TOOTH LOSS PATTERNS IN PATIENTS WITH PERIODONTITIS AND DIABETES MELLITUS

ABSTRACT

Aim: Periodontitis is an inflammatory, multifactorial disease which results in destruction of supporting tissue and bone thereby resulting in loosening of the tooth. Tooth loss is one of the major oral issues faced by elderly patients. Thus the present study aimed to investigate the prevalence of tooth loss among periodontitis patients.

Methodology: Data collection was conducted from June 2020 to March 2021 among 200 periodontitis patients with diabetes mellitus based on the record management system software to analyse the most frequent missing tooth at the time of first visit. Frequency of maxillary anterior, maxillary posterior, mandibular anterior and mandibular posterior tooth loss was assessed in the study.

Results: Among the frequency distribution the mandibular posterior tooth loss was the most common among periodontitis with diabetes patients. In case of anterior tooth loss the results were almost similar with 16% of maxillary anterior tooth loss and 17% in case of mandibular anterior tooth loss. Male subjects presented with more missing teeth in mandibular posterior tooth region when compared to females but not statistically significant ($p>0.05$)..

Conclusion: The present study results showed that there is no significant association between sex and maxillary anterior, mandibular anterior, maxillary posterior and mandibular posterior tooth loss ($p>0.05$). The present study showed that mandibular posterior tooth loss was most frequent among periodontitis with diabetes mellitus patients.

Keywords: Edentulism, diabetes, novel method, periodontitis, tooth loss

1.INTRODUCTION

Diabetes mellitus is a systemic disease characterized by increased blood glucose levels and abnormalities of lipid metabolism due to absence or decreased level of insulin. It affects all the body organs and their functions either directly or indirectly. Every dentist should have a basic understanding of the etiopathogenesis, oral and systemic manifestations of this disease[1]. Periodontitis is most commonly a consequence of extension of the gingival inflammation into the underlying supporting structures of the periodontium, initiated by the presence of plaque and its products on the surfaces of the teeth and the adjoining structures[2]. Tissue destruction in periodontitis results in the breakdown of the collagen fibers of the periodontal ligament, resulting in the periodontal pocket between the gingiva and tooth[3]. The causes of tooth loss vary with geographical location, culture and even time. Studies reported more teeth

lost due to periodontal reasons compared with dental caries[4]. Diabetes and periodontitis influence the clinical outcome of each other and control of both influences the clinical improvement of each[5].

Majority of well-controlled studies show a higher prevalence and severity of periodontal disease in diabetics than in non-diabetics with similar local irritation including greater loss of attachment, greater alveolar bone loss, increased bleeding on probing, and increased tooth mobility resulting in tooth loss[6]. Most striking changes in uncontrolled diabetes are reduction in defense mechanisms and increased susceptibility to infection leading to destructive periodontal disease and which results in tooth loss[7]. Diabetes has impaired defense mechanisms involving micro- and macro-vasculatures. The increased susceptibility to infection and reduced healing capacity with altered collagen metabolism may explain the increased level of periodontal destruction[8].

According to the World Health Organization adults should have a minimum of 21 functional teeth to provide the ability to experience a good dietary intake without the need of dentures. It has been shown that edentualism reduces the quality of life[9]. Potential risk factors for edentulism are low level of education, older age, gender and marital status. Lower income has also been suggested to be a risk factor for tooth loss [10].

Our team has extensive knowledge and research experience that has translated into high quality publications[11–22][23–27][28][29]To our knowledge, data on the prevalence of tooth loss among periodontitis with diabetes patients at the time of visit is minimal. Therefore, the present study was aimed to evaluate the prevalence of tooth loss among periodontitis patients with diabetes mellitus.

2. MATERIALS AND METHODS

2.1 Study setting

This study was carried out in a university setting which consists of subjects predominantly South Indian population. Advantages of the study include available data and similar ethnicity. Disadvantages of this study is the fact that it is a unicentre study and the geographic location trends are not assessed. Approval of the study is by the ethical board of Saveetha university. Number of people involved are 3 reviewers- a guide, a researcher and a reviewing expert.

2.2 Sampling

This is a retrospective study in which the samples were considered from the time period of June 2019 to March 2020. Case sheets reviewed for the research include patients with tooth loss patterns. Cross verification of the required samples was done by the reviewing expert. Measures were taken to minimize the sampling bias. These are inclusion of only clear and readily available data followed by simple random sampling. Both internal and external validation was also obtained to carry out the study.

2.3 Data collection/Tabulation

Data required for this study was procured by reviewing the patient records of about 86000 patients visiting the dental college. The samples were collected from June 2019 to March 2020. Dental Information Archiving Software is the database system used in college to record all the details of the patient, which include their demographic data, photographs, diagnosis and treatment reports The required data i.e, periodontitis patients with diabetes mellitus presented with missing teeth were collected and entered in a methodical manner in an excel sheet for the tabulation of data and further statistical analysis data was validated by 1-2 external reviewers and all the nonspecific, unclear or incomplete data were excluded from the study.

2.4 Statistical analysis

Statistical software used for analysis is the SPSS (statistical package for the social sciences) which is designed by IBM and Chi- square statistical test was used to determine the association of missing teeth region with gender. Independent variables include ethnicity, gender, age. Dependent variables include diabetes mellitus, tooth loss patterns, periodontitis.

3. RESULTS AND DISCUSSION

From the graphs it was seen that male population is 67.3% and the female population is 32.6% (Figure 1). And 7.04% of central incisor, 9.55% of lateral incisor, 12.56% of canine, 8.54% of 1st premolar , 5.03% of 2nd Premolar, 21.11% of 1^{st} molar, 19.10% of 2^{nd} molar , 17.09% of 3^{rd} molar of them were missing in the maxillary arch on the right side (Figure 2). 4.52% of central incisor, 7.04% of lateral incisor, 9.55% of canine, 10.05% of 1^{st} premolar , 10.05% of 2^{nd} Premolar , 13.07% of 1^{st} molar, 33.67% of 2^{nd} molar , 12.06% of 3^{rd} molar were missing in the maxillary arch on the left side (Figure 3) 6.03% of central incisor, 6.53% of lateral incisor, 5.03% of canine, 13.07% of 1^{st} premolar, 14.57% of 2^{nd} Premolar , 27.14% of 1^{st} molar, 13.57% of 2^{nd} molar ,14.07% of 3^{rd} molar were missing in the mandibular arch on the right side (Figure 4). 2.51% central incisor, 11.56% of lateral incisor, 8.54% of canine, 17.59% of 1^{st} premolar ,12.56% of 2^{nd} Premolar, 17.59% of 1^{st} molar, 22.11% of 2^{nd} molar, 7.54% of 3^{rd} molars were missing in the mandibular arch on the left side (Figure 5). Figure 6 denotes 14.46% missing teeth in the maxillary anterior region, 32.66% of missing teeth in the maxillary posterior region, 17.09% of missing teeth in the mandibular anterior region and 33.67% of missing teeth in the mandibular posterior region. 12.56% of males and 4.02% of females had missing teeth in the maxillary anterior region, 21.61% of males and 11.06% of females had missing teeth in the maxillary posterior region. 8.54% of males and 8.54% of females had missing teeth in the mandibular anterior region. Males (24.62%) had more missing teeth in the mandibular posterior region when compared to females (9.05%) (Chi-square test shows p value= 0.243 ($p>0.05$), hence statistically not significant).

Montandon et al [30] showed that the prevalence of tooth loss in male population is due to periodontitis with diabetes mellitus and posterior tooth loss is the most common which is similar to our study results where the mandibular posterior tooth loss was most frequent among periodontitis patients with diabetes mellitus.

Indurkar [31]et al showed that maxillary posterior tooth had more amount of bone defects while evaluating CBCT, thereby shown to be the most commonly affected teeth region by periodontitis which was contradictory with our study results where mandibular teeth region were more affected among periodontitis patients with diabetes mellitus. Ikimi[32] et al showed that among Nigerian patients the tooth loss was more frequent among diabetic patients than among the systemically healthy patients with periodontitis.

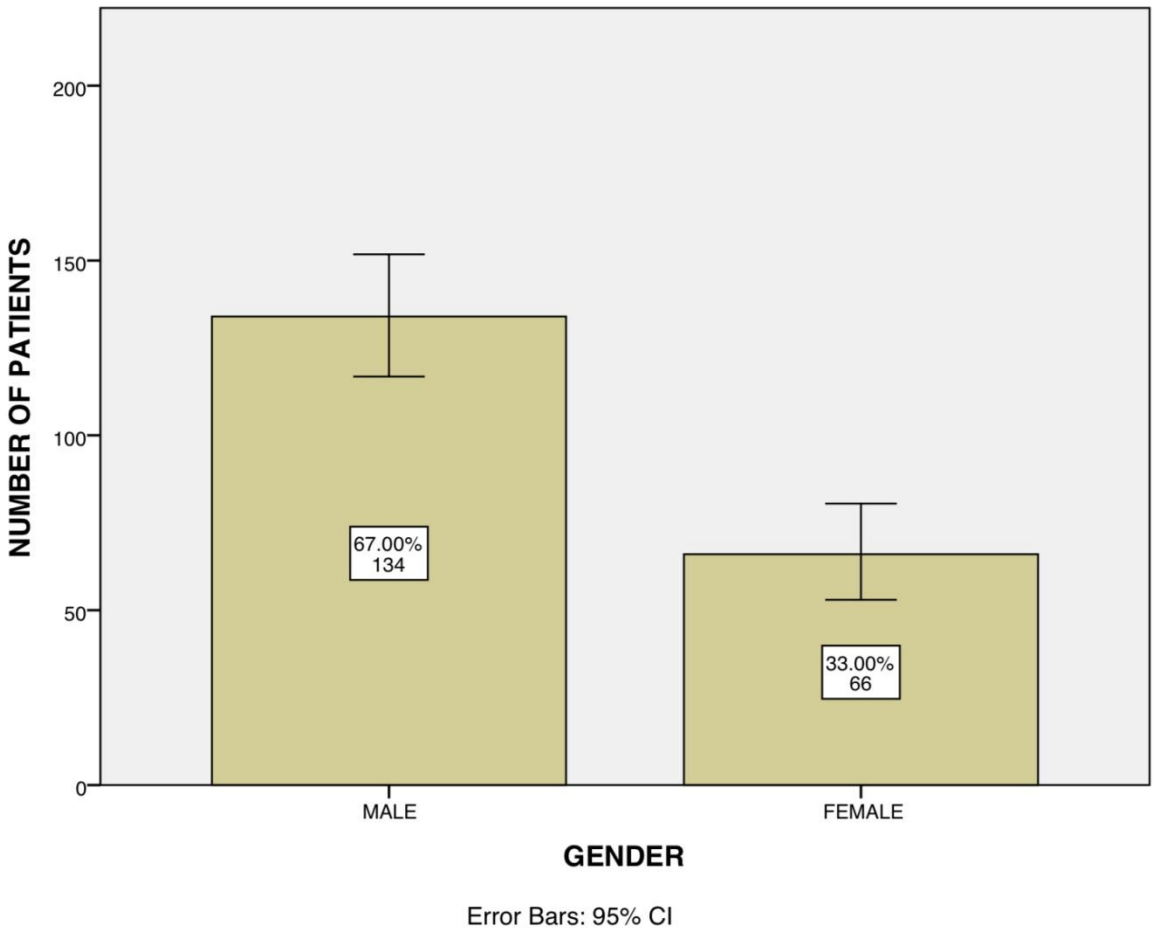

Figure 1: Bar graph showing the distribution of gender with the missing tooth across the sample size. x axis represents the gender and the y axis represents the percentage of participants. Most number of missing teeth seen in male population is 67.3% and in the female population is 32.6%. This reveals that missing teeth are predominantly seen in male population.

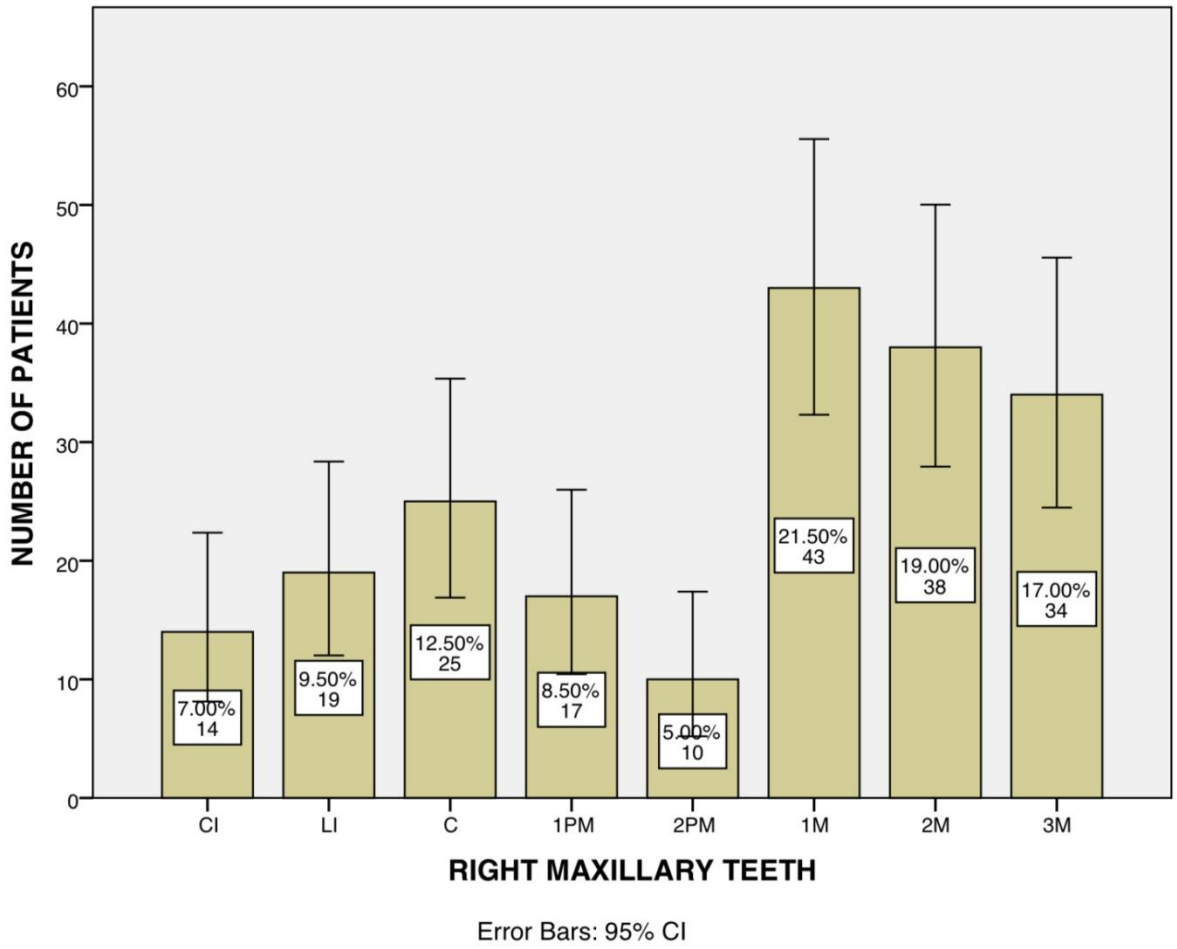

Figure 2: Bar graph denotes the distribution of missing teeth in the right maxillary arch. X axis denotes the right maxillary teeth types and Y axis denotes the number of missing teeth. Maximum number of missing teeth are seen in relation to 1st molars. [CI-Central incisor; LI-lateral incisor; C- canine ; 1PM- 1st premolar; 2PM- 2nd Premolar ; 1M- 1 st molar; 2M- 2 nd molar ; 3M- 3 rd molar]

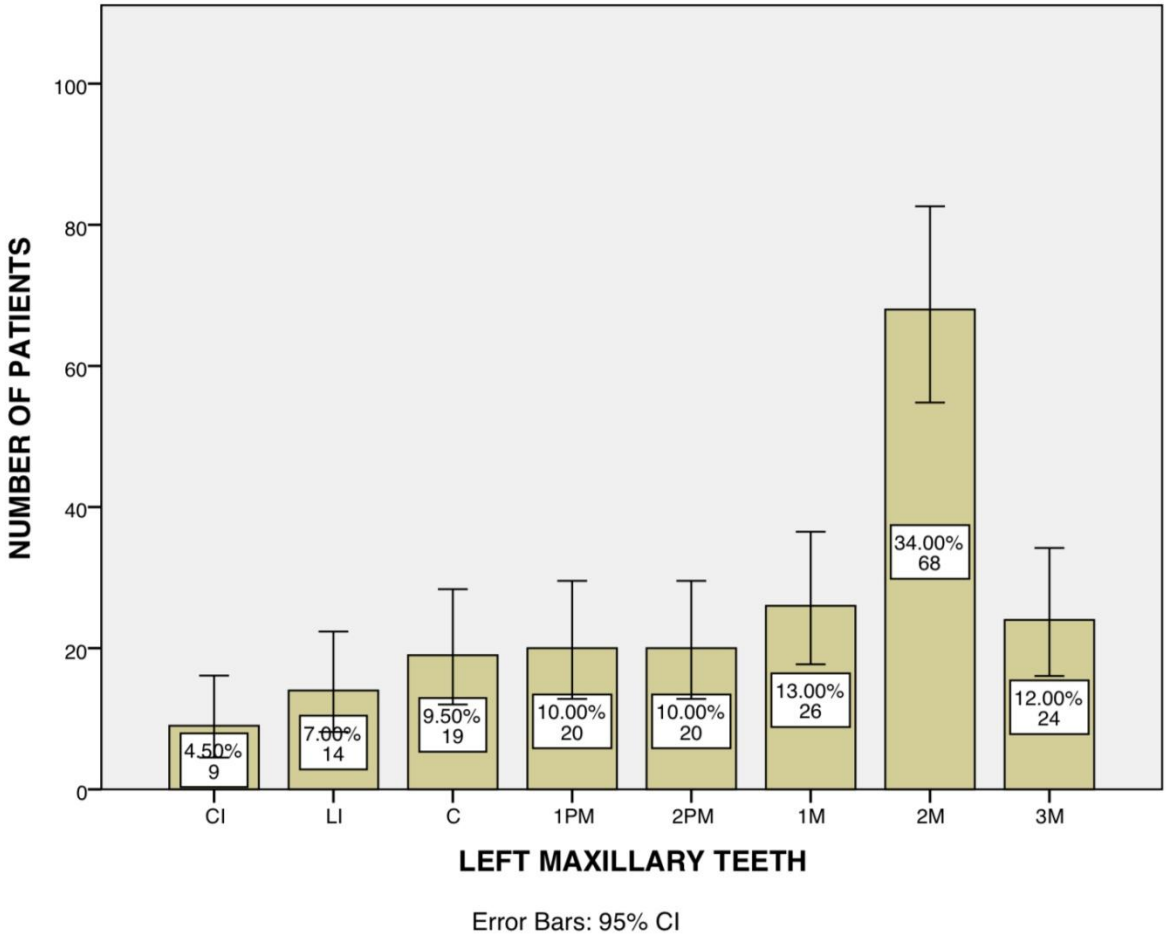

Figure 3: Bar graph denotes the distribution of missing teeth in the right maxillary arch. X axis denotes the left maxillary teeth types and Y axis denotes the number of missing teeth. Maximum number of missing teeth are seen in relation to 2nd molars. [CI-Central incisor; LI- lateral incisor; C- canine ; 1PM- 1st premolar; 2PM- 2nd Premolar ; 1M- 1 st molar; 2M- 2 nd molar ; 3M- 3 rd molar]

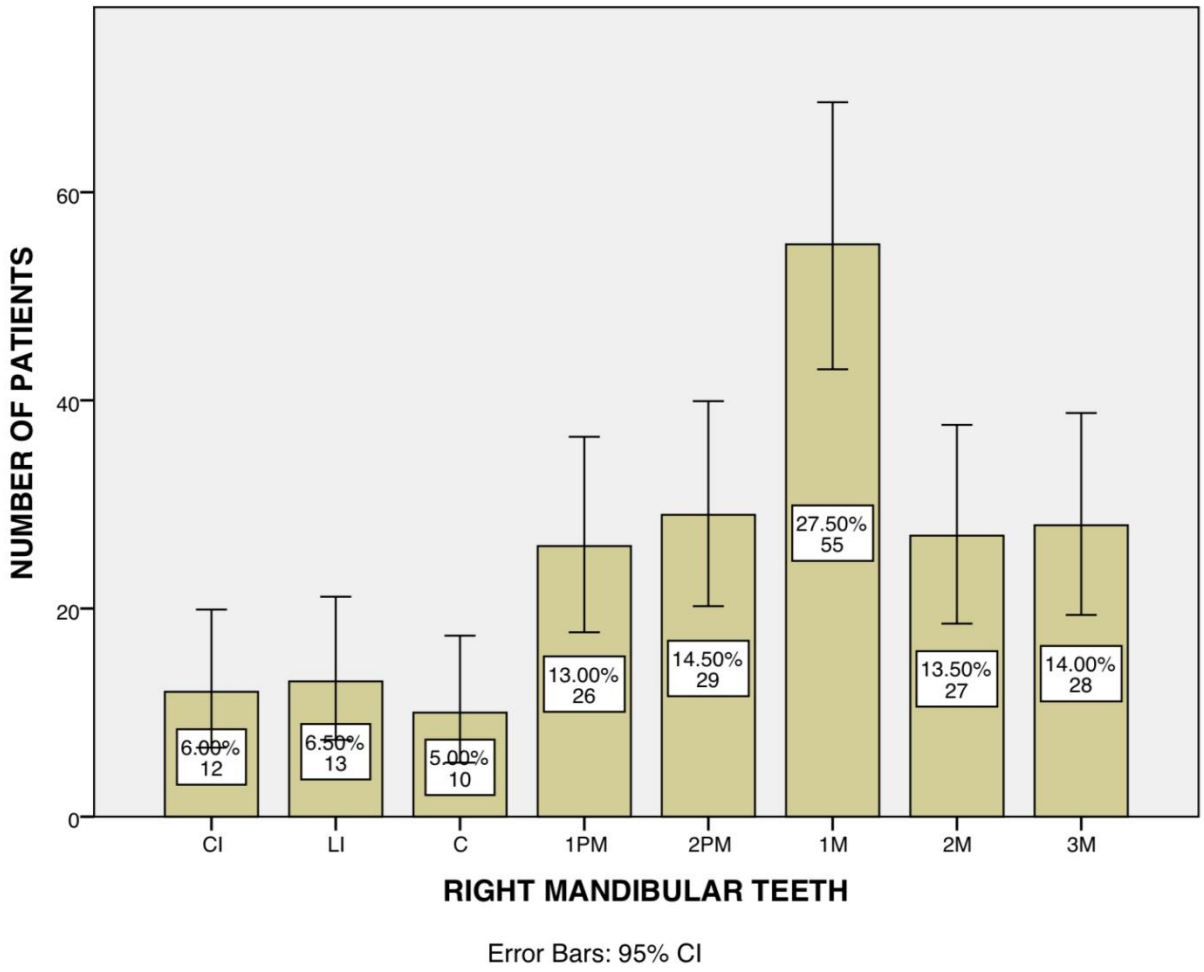

Figure 4: Bar graph denotes the distribution of missing teeth in the right maxillary arch. X axis denotes the right mandibular teeth types and Y axis denotes the number of missing teeth. Maximum number of missing teeth are seen in relation to 1st molars. [CI-Central incisor; LI-lateral incisor; C- canine ; 1PM- 1st premolar; 2PM- 2nd Premolar ; 1M- 1 st molar; 2M- 2 nd molar ; 3M- 3 rd molar]

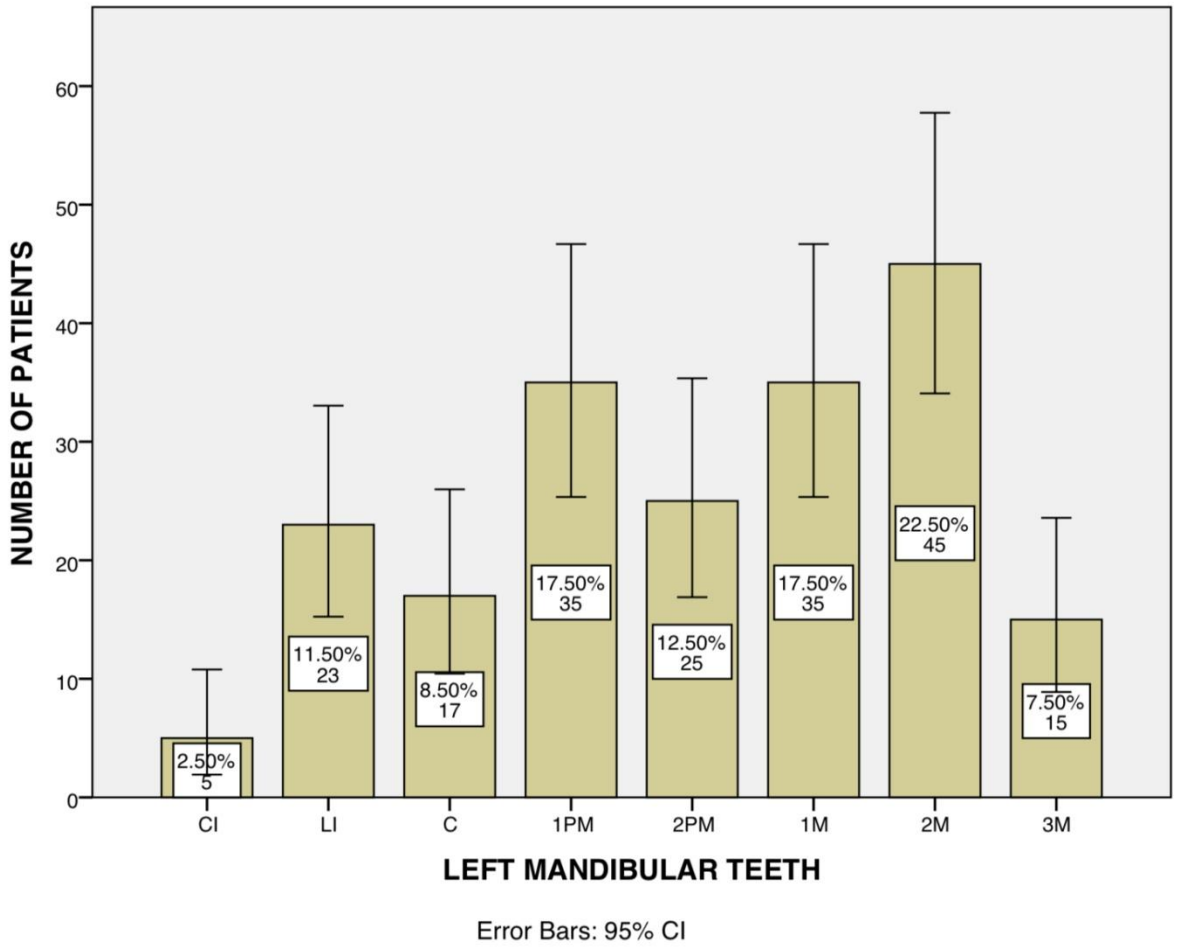

Figure 5: Bar graph denotes the distribution of missing teeth in the right maxillary arch. X axis denotes the left mandibular teeth types and Y axis denotes the number of missing teeth. Maximum number of missing teeth are seen in relation to 2nd molars. [CI-Central incisor; LI-lateral incisor; C- canine ; 1PM- 1st premolar; 2PM- 2nd Premolar ; 1M- 1 st molar; 2M- 2 nd molar ; 3M- 3 rd molar]

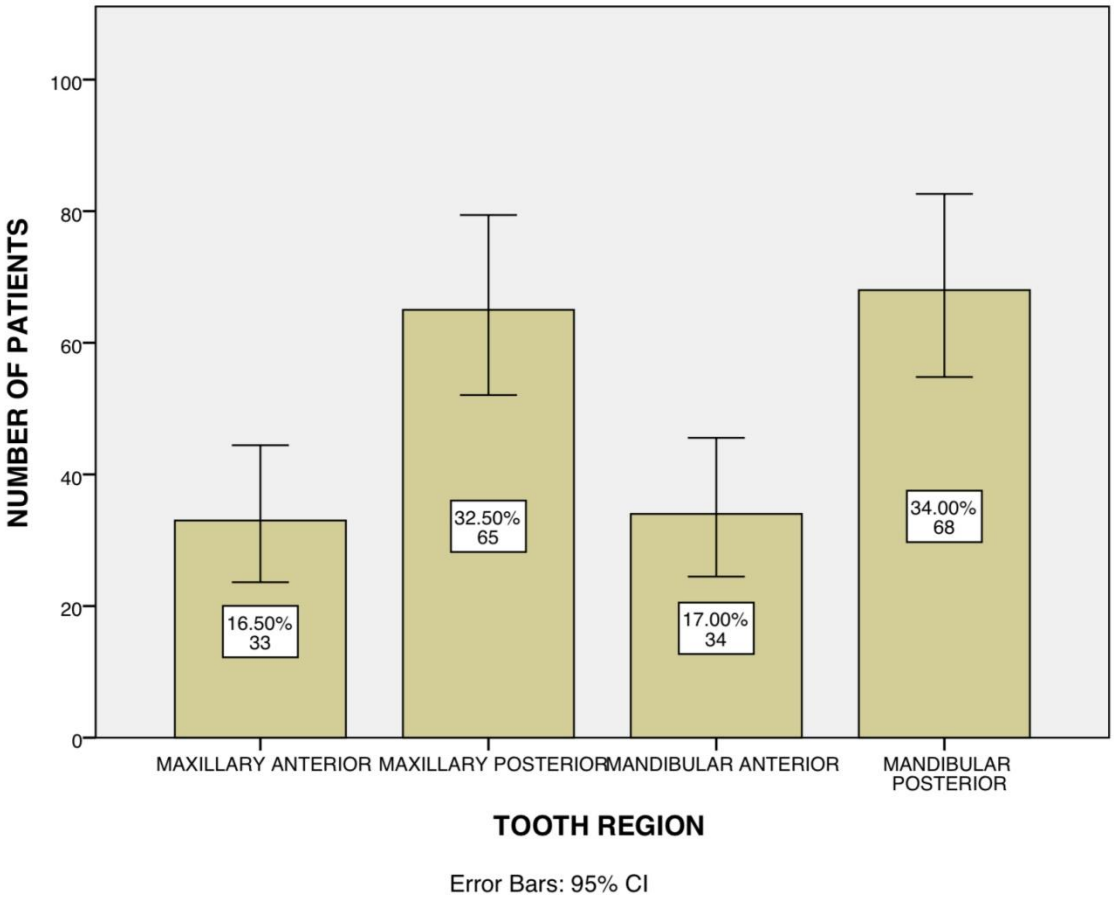

Figure 6: Bar graph denotes distribution of tooth loss in relation to region of teeth (maxillary/mandibular, anterior/posterior). X axis denotes the type of teeth and Y axis denotes the number of missing teeth. It is seen that the mandibular posteriors are missing the most.

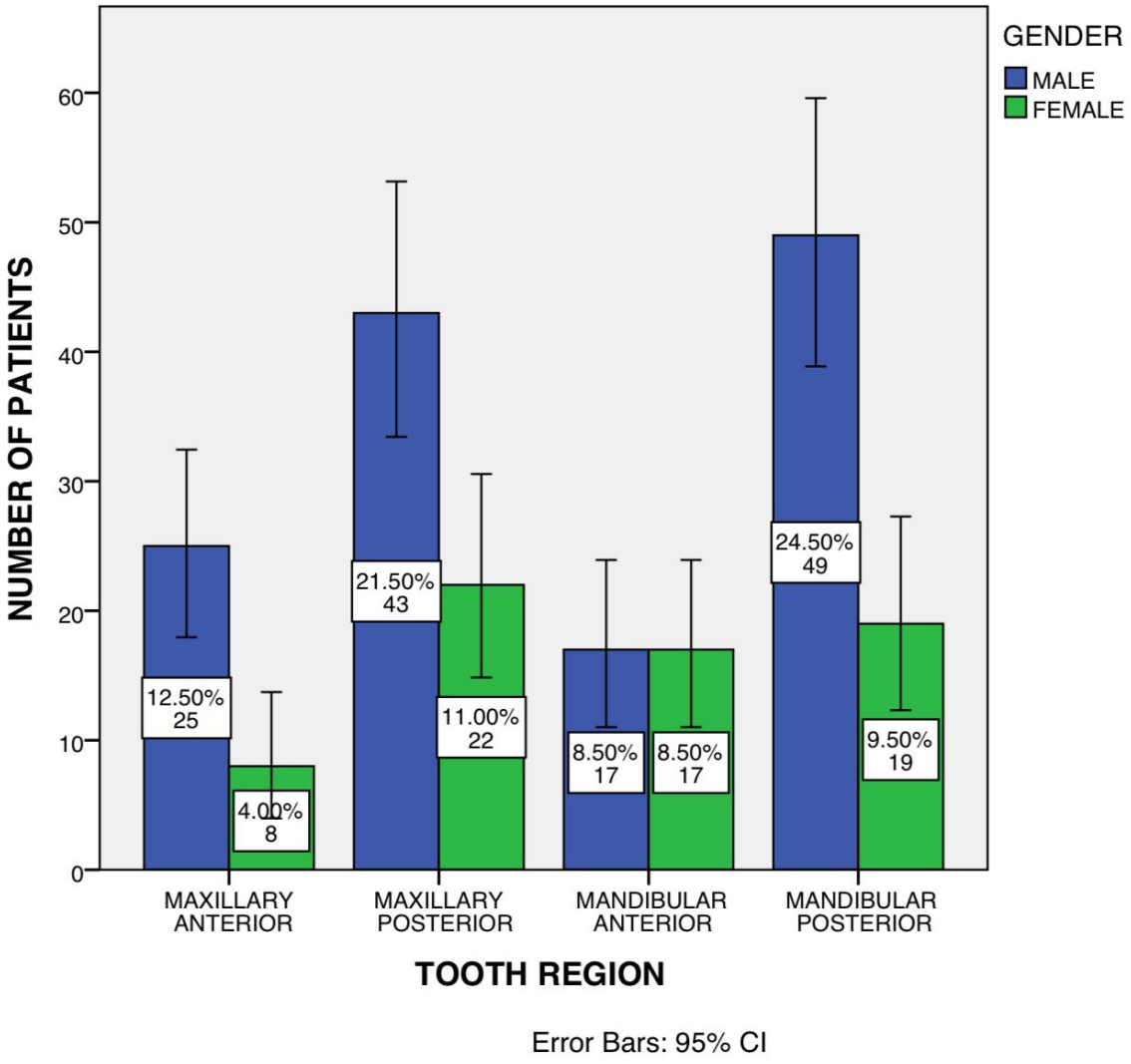

Figure 7: Bar graph shows association between tooth loss in relation to region (maxillary/mandibular, anterior/posterior) and gender of patients. X axis denotes the region of tooth loss and Y axis denotes the number of missing teeth. Males (blue) had the maximum number of missing mandibular posteriors than females (green). Chi-square test shows p value= 0.243, Hence not significant.

4.CONCLUSION

Within the limitations of the present study the results showed that mandibular tooth loss was most frequent among periodontitis with diabetes patients. Though mandibular posterior missing was more

commonly missing in male population when compared to females, the gender is not significantly associated with tooth loss in periodontitis patients with diabetes mellitus.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

REFERENCES

1. Loe H. Periodontal Disease: The sixth complication of diabetes mellitus [Internet]. Vol. 16, Diabetes Care. 1993. p. 329–34. Available from: http://dx.doi.org/10.2337/diacare.16.1.329

2. Miller LS, Manwell MA, Newbold D, Reding ME, Rasheed A, Blodgett J, et al. The relationship between reduction in periodontal inflammation and diabetes control: a report of 9 cases. J Periodontol. 1992 Oct;63(10):843–8.

3. Fox CH. New considerations in the prevalence of periodontal disease. Curr Opin Dent. 1992 Mar;2:5–11.

4. Karoussis IK, Muller S, Salvi GE, Heitz-mayfield LJA, Bragger U, Lang NP. Association between periodontal and peri-implant conditions: a 10-year prospective study [Internet]. Vol. 15, Clinical Oral Implants Research. 2004. p. 1–7. Available from: http://dx.doi.org/10.1111/j.1600-0501.2004.00982.x

5. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. Lancet. 2005 Nov 19;366(9499):1809–20.

6. Oliver RC, Tervonen T, Flynn DG, Keenan KM. Enzyme activity in crevicular fluid in relation to metabolic control of diabetes and other periodontal risk factors. J Periodontol. 1993 May;64(5):358–62.

7. Grossi SG, Genco RJ, Machtei EE, Ho AW, Koch G, Dunford R, et al. Assessment of risk for periodontal disease. II. Risk indicators for alveolar bone loss. J Periodontol. 1995 Jan;66(1):23–9.

8. Carollo-Bittel B, Persson RE, Persson GR, Lang NP. Supportive periodontal therapy for high- and

low-risk patients [Internet]. Vol. 2, Journal of Investigative and Clinical Dentistry. 2011. p. 110–6. Available from: http://dx.doi.org/10.1111/j.2041-1626.2011.00050.x

9. Grossi SG, Zambon JJ, Ho AW, Koch G, Dunford RG, Machtei EE, et al. Assessment of Risk for Periodontal Disease. I. Risk Indicators for Attachment Loss [Internet]. Vol. 65, Journal of Periodontology. 1994. p. 260–7. Available from: http://dx.doi.org/10.1902/jop.1994.65.3.260

10. Salvi GE, Carollo-Bittel B, Lang NP. Effects of diabetes mellitus on periodontal and peri-implant conditions: update on associations and risks. J Clin Periodontol. 2008 Sep;35(8 Suppl):398–409.

11. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. J Periodontol. 2018 Oct;89(10):1241–8.

12. Paramasivam A, Priyadharsini JV, Raghunandhakumar S, Elumalai P. A novel COVID-19 and its effects on cardiovascular disease. Hypertens Res. 2020 Jul;43(7):729–30.

13. S G, T G, K V, Faleh A A, Sukumaran A, P N S. Development of 3D scaffolds using nanochitosan/silk-fibroin/hyaluronic acid biomaterials for tissue engineering applications. Int J Biol Macromol. 2018 Dec;120(Pt A):876–85.

14. Fernando de Almeida Barros Mourão C. Autologous platelet concentrates for treating periodontal infrabony defects. Evid Based Dent. 2019 Jun;20(2):54–5.

15. Del Fabbro M, Karanxha L, Panda S, Bucchi C, Nadathur Doraiswamy J, Sankari M, et al. Autologous platelet concentrates for treating periodontal infrabony defects. Cochrane Database Syst Rev. 2018 Nov 26;11:CD011423.

16. Paramasivam A, Vijayashree Priyadharsini J. MitomiRs: new emerging microRNAs in mitochondrial dysfunction and cardiovascular disease. Hypertens Res. 2020 Aug;43(8):851–3.

17. Jayaseelan VP, Arumugam P. Dissecting the theranostic potential of exosomes in autoimmune disorders. Cell Mol Immunol. 2019 Dec;16(12):935–6.

18. Vellappally S, Al Kheraif AA, Divakar DD, Basavarajappa S, Anil S, Fouad H. Tooth implant prosthesis using ultra low power and low cost crystalline carbon bio-tooth sensor with hybridized data acquisition algorithm [Internet]. Vol. 148, Computer Communications. 2019. p. 176–84. Available from: http://dx.doi.org/10.1016/j.comcom.2019.09.020

19. Vellappally S, Al Kheraif AA, Anil S, Assery MK, Kumar KA, Divakar DD. Analyzing Relationship between Patient and Doctor in Public Dental Health using Particle Memetic Multivariable Logistic

Regression Analysis Approach (MLRA2). J Med Syst. 2018 Aug 29;42(10):183.

20. Venkatesan J, Singh SK, Anil S, Kim S-K, Shim MS. Preparation, Characterization and Biological Applications of Biosynthesized Silver Nanoparticles with Chitosan-Fucoidan Coating. Molecules [Internet]. 2018 Jun 12;23(6). Available from: http://dx.doi.org/10.3390/molecules23061429

21. Venkatesan J, Rekha PD, Anil S, Bhatnagar I, Sudha PN, Dechsakulwatana C, et al. Hydroxyapatite from Cuttlefish Bone: Isolation, Characterizations, and Applications [Internet]. Vol. 23, Biotechnology and Bioprocess Engineering. 2018. p. 383–93. Available from: http://dx.doi.org/10.1007/s12257-018-0169-9

22. Vellappally S, Al Kheraif AA, Anil S, Wahba AA. IoT medical tooth mounted sensor for monitoring teeth and food level using bacterial optimization along with adaptive deep learning neural network [Internet]. Vol. 135, Measurement. 2019. p. 672–7. Available from: http://dx.doi.org/10.1016/j.measurement.2018.11.078

23. PradeepKumar AR, Shemesh H, Nivedhitha MS, Mohamed Jubair Hashir M, Arockiam S, Maheswari TNU, 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 [Internet]. Vol. 47, Journal of Endodontics. 2021. p. 1198–214. Available from: http://dx.doi.org/10.1016/j.joen.2021.04.022

24. R H, Ramani P, Tilakaratne WM, Sukumaran G, Ramasubramanian A, Krishnan RP. Critical appraisal of different triggering pathways for the pathobiology of pemphigus vulgaris-A review. Oral Dis [Internet]. 2021 Jun 21; Available from: http://dx.doi.org/10.1111/odi.13937

25. Ezhilarasan D, Lakshmi T, Subha M, Deepak Nallasamy V, Raghunandhakumar S. The ambiguous role of sirtuins in head and neck squamous cell carcinoma. Oral Dis [Internet]. 2021 Feb 11; Available from: http://dx.doi.org/10.1111/odi.13798

26. Sarode SC, Gondivkar S, Sarode GS, Gadbail A, Yuwanati M. Hybrid oral potentially malignant disorder: A neglected fact in oral submucous fibrosis. Oral Oncol. 2021 Jun 16;105390.

27. Kavarthapu A, Gurumoorthy K. Linking chronic periodontitis and oral cancer: A review. Oral Oncol. 2021 Jun 14;105375.

28. Vellappally S, Al-Kheraif AA, Anil S, Basavarajappa S, Hassanein AS. Maintaining patient oral health by using a xeno-genetic spiking neural network [Internet]. Journal of Ambient Intelligence and Humanized Computing. 2018. Available from: http://dx.doi.org/10.1007/s12652-018-1166-8

29. Aldhuwayhi S, Mallineni SK, Sakhamuri S, Thakare AA, Mallineni S, Sajja R, et al. Covid-19 Knowledge and Perceptions Among Dental Specialists: A Cross-Sectional Online Questionnaire Survey. Risk Manag Healthc Policy. 2021 Jul 7;14:2851–61.

30. Lussi A, Ganss C. Erosive Tooth Wear: From Diagnosis to Therapy. Karger Medical and Scientific Publishers; 2014. 296 p.

31. Khader YS, Dauod AS, El-Qaderi SS, Alkafajei A, Batayha WQ. Periodontal status of diabetics compared with nondiabetics: a meta-analysis. J Diabetes Complications. 2006 Jan;20(1):59–68.

32. Mealey BL, Ocampo GL. Diabetes mellitus and periodontal disease. Periodontol 2000. 2007;44:127–53.