

Tooth loss patterns in hypertensive patients with chronic periodontitis

ABSTRACT

Aim: The aim of the study is to study the tooth loss pattern in patients with chronic periodontitis and hypertension.

Study design: Retrospective cohort study

Materials and methods: The case sheet records (DIAS data) of tooth loss pattern in hypertensive patients with chronic periodontitis were extracted. A total of 1318 case sheets were analysed for the study. Age, gender and tooth loss pattern with respect to the region were collected and statistically analysed. Descriptive statistics (Percentage, Mean, Standard deviation) and Inferential test (Chi-square test) were performed to determine the association between age, gender and tooth loss pattern in patients with chronic periodontitis and hypertension.

Results: The results showed that that females were affected more with tooth loss with hypertension with chronic periodontitis when compared to males. According to age, patients between 50 to 70 years with chronic periodontitis and hypertension were more affected by tooth loss (p value = 0.001 ($p < 0.05$; Statistically significant)).

Conclusion: The present study highlighted a possible relationship between hypertension and tooth loss due to chronic periodontitis. Loss of mandibular posterior teeth were more common and females were more prone to tooth loss than males with hypertension due to chronic periodontitis. However, the underlying mechanism has to be further investigated in a different study design, thus more conclusive findings would be elucidated.

Keywords: Hypertensive patients; Chronic periodontitis; Innovative technique; Tooth loss pattern

1. INTRODUCTION

A beautiful smile is due to the harmonious relationship between the components of the oral cavity such as lips, teeth, and gingiva for all individuals. Factors hindering this smile among the population is generally tooth loss. Tooth loss is a multifactorial process involving dental caries, periodontal disease, a variety of socio environmental factors, educational levels, access to care and insurance status and general health status

Hypertension is a major global health disorder affecting about 972 million adults in 2000 and expected to increase to 1.56 billion by the year 2025 [1]. Meanwhile periodontal disease is a group of chronic inflammatory diseases involving soft tissues and bone surrounding the teeth, known as periodontium. It is characterized by inflammation of tooth supporting tissues caused by bacterial infection [2]. Gingivitis is a reversible condition manifested as redness, gum swelling and may progress to periodontitis if left untreated.

Periodontal disease is the second most common oral disease alongside dental caries in Malaysia and worldwide [3]. Hypertension and periodontitis share some common risk factors, such as increased age, smoking, stress and socioeconomic factors. These risk factors may confound the association of the two diseases [4]

Since periodontal diseases may contribute to endothelial dysfunction as a result of inflammation, it has been identified as a risk factor for hypertension [5]. Therefore, periodontitis is known to be an important risk factor for cardiovascular disease including stroke [6], peripheral artery disease [7] as well as coronary heart disease [8]. Our team has extensive knowledge and research experience that

has translate into high quality publications.[9–21],[22–26] [27] [28]. This study aims to analyse the tooth loss pattern in hypertensive patients with chronic periodontitis.

2. MATERIALS AND METHODS

The data comprising of demographic details and tooth loss pattern in hypertensive patients with chronic periodontitis were collected from the duration of June 2019 to April 2020. A total of 1348 case sheets were analysed. The samples were collected by simple random sampling method. Cross verification of data was done. FDI tooth numbering system was followed in this study. Incomplete and censored data were excluded. The analysis was done using SPSS version 19. The dependent variables were the number of missing teeth. The independent variables were age and gender. The data was statistically analysed using the Chi- square test. The level of significance was set at 0.05.

3. RESULTS AND DISCUSSION

The result showed that the majority of the hypertensive patients with chronic periodontitis were with missing posterior teeth, in which mandibular first molars were most common followed by maxillary first molars and mandibular and maxillary second molar. The results indicated that female patients with hypertension and chronic periodontitis were affected more with tooth loss than males [Figure 1]. And also, patients between the age group of 50 to 70 years old were affected more with tooth loss than other age groups [Figure 2]. The comparison of age of the patients and gender of the patients with the number of missing teeth were statistically significant [$p < 0.05$]

Previous studies have reported that the prevalence of chronic periodontitis with hypertension was 16% [29]. Another study found that 22% of patients were presented with moderate periodontal disease and 68% were presented with severe periodontal disease [30].

Previous literatures have reported that the prevalence of hypertension were 18.7% in absence of periodontitis, 35.1% in mild periodontitis, 32.3% in moderate periodontitis and 52.8% in severe periodontitis groups. This evidence indicates there is an association between hypertension and periodontitis [31]. A more severe periodontitis may lead to the patient having a higher risk of developing hypertension. A moderate to severe periodontal disease (odds ratio: 1.22; 95% CI: 1.10–1.35) and severe periodontal disease (odds ratio: 1.49; 95% CI: 1.09–2.05) were associated with hypertension [32].

Several studies have reported an association between tooth loss and hypertension.[33],[34] Mustafa Al-Ahmad BE et al. in a cross-sectional study found that tooth loss is significantly associated with hypertension in postmenopausal women[35]. A study in Korean population found interaction between tooth loss and ischemic stroke[36]. In a short-term prospective cohort study, a significant association was found between the presence of periodontal disease and hypertension in Japanese university students. But, the risk of prehypertension was not associated with presence of periodontal disease[37]. A recent systematic review reported that the evidence suggesting that the treatment of inflammatory diseases like periodontitis could reduce blood pressure is inconclusive. The authors opinioned that oral health assessment and management of periodontal disease could not only improve oral and overall health and quality of life but also be of relevance in the management of patients with hypertension[32]. A systematic review assessing evidence from Mendelian randomization and a randomized controlled trial of nonsurgical periodontal therapy reported a causal relationship between periodontitis and BP was observed. The authors suggested that this provides proof of concept for the development of clinical trials in a large cohort of hypertensive patients[38]. Several studies reported that hypertensive subjects exhibited a more detrimental periodontal status compared to control subjects [39] [40] [41].

The limitations of this study was small sample size and it is a single centered study. It does not represent all ethnic groups or populations. The future scope is to study a larger population and among different ethnic groups. The study further aims at creating awareness and special preventive therapeutic measures for hypertensive patients.

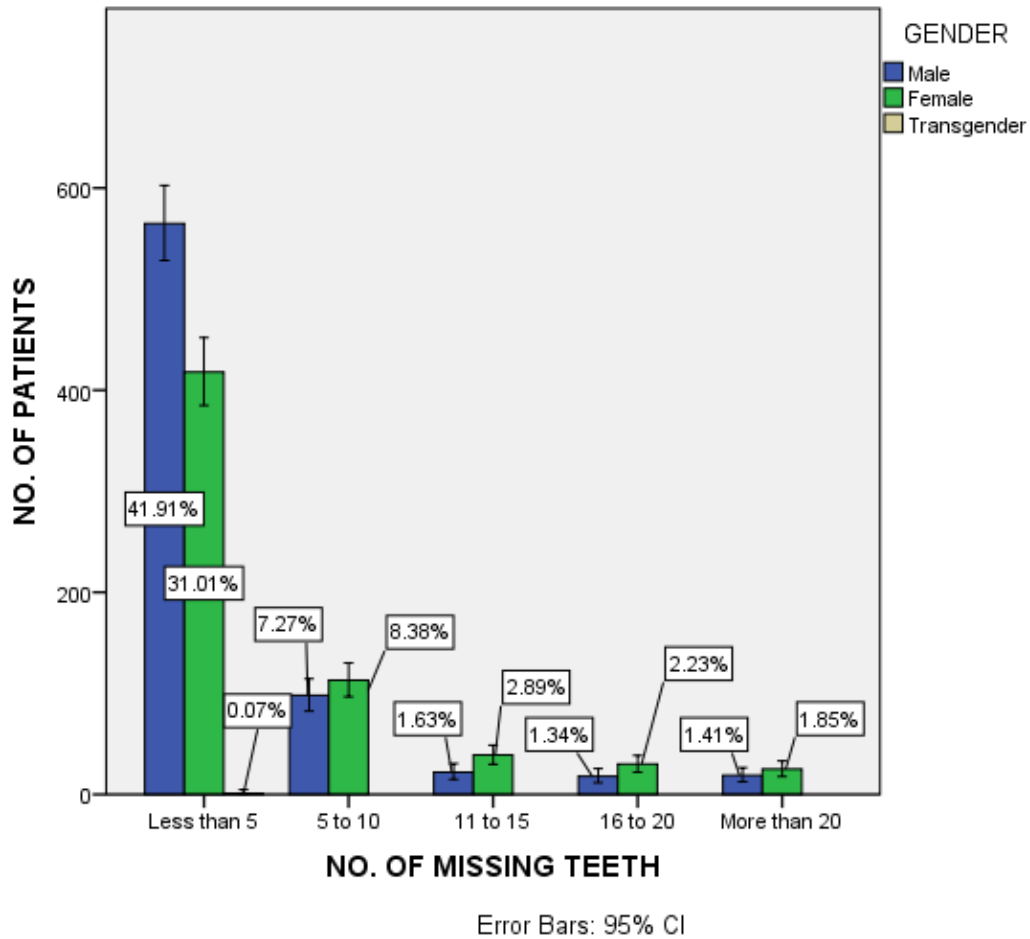


Fig. 1. The bar graph represents the comparison of gender of the patients and the number of missing teeth. The X- axis represents the number of missing teeth and the Y- axis represents the number of patients. The colour blue represents males, green colour represents females and yellow colour represents transgender.

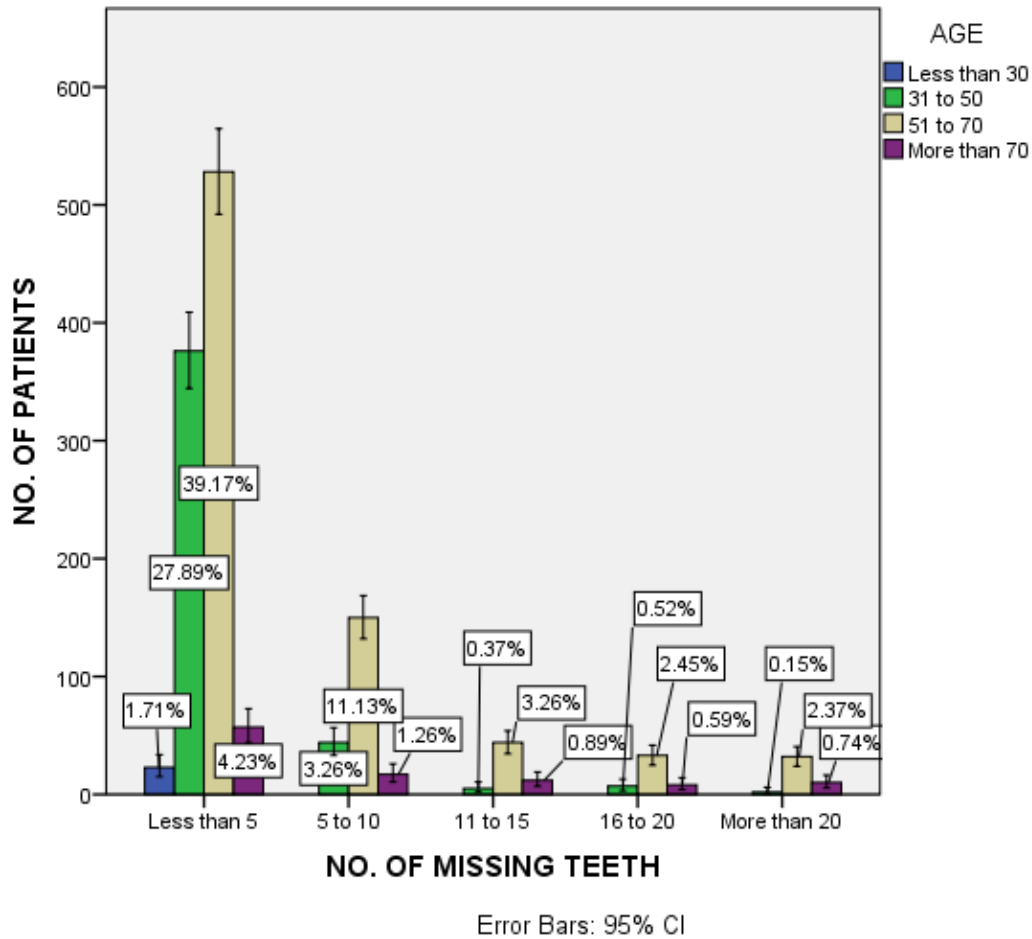


Fig. 2. The bar graph represents the comparison of age of the patients and the number of missing teeth. The X-axis represents the number of missing teeth and the Y-axis represents the number of patients. The colour blue represents the age group of less than 30 years old, Green colour represents the age group of 31 to 50 years old, Yellow colour represents the age group of 51 to 70 years old and the purple colour represents the age group of more than 70 years old.

4. CONCLUSION

The present study highlighted a possible relationship between hypertension and periodontal status. Within the limitations of the study it was seen that mandibular posterior teeth were most commonly missing followed by maxillary posterior teeth. It was also seen that the females were more prone to tooth loss than males with hypertension and chronic periodontitis. However, the underlying mechanism has to be further investigated in a different study design, thus more conclusive findings would be elucidated.

REFERENCES

- [1] Kearney PM, Whelton M, Reynolds K, et al. Global burden of hypertension: analysis of worldwide data. *Lancet* 2005; 365: 217–223.
- [2] Kim SW, Lee KS, Jin HS, et al. Rapid detection of duplication/deletion of the PMP22 gene in patients with Charcot-Marie-Tooth disease type 1A and hereditary neuropathy with liability to

- pressure palsy by real-time quantitative PCR using SYBR Green I dye. *J Korean Med Sci* 2003; 18: 727–732.
- [3] Agado BE, Crawford B, DeLaRosa J, et al. Effects of periodontal instrumentation on quality of life and illness in patients with chronic obstructive pulmonary disease: a pilot study. *J Dent Hyg* 2012; 86: 204–214.
- [4] Choi HM, Han K, Park Y-G, et al. Associations Among Oral Hygiene Behavior and Hypertension Prevalence and Control: The 2008 to 2010 Korea National Health and Nutrition Examination Survey. *J Periodontol* 2015; 86: 866–873.
- [5] Tonetti MS, D’Aiuto F, Nibali L, et al. Treatment of periodontitis and endothelial function. *N Engl J Med* 2007; 356: 911–920.
- [6] Biffi A, Sonni A, Anderson CD, et al. Variants at APOE influence risk of deep and lobar intracerebral hemorrhage. *Ann Neurol* 2010; 68: 934–943.
- [7] Higashi Y, Noma K, Yoshizumi M, et al. Endothelial function and oxidative stress in cardiovascular diseases. *Circ J* 2009; 73: 411–418.
- [8] Pasqualini D, Bergandi L, Palumbo L, et al. Association among oral health, apical periodontitis, CD14 polymorphisms, and coronary heart disease in middle-aged adults. *J Endod* 2012; 38: 1570–1577.
- [9] Ramesh A, Varghese S, Jayakumar ND, et al. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. *J Periodontol* 2018; 89: 1241–1248.
- [10] Paramasivam A, Priyadharsini JV, Raghunandhakumar S, et al. A novel COVID-19 and its effects on cardiovascular disease. *Hypertension research: official journal of the Japanese Society of Hypertension* 2020; 43: 729–730.
- [11] S G, T G, K V, et al. Development of 3D scaffolds using nanochitosan/silk-fibroin/hyaluronic acid biomaterials for tissue engineering applications. *Int J Biol Macromol* 2018; 120: 876–885.
- [12] Del Fabbro M, Karanxha L, Panda S, et al. Autologous platelet concentrates for treating periodontal infrabony defects. *Cochrane Database Syst Rev* 2018; 11: CD011423.
- [13] Paramasivam A, Vijayashree Priyadharsini J. Mitomi Rs: new emerging microRNAs in mitochondrial dysfunction and cardiovascular disease. *Hypertens Res* 2020; 43: 851–853.
- [14] Jayaseelan VP, Arumugam P. Dissecting the theranostic potential of exosomes in autoimmune disorders. *Cellular & molecular immunology* 2019; 16: 935–936.
- [15] Vellappally S, Al Kheraif AA, Divakar DD, et al. Tooth implant prosthesis using ultra low power and low cost crystalline carbon bio-tooth sensor with hybridized data acquisition algorithm. *Comput Commun* 2019; 148: 176–184.
- [16] Vellappally S, Al Kheraif AA, Anil S, et al. Analyzing Relationship between Patient and Doctor in Public Dental Health using Particle Memetic Multivariable Logistic Regression Analysis Approach (MLRA2). *J Med Syst* 2018; 42: 183.
- [17] Varghese SS, Ramesh A, Veeraiyan DN. Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students. *J Dent Educ* 2019; 83: 445–450.
- [18] Venkatesan J, Singh SK, Anil S, et al. Preparation, Characterization and Biological Applications of Biosynthesized Silver Nanoparticles with Chitosan-Fucoidan Coating. *Molecules*; 23. Epub ahead of print 12 June 2018. DOI: 10.3390/molecules23061429.
- [19] Alsubait SA, Al Ajlan R, Mitwalli H, et al. Cytotoxicity of Different Concentrations of Three Root

Canal Sealers on Human Mesenchymal Stem Cells. *Biomolecules*; 8. Epub ahead of print 1 August 2018. DOI: 10.3390/biom8030068.

- [20] Venkatesan J, Rekha PD, Anil S, et al. Hydroxyapatite from Cuttlefish Bone: Isolation, Characterizations, and Applications. *Biotechnol Bioprocess Eng* 2018; 23: 383–393.
- [21] Vellappally S, Al Kheraif AA, Anil S, et al. IoT medical tooth mounted sensor for monitoring teeth and food level using bacterial optimization along with adaptive deep learning neural network. *Measurement* 2019; 135: 672–677.
- [22] PradeepKumar AR, Shemesh H, Nivedhitha MS, et al. Diagnosis of Vertical Root Fractures by Cone-beam Computed Tomography in Root-filled Teeth with Confirmation by Direct Visualization: A Systematic Review and Meta-Analysis. *J Endod* 2021; 47: 1198–1214.
- [23] R H, Ramani P, Tilakaratne WM, et al. Critical appraisal of different triggering pathways for the pathobiology of pemphigus vulgaris-A review. *Oral Dis*. Epub ahead of print 21 June 2021. DOI: 10.1111/odi.13937.
- [24] Ezhilarasan D, Lakshmi T, Subha M, et al. The ambiguous role of sirtuins in head and neck squamous cell carcinoma. *Oral Dis*. Epub ahead of print 11 February 2021. DOI: 10.1111/odi.13798.
- [25] Sarode SC, Gondivkar S, Sarode GS, et al. Hybrid oral potentially malignant disorder: A neglected fact in oral submucous fibrosis. *Oral Oncol* 2021; 105390.
- [26] Kavarthapu A, Gurumoorthy K. Linking chronic periodontitis and oral cancer: A review. *Oral Oncol* 2021; 105375.
- [27] Vellappally S, Abdullah Al-Kheraif A, Anil S, et al. Maintaining patient oral health by using a xeno-genetic spiking neural network. *J Ambient Intell Humaniz Comput*. Epub ahead of print 14 December 2018. DOI: 10.1007/s12652-018-1166-8.
- [28] Aldhuwayhi S, Mallineni SK, Sakhamuri S, et al. Covid-19 Knowledge and Perceptions Among Dental Specialists: A Cross-Sectional Online Questionnaire Survey. *Risk Manag Healthc Policy* 2021; 14: 2851–2861.
- [29] Shamsuddin SN, Ahmad A, Taib H, et al. Hypertension and its association with the severity of chronic periodontitis: a preliminary study. *Arch Orofacial Sci* 2015; 10: 3–9.
- [30] Soory M. Periodontal disease severity and systemic diseases prevalent in a Caribbean catchment area of patients. *West Indian Med J* 2007; 56: 190–193.
- [31] Zhang L, Zhang W-H, Zhang L, et al. Prevalence of overweight/obesity and its associations with hypertension, diabetes, dyslipidemia, and metabolic syndrome: a survey in the suburban area of Beijing, 2007. *Obes Facts* 2011; 4: 284–289.
- [32] Muñoz Aguilera E, Suvan J, Buti J, et al. Periodontitis is associated with hypertension: a systematic review and meta-analysis. *Cardiovasc Res* 2020; 116: 28–39.
- [33] Peres MA, Tsakos G, Barbato PR, et al. Tooth loss is associated with increased blood pressure in adults--a multidisciplinary population-based study. *J Clin Periodontol* 2012; 39: 824–833.
- [34] Polzer I, Schwahn C, Völzke H, et al. The association of tooth loss with all-cause and circulatory mortality. Is there a benefit of replaced teeth? A systematic review and meta-analysis. *Clin Oral Investig* 2012; 16: 333–351.
- [35] Al-Ahmad BEM, Kashmoola MA, Mustafa NS, et al. The relationship between tooth loss, body mass index, and hypertension in postmenopausal female. *Eur J Dent* 2018; 12: 120–122.
- [36] Kim S-W, Cho K-H, Han K-D, et al. Tooth Loss and Metabolic Syndrome in South Korea: The 2012 Korean National Health and Nutrition Examination Survey. *Medicine* 2016; 95: e3331.

- [37] Kawabata Y, Ekuni D, Miyai H, et al. Relationship Between Prehypertension/Hypertension and Periodontal Disease: A Prospective Cohort Study. *Am J Hypertens* 2016; 29: 388–396.
- [38] Czesnikiewicz-Guzik M, Osmenda G, Siedlinski M, et al. Causal association between periodontitis and hypertension: evidence from Mendelian randomization and a randomized controlled trial of non-surgical periodontal therapy. *European Heart Journal* 2019; 40: 3459–3470.
- [39] Vidal F, Cordovil I, Figueredo CMS, et al. Non-surgical periodontal treatment reduces cardiovascular risk in refractory hypertensive patients: a pilot study. *J Clin Periodontol* 2013; 40: 681–687.
- [40] Zia E, Hedblad B, Pessah-Rasmussen H, et al. Blood pressure in relation to the incidence of cerebral infarction and intracerebral hemorrhage. Hypertensive hemorrhage: debated nomenclature is still relevant. *Stroke* 2007; 38: 2681–2685.
- [41] Gołębiewska M, Taraszkiewicz-Sulik K, Kuklińska A, et al. Periodontal condition in patients with cardiovascular diseases. *Adv Med Sci* 2006; 51 Suppl 1: 69–72.

UNDER PEER REVIEW