



The Open Dentistry Journal

Content list available at: <https://opendentistryjournal.com>



REVIEW ARTICLE

Modifiable and Non-modifiable Risk Factors Affecting Oral and Periodontal Health and Quality of Life in South Asia

Mohmed Isaqali Karobari¹, S Siddharthan², Abdul Habeeb Adil³, Mohammed Mansoor Khan⁴, Adith Venugopal⁵, Dinesh Rokaya^{6,*}, Artak Heboyan⁷, Charu Mohan Marya⁸ and Anand Marya^{9,10}

¹Conservative Unit, School of Dental Sciences, Health Campus, Universiti Sains Malaysia, Kubang 16150 Kerian, Kelantan, Malaysia

²Faculty of Medicine, UniSZA, Kuala Terengganu, Malaysia

³Department of Community Dentistry, School of Dental Sciences, Health Campus, Universiti Sains Malaysia, Kubang 16150 Kerian, Kelantan, Malaysia

⁴Consultant Endodontist, Coral Dental Speciality Clinic, Vijayanagar Colony, Hyderabad, 500028, Telangana, India

⁵Department of Orthodontics, Faculty of dentistry, University of Puthisastra, Phnom Penh, Cambodia

⁶Department of Clinical Dentistry, Walailak University International College of Dentistry, Walailak University, Bangkok10400, Thailand

⁷Department of Prosthodontics, Faculty of Stomatology, Yerevan State Medical University after Mkhitar Heratsi, Str. Koryun 2, Yerevan 0025, Armenia

⁸Department of Public Health Dentistry, Sudha Rustagi College of Dental Sciences and Research, Haryana, India

⁹Department of Orthodontics, Faculty of dentistry, University of Puthisastra, Phnom Penh, Cambodia

¹⁰Center for Transdisciplinary Research, Saveetha Dental College, Saveetha Institute of Medical and Technical Science, Saveetha University, Chennai, India

Abstract:

Objectives:

The study aimed to review the prevalence of periodontal disease and associated factors among developing South Asian countries. The review was also aimed at providing an insight into how such factors play a role in affecting the Quality of life of patients with compromised oral health.

Background:

It has been observed that Oral health directly correlates with the Quality of life of an individual, so it is imperative to understand this, particularly in the developing parts of the world.

Methods:

A MeSH keyword search was carried out with the keywords: Periodontal diseases, Oral Health, Public Health, Asia, QoL, Quality of Life, Southeast Asia, Tobacco, and Risk Factors, and based on the findings, this detailed review was compiled.

Results:

The South Asian population forms 24.89% of the world population, while periodontal disease is an inflammatory condition that affects 11% of the globe. Several studies previously conducted across developing countries have shown that various factors like the socioeconomic status of an individual, smoking habit, consumption of alcohol, hypertension, history of diabetes, obesity, and stress are indirectly related to the onset of periodontal disease. Characteristics associated with specific populations like ethnicity, behavioral characteristics, and environmental factors may affect causing periodontitis.

Conclusion:

Dental practitioners in this region should consider risk factors that can be altered significantly to uplift the periodontal health status of an individual, which is not being considered in many developing countries.

Keywords: Oral health, Public health, Tobacco, Risk factors, Smoking habit, Periodontal health.

Article History

Received: March 3, 2022

Revised: August 20, 2022

Accepted: August 26, 2022

1. INTRODUCTION

Oral health disorders are considered to have a widespread presence, associated with a high rate of morbidity. While dental caries is prominent around the globe, nearly 15% of the adult population is greatly affected by severe periodontal disease [1]. The periodontium is a structure that holds and supports teeth and is formed by four components: the cementum, gingiva, periodontal ligaments, and the alveolar bone. Together, these four components act as a single unit to grasp the teeth and provide a supportive role [2]. Periodontal disease is an inflammatory condition that damages tissues that surround the teeth [3]. Histological alteration in gums occurs throughout the periodontal disease development and appears as sub-clinical inflammation. If the initial lesion is left untreated, the disorder progresses to form a chronic lesion. When a chronic lesion persists, bone tissue and ligaments of the periodontium are involved, and changes to the periodontal structure begin [4]. Ramseier and his colleagues in the year 2009 reported that the development of the disease is irregular, *i.e.*, An exacerbation period followed by a remission period [5]. On the flip side, Mohamed and his colleagues in 2013 proposed that the action is persistent, with inconsistent episodes of exacerbation and remission [6].

Periodontal disease begins with gingivitis, an inflammatory process caused by bacteria in dental plaque, a microbial biofilm that forms on teeth and gingiva. Gingivitis is caused by plaque, which results in soft tissue inflammation, with no attachment loss and firm periodontium [7]. Chronic periodontitis occurs because of untreated gingivitis, resulting in deep periodontal pockets that may eventually cause tooth loss. Periodontal disease is associated with systemic conditions like atherosclerosis and diabetes mellitus [8]. Microorganisms found in dental plaque play a significant role that rapidly advances the development of periodontal disease in an individual.

Chronic periodontitis is classified into two conditions: generalized and localized. When the condition damages more than 10 teeth in a person's dentition, it is diagnosed as generalized chronic periodontitis, while localized chronic periodontitis affects less than 10 teeth. Gingivitis and chronic periodontitis progress occur by forming dental plaque, which is influenced by environmental factors, microbial biofilm, and genetic factors [8]. Periodontal diseases are commonly found in emerging nations like India. Lack of awareness of oral health, poor socioeconomic status, improper or lack of dental office visits, and poor literacy results in the widespread presence of periodontal disease [7].

If allowed to persist, periodontal disease results in obliteration of hard and soft tissues that eventually result in pocket formation and recession of gingiva [9]. It has been found that periodontal disease is a critical health problem as it has a direct relationship with systemic diseases like cardiovascular disease, diabetes mellitus, prematurely born infants with low birth weight, respiratory disease, and cerebral infarction [7]. Any negative change to the periodontal health of

an individual can impact the quality of life of an individual, even though interventional treatment can help correct this in many cases. Since there is a lack of a specific oral health-related quality of life instrument, this review was prepared to provide an understanding of the situation in Southeast Asia with a special focus on periodontal health.

2. SOUTH ASIAN PERSPECTIVE ON PERIODONTAL AND ORAL HEALTH

Even though oral and periodontal health concerns exist in many developed countries, they still have not been explored and understood in the South Asia region, including Nepal, India, Bangladesh, Cambodia, Myanmar, and Sri Lanka [10, 11]. Previous studies have also shown that migrants from South Asian countries pose a significant dental healthcare challenge as their attitude towards treatment is derived from their ethnic origin, culture, and experience [12, 13]. While several studies have been conducted across developed countries to analyze oral health attitudes, habits, and knowledge, there have been no reviews on the risk factors associated with these problems in developing countries. Therefore, this review was planned to synthesize evidence related to periodontal disease-causing risk factors across the South Asian region.

Since achieving good oral health is a worldwide goal, cultural, community, and individual aspects of various populations must be considered. The first step must be to identify and analyze regional risk factors that lead to lower oral and periodontal health standards in this region to set guidelines for new oral health programs in South Asia. Healthcare plans that encourage preventive care for periodontal disease should be given importance to bring about more awareness among the general public towards risk factors such as smoking, socioeconomic status, stress, and their direct impact on the general health of an individual [14].

3. INFLUENCE OF PERIODONTAL HEALTH ON SYSTEMIC HEALTH

In 2000, the Surgeon General of the United States of America emphasized that good oral health is crucial for general well-being [15]. In 2007 the World Health Organization board of executives recognized the relationship between general health, Quality of life, and oral health [16]. Current evidence shows the association between periodontitis and sporadic late-onset Alzheimer's disease, demonstrating epidemiologic, microbiologic, and inflammatory characteristics [17]. The link between periodontitis and the formation of peptic ulcers has been studied, and one of the etiological factors in such cases is the constant use of drugs like aspirin and nonsteroidal anti-inflammatory drugs (NSAIDs), alcohol consumption, and smoking [18]. Over time research has shown that periodontal problems lead to long-term issues such as erectile dysfunction, premature deliveries, osteoporosis, and preeclampsia [19 - 22].

4. RISK FACTORS INFLUENCING PERIODONTAL DISEASE IN THE SOUTHEAST ASIAN REGION

4.1. Oral Health Status

While oral health problems affect more than half the

* Address correspondence to this author at the Department of Clinical Dentistry, Walailak University International College of Dentistry, Walailak University, Bangkok 10400, Thailand; E-mail: dineshrokaya115@hotmail.com

world's population, chronic periodontitis affects more than 7% of the global population, making them a significant cause of concern [23]. South Asian countries such as India have reported a higher periodontal and oral problems incidence than their neighboring countries [24]. Previous research has shown that the prevalence of tooth decay and periodontal diseases was approximately 65% in rural areas in India [25]. Even after widespread periodontal and dental problems, the National non-communicable disease programs still do not include managing oral health problems.

4.2. Age

Many studies have stated that the prevalence of periodontal disease has been found to increase with advancing age [26]. Papapanou and his colleagues in the year 1989 found that the mean loss of bone in 70-year-old individuals was 0.28 mm, while it was only 0.07 mm among 25-year-old subjects [27]. Studies conducted in developed countries have described changes in periodontal disease progression patterns with a corresponding increase in age. Studies found that the destruction of periodontal structures and loss of bone is rarely found among subjects below 40 years of age. Whereas, in the elderly population, it was observed that advanced periodontal conditions led to a comparatively more rapid disintegration of periodontal structures [28]. The elderly population is physically vulnerable and often systemically and dentally compromised in the South Asian region [29].

4.3. Gender Predilection

Various studies have found increased destruction of periodontal structures in male population samples compared with females. This may be attributed to ignorance of oral hygiene measures in males compared to females, especially in low-income developing countries [30]. This association has not been established clearly, and any direct or indirect effects related to gender predilection of periodontal diseases must be investigated further.

4.4. Socioeconomic Status (SES)

The link between socioeconomic status and periodontal disease has been demonstrated in several studies. Low

socioeconomic status is associated with gingival and periodontal pathological conditions. Conversely, high educational qualifications and living standards have been shown to positively influence the periodontal health of an individual [31]. However, this factor varies widely and needs to be analyzed in detail across different targeted demographic groups across South Asia (Table 1) [32].

4.5. Culture and Literacy

Periodontal health is directly associated with an individual's education level. Previous studies have shown that individuals with a relatively high level of education have less predisposition toward periodontal disease [28]. Various studies conducted among populations of different races concluded that there is varied periodontal disease prevalence among different country races [28]. Although race and hereditary factors cannot be modified for a specific population, genetic linkage can risk periodontal disease among developing populations.

4.6. Alcohol

Several researchers have studied the association between behavior, improper oral hygiene, and severity of periodontal disease in alcohol-consuming individuals. Previous evidence shows that alcohol has a direct effect on the host's defense [33]. This is because of complement deficiency, improper neutrophil action (declined adherence, phagocytotic activity, and motility), and infection predisposition. Alcohol has a degenerating effect on hepatic activities such as prothrombin production, vitamin K activity, clotting, and hemorrhage [33]. Discoloration of gingiva, inflammation and bleeding are common among individuals who consume alcohol regularly [33]. A combination of vitamin B-complex and protein deficiency is common among alcohol-consuming individuals. It has also been observed that ethanol initiates bone resorption and inhibits bone formation. Based on results obtained from a previous study, the Alcohol per capita consumption in many South Asian countries exceeded the global average by an alarming margin [34]. Therefore, detailed National monitoring systems must be established in these countries to collect data on periodontal and oral health problems arising from alcohol consumption. This data can formulate policies and set up rehabilitation programs with government support.

Table 1. The socioeconomic and health expenditure profile of Southeast Asian countries [32].

Country	Population	Life Expectancy	Health Expenditure (% of GDP)	GDP Per Capita (USD)
Brunei Darussalam	430,000	77	2.5	73,200
Cambodia	15,709,000	64	7.5	3,300
Indonesia	255,994,000	72	3.1	10,600
Lao PDR	6,912,000	64	2	5000
Malaysia	30,514,000	75	4	24,700
Myanmar	56,320,000	66	1.8	4,700
Philippines	100,998,000	69	4.4	7000
Singapore	5,674,000	85	4.6	82,800
Thailand	67,946,000	74	4.6	14,400
Vietnam	94,349,000	73	6	5,600

Table 2. An overview of the gender-wise tobacco consumption in Southeast Asia [44].

Country	Smoking	
	Male %	Female%
Brunei Darussalam	36.3	3.7
Cambodia	32.9	2.4
Indonesia	66	6.7
Lao PDR	50.8	7.1
Malaysia	43	1.4
Myanmar	43.8	8.4
Philippines	41.9	5.8
Singapore	21.1	3.4
Thailand	37.7	1.7
Vietnam	45.3	1.1

4.7. Tobacco Smoking

There is enough evidence to prove that individuals who smoke have a higher predisposition to periodontal destruction [35]. Consumption of tobacco-based products on a long-term basis has led to periodontal disease progression [36]. Risk factors like smoking alter the host immune response, inhibiting bacteria's activity and forming dental plaque [37]. Smoking individuals with periodontal disease do not present with inflammatory signs and bleeding of the gingiva because nicotine consumption is responsible for local vasoconstriction and declined blood flow [28, 38]. According to a previous study, the Southeast Asian region houses 400 million tobacco users, of which the males form the majority of the smokers, while their female counterparts indulge in smokeless tobacco use [39]. In South Asian countries such as Bangladesh, three out of five adults were exposed to second-hand smoke [40]. An area of grave concern is the mortality caused by tobacco consumption, which was found to be approximately 135000 each year according to previously obtained data [41]. In countries such as India, Sri Lanka, and Myanmar, there is high consumption of smokeless tobacco, which is highly addictive [42]. Tobacco consumption claims more than 1.6 million lives in the Southeast Asian region annually, which also ranks among the largest producers of such products [43]. The Southeast Asian region accounts for 81% of the world's smokeless tobacco users and more than 22% of the adult smokers globally, which makes it a worrying problem [43] (Table 2) [44].

5. INFLUENCE OF PERIODONTAL HEALTH ON QUALITY OF LIFE

Periodontal disease is a dormant disease that does not show many clinical characteristics unless severe progression occurs. Geriatric research has shown that older adults lack nutrition due to loss of teeth and deteriorated periodontal health [45]. Conditions such as loss of teeth, loss of bone, and gingival recession directly impact aesthetics and indirectly influence an individual's quality of life [46]. The periodontal health status of an individual is essential to maintain the teeth firmly in their place. When periodontal health is ignored, halitosis becomes a barrier to an individual's social well-being [47]. Improper alignment of teeth again leads to bad aesthetics, which might hinder the social capabilities of a person and affect different aspects of one's life, such as employment, speaking arrangements, and public image [8]. Several studies have been

conducted to help associate an individual's periodontal health with cardiovascular disease, stress, and obesity. Periodontal health and pregnancy have a similar relationship with metabolic syndrome and inflammatory response [8].

CONCLUSION

To summarize, periodontal health literacy levels are low among the South Asian population, and many practices are influenced by age, literacy, and culture. The factors mentioned above must be considered if preventive and interventional programs are planned in this region to improve periodontal health. There needs to be an in-depth analysis of cultural factors across this region to understand and implement periodontal health improvement programs.

Though the periodontal disease has a direct and indirect association with various systemic conditions, its importance is only being realized in developing regions such as South Asia in the past few years. Factors like tobacco usage and alcohol consumption significantly affect periodontal health. The risk factors that can be altered must be included in public health awareness campaigns to understand better individuals who indulge in a few or many of these habits. This review details the factors that influence periodontal health both directly and indirectly and helps get a better understanding of how to improve the Quality of life.

LIST OF ABBREVIATIONS

- WHO** = World Health Organization
NSAIDs = Nonsteroidal Anti-Inflammatory Drugs
SES = Socioeconomic Status

CONSENT FOR PUBLICATION

Not applicable.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

- [1] The Lancet. Oral health: Prevention is key. *Lancet* 2009; 373(9657): 1. [http://dx.doi.org/10.1016/S0140-6736(08)61933-9] [PMID: 19121705]
- [2] Tobón ASI, Isaza GDM, Restrepo CEM, Zapata MSM, Martínez PMC. Association of salivary levels of the bone remodelling regulators sRANKL and OPG with periodontal clinical status. *J Clin Periodontol* 2012; 39(12): 1132-40. [http://dx.doi.org/10.1111/jcpe.12012] [PMID: 23039038]
- [3] Santos VR, Lima JA, Gonçalves TED, *et al.* Receptor activator of nuclear factor-kappa B ligand/osteoprotegerin ratio in sites of chronic periodontitis of subjects with poorly and well-controlled type 2 diabetes. *J Periodontol* 2010; 81(10): 1455-65. [http://dx.doi.org/10.1902/jop.2010.100125] [PMID: 20476881]
- [4] Taylor JJ. Protein biomarkers of periodontitis in saliva. *ISRN Inflamm* 2014; 2014: 593151. [http://dx.doi.org/10.1155/2014/593151] [PMID: 24944840]
- [5] Ramseier CA, Kinney JS, Herr AE, *et al.* Identification of pathogen and host-response markers correlated with periodontal disease. *J Periodontol* 2009; 80(3): 436-46. [http://dx.doi.org/10.1902/jop.2009.080480] [PMID: 19254128]
- [6] Mohamed HG, Idris SB, Ahmed MF, *et al.* Association between oral health status and type 2 diabetes mellitus among Sudanese adults: A matched case-control study. *PLoS One* 2013; 8(12): e82158. [http://dx.doi.org/10.1371/journal.pone.0082158] [PMID: 24349205]
- [7] Bansal A, Ingle NA, Kaur N, Ingle E, Charania Z. Effect of gum massage therapy with honey and olive oil on common pathogenic oral microorganisms: A randomized controlled clinical trial. *J Int Oral Health* 2015; 7(11): 63.
- [8] Kinane DF, Stathopoulou PG, Papapanou PN. Periodontal diseases. *Nat Rev Dis Primers* 2017; 3(1): 17038. [http://dx.doi.org/10.1038/nrdp.2017.38] [PMID: 28805207]
- [9] Kuehl K. The relationship between oral infection, systemic disease, mortality, and life-history events Doctoral dissertation. 2019. Available from: http://mars.gmu.edu/bitstream/handle/1920/11571/Kuehl_thesis_2019.pdf?isAllowed=y&sequence=1
- [10] Kandelman D, Arpin S, Baez RJ, Baehni PC, Petersen PE. Oral health care systems in developing and developed countries. *Periodontol* 2000 2012; 60(1): 98-109. [http://dx.doi.org/10.1111/j.1600-0757.2011.00427.x] [PMID: 22909109]
- [11] World Health Organization. What is the burden of oral disease? Available from: http://www.who.int/oral_health/disease_burden/global/en/ (Accessed on: 12 July 2018).
- [12] Arora G, Mackay DF, Conway DI, Pell JP. Ethnic differences in oral health and use of dental services: Cross-sectional study using the 2009 adult dental health survey. *BMC Oral Health* 2017; 17(1): 1. [http://dx.doi.org/10.1186/s12903-016-0228-6] [PMID: 27412290]
- [13] Williams SA, Summers RM, Ahmed IA, Prendergast MJ. Caries experience, tooth loss and oral health-related behaviours among Bangladeshi women resident in West Yorkshire, UK. *Community Dent Health* 1996; 13(3): 150-6. [PMID: 8897738]
- [14] Petersen PE, Bourgeois D, Ogawa H, Estupinan DS, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull World Health Organ* 2005; 83(9): 661-9. [PMID: 16211157]
- [15] US Department of Health and Human Services. Oral health in America: A report of the surgeon general. *J Calif Dent Assoc* 2000; 28(9): 685-95.
- [16] Petersen PE. World Health Organization global policy for improvement of oral health - World Health Assembly 2007. *Int Dent J* 2008; 58(3): 115-21. [http://dx.doi.org/10.1111/j.1875-595X.2008.tb00185.x] [PMID: 18630105]
- [17] Gurav AN. Alzheimer's disease and periodontitis - An elusive link. *Rev Assoc Med Bras* 2014; 60(2): 173-80. [http://dx.doi.org/10.1590/1806-9282.60.02.015] [PMID: 24919005]
- [18] Boylan MR, Khalili H, Huang ES, *et al.* A prospective study of periodontal disease and risk of gastric and duodenal ulcer in male health professionals. *Clin Transl Gastroenterol* 2014; 5(2): e49. [http://dx.doi.org/10.1038/ctg.2013.14] [PMID: 24522171]
- [19] Sharma A, Pradeep AR, Raju P A. Association between chronic periodontitis and vasculogenic erectile dysfunction. *J Periodontol* 2011; 82(12): 1665-9. [http://dx.doi.org/10.1902/jop.2011.110049] [PMID: 21513476]
- [20] López NJ, Da Silva I, Ipinza J, Gutiérrez J. Periodontal therapy reduces the rate of preterm low birth weight in women with pregnancy-associated gingivitis. *J Periodontol* 2005; 76(11Suppl.): 2144-53. [http://dx.doi.org/10.1902/jop.2005.76.11-S.2144]
- [21] Ruggiero SL. Special Committee on Medication Related Osteonecrosis of the Jaws. Illinois, United States: American Association of Oral and Maxillofacial Surgeons 2014; pp. 1-26.
- [22] Sanchez RL, Jones DC, Cullen MT. Urinary calcium as an early marker for preeclampsia. *Obstet Gynecol* 1991; 77(5): 685-8. [PMID: 2014080]
- [23] Kassebaum NJ, Smith AGC, Bernabé E, *et al.* Global, regional, and national prevalence, incidence, and disability-adjusted life years for oral conditions for 195 countries, 1990–2015: A systematic analysis for the global burden of diseases, injuries, and risk factors. *J Dent Res* 2017; 96(4): 380-7. [http://dx.doi.org/10.1177/0022034517693566] [PMID: 28792274]
- [24] Balaji SM. Burden of dental diseases in India as compared to South Asia: An insight. *Indian J Dent Res* 2018; 29(3): 374-7. [http://dx.doi.org/10.4103/ijdr.IJDR_333_18] [PMID: 29900925]
- [25] Mathur VP, Shah N, Kant S, *et al.* Prevalence of dental caries and periodontal disease in a rural area of Faridabad District, Haryana, India. *Indian J Dent Res* 2017; 28(3): 242-7. [http://dx.doi.org/10.4103/ijdr.IJDR_370_16] [PMID: 28721985]
- [26] Mack F, Mojon P, Budtz JE, *et al.* Caries and periodontal disease of the elderly in Pomerania, Germany: Results of the study of health in pomerania. *Gerodontology* 2004; 21(1): 27-36. [http://dx.doi.org/10.1046/j.1741-2358.2003.00001.x] [PMID: 15074537]
- [27] Papapanou PN, Wennström JL. Radiographic and clinical assessments of destructive periodontal disease. *J Clin Periodontol* 1989; 16(9): 609-12. [http://dx.doi.org/10.1111/j.1600-051X.1989.tb02146.x] [PMID: 2794096]
- [28] AlJehani YA. Risk factors of periodontal disease: Review of the literature. *Int J Dent* 2014; 2014: 182513. [http://dx.doi.org/10.1155/2014/182513] [PMID: 24963294]
- [29] Razak PA, Richard KM, Thankachan RP, Hafiz KA, Kumar KN, Sameer KM. Geriatric oral health: A review article. *J Int Oral Health* 2014; 6(6): 110-6. [PMID: 25628498]
- [30] Meisel P, Reifenberger J, Haase R, Nauck M, Bandt C, Kocher T. Women are periodontally healthier than men, but why don't they have more teeth than men? *Menopause* 2008; 15(2): 270-5. [http://dx.doi.org/10.1097/gme.0b013e31811ecce0a] [PMID: 17917610]
- [31] Susin C, Oppermann RV, Haugejorden O, Albandar JM. Tooth loss and associated risk indicators in an adult urban population from south Brazil. *Acta Odontol Scand* 2005; 63(2): 85-93. [http://dx.doi.org/10.1080/00016350510019694] [PMID: 16134547]
- [32] Duangthip D, Gao SS, Lo ECM, Chu CH. Early childhood caries among 5- to 6-year-old children in Southeast Asia. *Int Dent J* 2017; 67(2): 98-106. [http://dx.doi.org/10.1111/idj.12261] [PMID: 27753083]
- [33] Tezal M, Grossi SG, Ho AW, Genco RJ. The effect of alcohol consumption on periodontal disease. *J Periodontol* 2001; 72(2): 183-9. [http://dx.doi.org/10.1902/jop.2001.72.2.183]
- [34] Monzavi SM, Afshari R, Rehman N. Alcohol related disorders in Asia Pacific region: Prevalence, health consequences and impacts on the nations. *Asia Pac J Med Toxicol* 2015; 4: 56101077.
- [35] Kubota M, Tanno NM, Yamada S, Okuda K, Ishihara K. Effect of smoking on subgingival microflora of patients with periodontitis in Japan. *BMC Oral Health* 2011; 11(1): 1. [http://dx.doi.org/10.1186/1472-6831-11-1] [PMID: 21208407]
- [36] Zini HD, Sgan C, Marcenes W. Socioeconomic position, smoking, and plaque: A pathway to severe chronic periodontitis. *J Clin Periodontol* 2011; 38(3): 229-35. [http://dx.doi.org/10.1111/j.1600-051X.2010.01689.x] [PMID: 21198768]
- [37] Ozçaka O, Bıçakçı N, Pussinen P, Sorsa T, Köse T, Buduneli N. Smoking and matrix metalloproteinases, neutrophil elastase, and

- myeloperoxidase in chronic periodontitis. *Oral Dis* 2011; 17(1): 68-76.
- [38] Wang QY, Cai C, Duan YZ, Wang XJ. Nicotinic acetylcholine receptor but not acetylcholinesterase plays an important role in nicotine-related periodontitis. *Med Hypotheses* 2010; 74(5): 954-5. [http://dx.doi.org/10.1016/j.mehy.2009.12.013] [PMID: 20047798]
- [39] Regional Office for South-East Asia. In: *The WHO FCTC Indicators: Global Tobacco Survey*. New Delhi, India: World Health Organization 2011.
- [40] Palipudi K, Choudhury S, Andes L, Sinha DN, Mustafa Z, Asma S. Exposure to tobacco smoke among adults in Bangladesh. *Indian J Public Health* 2011; 55(3): 210-9. [http://dx.doi.org/10.4103/0019-557X.89942] [PMID: 22089689]
- [41] Öberg M, Jaakkola MS, Woodward A, Peruga A, Prüss UA. Worldwide burden of disease from exposure to second-hand smoke: A retrospective analysis of data from 192 countries. *Lancet* 2011; 377(9760): 139-46. [http://dx.doi.org/10.1016/S0140-6736(10)61388-8] [PMID: 21112082]
- [42] Sinha D, Rolle I, Rinchen S, Palipudi KM, Asma S. Tobacco use among youth and adults in member countries of South-East Asia region: Review of findings from surveys under the global tobacco surveillance system. *Indian J Public Health* 2011; 55(3): 169-76. [http://dx.doi.org/10.4103/0019-557X.89946] [PMID: 22089684]
- [43] World Health Organization. *Tobacco Control in South-East Asia Region*. World Health Organization Available from: <https://www.who.int/southeastasia/health-topics/tobacco/tobacco-control-in-the-south-east-asia-region>
- [44] World Health Organization. *Global NCD target reduce tobacco use*. In: *Policy Brief*. Geneva: World Health Organization 2016.
- [45] Sheiham A, Steele JG, Marcenes W, Tsakos G, Finch S, Walls AWG. Prevalence of impacts of dental and oral disorders and their effects on eating among older people; A national survey in Great Britain. *Community Dent Oral Epidemiol* 2001; 29(3): 195-203. [http://dx.doi.org/10.1034/j.1600-0528.2001.290305.x] [PMID: 11409678]
- [46] AlSeraidi M, Hansa I, Dhaval F, Ferguson DJ, Vaid NR. The effect of vestibular, lingual, and aligner appliances on the quality of life of adult patients during the initial stages of orthodontic treatment. *Prog Orthod* 2021; 22(1): 3. [http://dx.doi.org/10.1186/s40510-020-00346-0] [PMID: 33458787]
- [47] Buunk WY, Le Clercq DM, Verheggen UE, de Jong N, Spreen M. Halitosis, and oral health related quality of life: A case report. *Int J Dent* 2012; 10(1): 3-8.

