PhD. Khartoum University.

Armitage, G. (1996). Periodontal Diseases: Diagnosis. Annals of Periodontology, 1(1), pp.37-215.

Beck, J., Koch, G., Rozier, R. and Tudor, G. (1990). Prevalence and Risk Indicators for Periodontal Attachment Loss in a Population of Older Community-Dwelling Blacks and Whites. Journal of Periodontology, 61(8), pp.521-528.

Bergström, J. (1990). Oral hygiene compliance and gingivitis expression in cigarette smokers. European Journal of Oral Sciences, 98(6), pp.497-503.

Bergstrom, J. and Bostrom, L. (2001). Tobacco smoking and periodontal hemorrhagic responsiveness. Journal of Clinical Periodontology, 28(7), pp.680-685.

Borrell, L., Burt, B., Gillespie, B., Lynch, J. and Neighbors, H. (2002). Race and periodontitis in the US: beyond black and white. J Public Health Dent, 62, pp.92–101.

Borrell, L., Lynch, J., Neighbors, H., Burt, B. and Gillespie, B. (2002). Is there homogeneity in periodontal health between African Americans and Mexican Americans? Ethn Dis., 12(1), pp.97-110.

Borrell, L., Taylor, G., Borgnakke, W., Nyquist, L., Woolfolk, M., Allen, D. and Lang, W. (2003). Factors Influencing the Effect of Race on Established Periodontitis Prevalence. Journal of Public Health Dentistry, 63(1), pp.20-29.

Jensen, J., Goodson, W., Hopf, H. and Hunt, T. (1991). Cigarette smoking decreases tissue oxygen. Archives of Surgery, 126(9), pp.1131–1134.

Hassan, N., Gunaid, A., Murray-Lyon, I. (2007). Khat (Cantha edulis): health aspects of khat chewing. Eastern Mediterranean Health Journal, 13(3), pp.706-18.

Genco, R. (1996). Current View of Risk Factors for Periodontal Diseases. Journal of Periodontology, 67(10), pp.1041-1049.

Kalix, P. (1984). The pharmacology of khat. General Pharmacology: The Vascular System, 15(3), pp.179-187.

Kirby, A. (2017). [online] Available at: http://news.bbc.co.uk/2/hi/programmes/6530453.stm, 2007 [Accessed 4 Mar. 2017].

Kubota, M., Tanno-Nakanishi, M., Yamada, S., Okuda, K. and Ishihara, K. (2011). Effect of smoking on subgingival microflora of patients with periodontitis in Japan. BMC Oral Health, 11(1).

López-Marcos, J., García-Valle, S. and García-Iglesias, A. (2005). Periodontal aspects in menopausal women undergoing hormone replacement therapy. Med Oral Patol Oral Cir Bucal, 10(2), pp.132-141.

Locker, D. and Leake, J. (1993). Periodontal Attachment Loss in Independently Living Older Adults in Ontario, Canada. Journal of Public Health Dentistry, 53(1), pp.6-11.

Locker, D. and Leake, J. (1993). Risk Indicators and Risk Markers for Periodontal Disease Experience in Older Adults Living Independently in Ontario, Canada. Journal of Dental Research, 72(1), pp.9-17.

Mengel, R., Eigenbrodt, M., Schunemann, T. and Flores-de-Jacoby, L. (1996). Periodontal status of a subject sample of Yemen. Journal of Clinical Periodontology, 23(5), pp.437-443.

Nunn, M. (2003). Understanding the etiology of periodontitis: an overview of periodontal risk factors. Periodontology 2000, 32(1), pp.11-23.

Oliver, R., Brown, L. and Löe, H. (1998). Periodontal Diseases in the United States Population. Journal of Periodontology, 69(2), pp.269-278.

Rezavandi, K., Palmer, R., Odell, E., Scott, D. and Wilson, R. (2002). Expression of ICAM-1 and E-selectin in gingival tissues of smokers and non-smokers with periodontitis. Journal of Oral Pathology & Medicine, 31(1), pp.59-64.

Richard P, Gururajarao TR, Chava V. (2000). Influence of lifestyle, gender and socioeconomic status as determinants of dental health behavior, periodontal status awareness. JPFA, 14, pp.21-5.

Sakki, T., Knuuttila, M. and Anttila, S. (1998). Lifestyle, gender and occupational status as determinants of dental health behavior. Journal of Clinical Periodontology, 25(7), pp.566-570.

Schaudinn, C., Gorur, A., Keller, D., Sedghizadeh, P. and Costerton, J. (2009). Periodontitis: an archetypical biofilm disease. J Am Dent Assoc., 140(8), pp.978-86.

Slade, G. and Spencer, A. (1995). Periodontal attachment loss among adults aged 60+ in South Australia. Community Dentistry and Oral Epidemiology, 23(4), pp.237-242.

Socransky, S. and Haffajee, A. (1992). The Bacterial Etiology of Destructive Periodontal Disease: Current Concepts. Journal of Periodontology, 63(4s), pp.322-331.

Susin, C., Oppermann, R., Haugejorden, O. and Albandar, J. (2005). Tooth loss and associated risk indicators in an adult urban population from south Brazil. Acta Odontologica Scandinavica, 63(2), pp.85-93.

Taani, Q. (1995). The periodontal status of Jordanian adolescents measured by CPITN. Int Dent J, 45(6), pp.382-5.

Thomas, E., Van, D. and Sheilesh, D. (2005). Risk Factors for Periodontitis. J Int Acad Periodontol., 7(1), pp.3–7.

Vouros, I., Kalpidis, C., Chadjipantelis, T. and Konstantinidis, A. (2009). Cigarette smoking associated with advanced periodontal destruction in a Greek sample population of patients with periodontal disease. Journal of the International Academy of Periodontology, 11(4), pp.250–257.

Zhang, Q., Li, Z., Wang, C., Shen, T., Yang, Y., Chotivichien, S. and Wang, L. (2014). Prevalence and predictors for periodontitis among adults in China, 2010. Global Health Action, 7(1), p.24503.

Zini, A., Sgan-Cohen, H. and Marcenes, W. (2010). Socio-economic position, smoking, and plaque: a pathway to severe chronic periodontitis. Journal of Clinical Periodontology, 38(3), pp.229-235.