

CORRELATION BETWEEN SMOKING AND SEVERITY OF PERIODONTAL DISEASE: A CROSS-SECTIONAL STUDY

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ABSTRACT

Smoking is a highly prevalent addiction present worldwide, especially in India. It not only affects the pulmonary system but also has a major impact on oral health. Periodontal disease comprises a range of polymicrobial infectious diseases such as gingivitis and periodontitis that affect the tooth-supporting structures. Smoking has been identified as a risk factor for periodontal disease progression and can also alter treatment response. This study aims at associating the type of tobacco use and periodontal disease progression. This retrospective study was conducted among 500 patients using their records from the Department of Periodontics, Saveetha Dental College and Hospitals, Chennai from June 2019-April 2020 and patients who had smoking habits were identified. Data regarding their age, gender, type of tobacco use and periodontal status were collected and then subjected to statistical analysis. Microsoft Excel 2016 data spreadsheet was used to collect data and later exported to the Statistical Package for Social Science for Windows (SPSS version 20.0, IL, Chicago, USA) for analysis. The results of the study showed that among the patients with smoking habits, individuals within the age group of 25-35 years (31.4%) showed the highest prevalence of tobacco use whereas people among 65-75 years (1.2%) had the least. Majority of the smokers were diagnosed with periodontitis (84.4%), followed by gingivitis (12.4%) but diagnosis of healthy gingiva was very rare (3.2%). Smokeless form of tobacco was commonly used (61.2%). There was a male predominance (94.2%). Smoking, especially the type of tobacco used and severity of periodontal disease was found to have a strong association ($p=0.000$). The study draws attention to the fact that tobacco usage has a negative impact on oral health and can lead to periodontitis.

KEY WORDS: Gingivitis; Periodontal disease; Periodontitis; Smokeless tobacco; Smoking

INTRODUCTION

Periodontal diseases are one among the most chronic diseases in adults (Lung *et al.*, 2005; Ramesh, Sheeja Saji Varghese, *et al.*, 2016; Priyanka *et al.*, 2017). It is also the second most common cause for tooth loss in adults (Abdulkarim, Mokuolu and Adeniyi, 2005; Panda *et al.*, 2014; Ramesh, Ravi and Kaarthikeyan, 2017). It is a phenomenon with patterns of progression and resolution that happens cyclically (Locker and Leake, 1993; Varghese *et al.*, 2015; Khalid *et al.*, 2016, 2017; Mootha *et al.*, 2016) in the oral cavity.

Smoking is a major cause of human disease that is preventable (Tonetti, 1998; Ramesh, Sheeja S. Varghese, *et al.*, 2016). Tobacco contains more than 3800 chemicals including hydrogen cyanide, carbon monoxide, and oxidizing radicals, among which 60 chemicals are known to be carcinogenic (Eriksen, LeMaistre and Newell, 1988; Avinash, Malaippan and Dooraiswamy, 2017). It has been established that myocardial infarctions and chronic lung diseases are caused by tobacco smoking (Johnson and Bain, 2000;

Ravi *et al.*, 2017). Smoking impairs the response of the immune system and reduces the healing ability of the periodontal tissue (Johnson and Hill, 2004; Ramamurthy and Mg, 2018). Smoking also affects treatment response (Panda *et al.*, 2014; Thamaraiselvan *et al.*, 2015; Kavarthapu and Thamaraiselvan, 2018; Ramesh *et al.*, 2019). Therefore, smoking is considered as an important risk factor for periodontitis (Palmer *et al.*, 2005).

Severity of periodontitis varies according to the frequency of tobacco smoking and the underlying systemic diseases already present in an individual (Do *et al.*, 2008). There are various studies which prove the association of smoking with periodontal destruction. One such study was conducted by Ankola *et al.* in Belgium, which concluded that plaque and calculus deposits increased in smokers more than non-smokers predisposing them to periodontitis (Ankola *et al.*, 2007).

In a study conducted by Muniandy S *et al.* in India, awareness that smoking can potentially cause gum diseases were considerably less among active smokers (Muniandy, 2019). This shows that the majority of the dental patients diagnosed with periodontitis could also be unaware that their smoking habit had an effect on their oral health, despite the numerous dental campaigns and awareness programs. This study focuses on understanding the current scenario in use of tobacco and disease progression affecting the given population and sheds light on the emphasis for newer public dental health programs which increases the awareness about effects of smoking on periodontal health.

MATERIALS AND METHODS

A retrospective study was carried out among 500 patients using records from the Department of Periodontics, Saveetha Dental College and Hospitals, Chennai from June 2019-March 2020. Institutional ethical committee clearance was obtained for data retrieval and usage as needed for the study (SDC/SIHEC/2020/DIASDATA/0619-0320). Patients who had smoking habits were identified. Data regarding their age, gender, type of tobacco use and periodontal status were collected and then subjected to statistical analysis. Microsoft Excel 2016 data spreadsheet was used to collect data and later exported to the Statistical Package for Social Science for Windows (SPSS version 20.0, IL, Chicago, USA) for analysis. Differential statistics and inferential statistics were done for data summarization and presentation.

RESULTS AND DISCUSSION

The final data set consisted of 500 patients who had the habit of tobacco usage. The age group associated with the highest prevalence of tobacco use was within the range of 25-35 years (31.4%) and the least among the age group of 65-75 years (1.2%). (Table 1) Distribution of gender among patients who used various forms of tobacco showed male predominance (94.2%). (Figure 1)

Out of 500 patients, 84.4% of them had periodontitis, followed by gingivitis (12.4%) and clinically healthy gingiva was the least (3.2%). (Figure 2) Distribution of forms of tobacco (smoking and smokeless) usage among 500 patients showed smokeless as predominant type (61.2%). Among 306 (61.2%) smokeless tobacco users, 270 patients had periodontitis, 35 patients had gingivitis and only one patient had clinically healthy gingiva. Whereas, among 194 (38.8%) patients with cigarette smoking, 152 of them had periodontitis, 27 patients had gingivitis and clinically healthy gingiva was observed in 15 patients. Type of tobacco and severity of periodontal disease was found to have a strong association ($p=0.000$). (Figure 3)

The data for this study was based on residents of Chennai seeking treatment at Saveetha Dental College and Hospitals, Chennai. This study gives importance to prevalence of use of different forms of tobacco and their correlation with the periodontal disease progression.

In the present study (Table 1), smoking is highly prevalent among the patients within the range of 25-35 years (31.4%). This is in agreement with the results obtained in a study by PalakMayur shah et al in Chennai, which suggests that individuals below the age of 35 years were the highly prevalent group associated with smoking and the reason for their increased tendency towards smoking was attributed to work and education related stress along with peer pressure (Shah, Geetha and Thangavelu, 2019). Also, present study showed decreased tobacco usage among the older age group of 65-75 years (1.2%) which is coherent with a study conducted by Gautham DK et al in Himachal Pradesh showing reduced smokers above the age of 65 years (Gautamet *al.*, 2011). This can be due to their increased awareness overtime about the harmful outcomes of smoking or can also mean that they are smokers who quit the habit due to an illness.

Among the patients with a habit of tobacco use (Figure 1), there is a male predominance (94.2%) (figure 1). This is in line with the study conducted by JyotiGoyal et al in Ghaziabad and Kadante et al (Kadtaneet *al.*, 2014; Goyal *et al.*, 2019). Increased utilization of tobacco among males may be due to the greater accessibility of these items. However, in the present study, females rarely used tobacco. This result can be clarified by the lack of social acceptance of females consuming tobacco and this finding has been discussed in an investigation by Rani M et al (Rani *et al.*, 2003).

In the present study (Figure 2), most of the patients were diagnosed with periodontitis (84%). Similar results were observed in many other studies by Linden and Mullally, Harber et al and Schenkein et al (Haber, 1994; Linden and Mullally, 1994; Schenkein *et al.*, 1995). All of these studies have shown that compared to non-smokers, smokers had a higher chance of periodontitis. The reason can be reduction in helper lymphocytes by smoking which are important to B-cell function, and thereby antibody production (Al-Tayeb, 2008). Another reason can be smoking affects bone metabolism leading to bone loss explained by Rosa et al (Rosa, Lucas and Lucas, 2008). At the same time, gingivitis is uncommon because gingival bleeding and gingival inflammatory symptoms are suppressed in smokers. This result is parallel to those reported by Schuller et al. (Shuler, 1968).

Smokeless form of tobacco was predominant (62.1%) in the present study (Figure 3). Similar results were obtained in a study by Naveen Kumar et al (Naveen-Kumar *et al.*, 2016). This can be due to the ability to attain sustained pleasure with smokeless tobacco for a longer time than the decreased duration of cigarette smoking. Another study by Mohamed et al, had contradictory results in which the most utilised form of tobacco was bidi followed by smokeless forms (Mohamed and Janakiram, 2013). These differences may be due to the variation in geographic location.

There exists an association between type of tobacco use and periodontal diagnosis (Figure 3). The severity of periodontal diseases increases with the use of smokeless tobacco in the present study. More patients with the habit of smokeless tobacco were diagnosed with periodontitis compared to smoking. This correlation can hold true, because a study conducted by Navkiran et al in Chhattisgarh , India (25) also concluded that with increase in duration of use of smokeless tobacco, there was a significant increase in gingival recession and bone loss. Therefore, the severity of periodontal diseases increases with the use of tobacco in the present study.

CONCLUSION

The present study showed that smoking and periodontal disease progression were related. Use of smokeless tobacco was highly preferred in the given study population and it was proven to be associated with a higher number of patients diagnosed with periodontitis.

AUTHORS CONTRIBUTION

Cinthura. C carried out the retrospective study, participated in the sequence alignment, statistical analysis and drafted the manuscript. Dr. ArvinaRajasekar conceived the study, participated in its design and coordinated in drafting the manuscript. All authors read and approved the manuscript.

CONFLICT OF INTEREST

There were no conflicts of interest as defined by the authors.

REFERENCES

- [1] Abdulkarim, A. A., Mokuolu, O. A. and Adeniyi, A. (2005) 'Drug use among adolescents in Ilorin, Nigeria', *Tropical doctor*. SAGE Publications, 35(4), pp. 225–228. doi: 10.1258/004947505774938620.
- [2] Al-Tayeb, D. (2008) 'The effects of smoking on the periodontal condition of young adult saudi population', *Egyptian dental journal*. *Egyptian Dental Journal*, 54(1). Available at: http://www.kau.edu.sa/Show_Res.aspx?Site_ID=165&LNG=EN&RN=55389.
- [3] Ankola, A. et al. (2007) 'Assessment of periodontal status and loss of teeth among smokers and non-smokers in Belgaum city', *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine*. Medknow Publications, 32(1), p. 75. Available at: <http://www.ijcm.org.in/article.asp?issn=0970-0218;year=2007;volume=32;issue=1;spage=75;epage=76;aulast=Pankaj>.
- [4] Avinash, K., Malaippan, S. and Dooraiswamy, J. N. (2017) 'Methods of isolation and characterization of stem cells from different regions of oral cavity using markers: a systematic review', *International journal of stem cells*. Korean Society for Stem Cell Research, 10(1), p. 12. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5488772/>.
- [5] Do, L. G. et al. (2008) 'Smoking-attributable periodontal disease in the Australian adult population', *Journal of clinical periodontology*. Wiley Online Library, 35(5), pp. 398–404. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1600-051X.2008.01223.x>.
- [6] Eriksen, M. P., LeMaistre, C. A. and Newell, G. R. (1988) 'Health Hazards of Passive Smoking', *Annual review of public health*. Annual Reviews, 9(1), pp. 47–70. doi: 10.1146/annurev.pu.09.050188.000403.
- [7] Gautam, D. K. et al. (2011) 'Effect of cigarette smoking on the periodontal health status: A comparative, cross sectional study', *Journal of Indian Society of Periodontology*. Wolters Kluwer--Medknow Publications, 15(4), p. 383. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3283937/>.
- [8] Goyal, J. et al. (2019) 'Prevalence of periodontal status among nicotine dependent individuals of 35-44 years attending community dental camps in Ghaziabad district, Uttar Pradesh', *Journal of family medicine and primary care*. Wolters Kluwer--Medknow Publications, 8(7), p. 2456. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6691435/>.
- [9] Haber, J. (1994) 'Cigarette smoking: a major risk factor for periodontitis', *Compendium . europepmc.org*, 15(8), pp. 1002–1004. Available at: <https://europepmc.org/abstract/med/7987894>.
- [10] Johnson, G. K. and Hill, M. (2004) 'Cigarette Smoking and the Periodontal Patient', *Journal of periodontology*. Wiley Online Library, 75(2), pp. 196–209. doi: 10.1902/jop.2004.75.2.196.

- [11] Johnson, N. W. and Bain, C. A. (2000) 'Tobacco and oral disease', *British dental journal*. nature.com, 189(4), pp. 200–206. doi: 10.1038/sj.bdj.4800721.
- [12] Kadtane, S. S. et al. (2014) 'Perception about the role of dentists in smoking cessation: A cross-sectional study', *Int J Dent Med Res*. researchgate.net, 1(1), pp. 2–7. Available at: https://www.researchgate.net/profile/Safalya_Kadtane2/publication/280530359_Perception_About_The_Role_of_Dentist_in_Smoking_Cessation_A_Cross-sectional_Study/links/55b79fb408aed621de0472d2.pdf.
- [13] Kavarthapu, A. and Thamaraiselvan, M. (2018) 'Assessing the variation in course and position of inferior alveolar nerve among south Indian population: A cone beam computed tomographic study', *Indian journal of dental research: official publication of Indian Society for Dental Research*. Medknow Publications and Media Pvt. Ltd., 29(4), p. 405. doi: 10.4103/ijdr.IJDR_418_17.
- [14] Khalid, W. et al. (2016) 'Role of endothelin-1 in periodontal diseases: A structured review', *Indian journal of dental research: official publication of Indian Society for Dental Research*. Medknow Publications, 27(3), p. 323. Available at: <http://www.ijdr.in/tocd.asp?2016/27/3/323/186247/3>.
- [15] Khalid, W. et al. (2017) 'Comparison of serum levels of endothelin-1 in chronic periodontitis patients before and after treatment', *Journal of clinical and diagnostic research: JCDR*. JCDR Research & Publications Private Limited, 11(4), p. ZC78. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5449924/>.
- [16] Linden, G. J. and Mullally, B. H. (1994) 'Cigarette Smoking and Periodontal Destruction in Young Adults', *Journal of periodontology*. Wiley Online Library, 65(7), pp. 718–723. doi: 10.1902/jop.1994.65.7.718.
- [17] Locker, D. and Leake, J. L. (1993) 'Risk Indicators and Risk Markers for Periodontal Disease Experience in Older Adults Living Independently in Ontario, Canada', *Journal of dental research*. SAGE Publications Inc, 72(1), pp. 9–17. doi: 10.1177/00220345930720011501.
- [18] Lung, Z. H. S. et al. (2005) 'Poor patient awareness of the relationship between smoking and periodontal diseases', *British dental journal*. nature.com, 199(11), pp. 731–737. doi: 10.1038/sj.bdj.4812971.
- [19] Mohamed, S. and Janakiram, C. (2013) 'Periodontal status among tobacco users in Karnataka, India', *Indian journal of public health*. ijph.in. Available at: <http://www.ijph.in/article.asp?issn=0019-557X;year=2013;volume=57;issue=2;spage=105;epage=108;aulast=Mohamed>.
- [20] Mootha, A. et al. (2016) 'The Effect of Periodontitis on Expression of Interleukin-21: A Systematic Review', *International journal of inflammation*. Hindawi, 2016. doi: 10.1155/2016/3507503.
- [21] Muniandy, S. (2019) 'Knowledge on smoking and periodontal disease: A cross-sectional survey among targeted respondents', *Journal of Indian Society of Periodontology*. Wolters Kluwer--Medknow Publications, 23(3), p. 275. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6519089/>.
- [22] Naveen-Kumar, B. et al. (2016) 'Various forms of tobacco usage and its associated oral mucosal lesions', *Journal of clinical and experimental dentistry*. Medicina Oral SL, 8(2), p. e172. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4808313/>.
- [23] Palmer, R. M. et al. (2005) 'Mechanisms of action of environmental factors--tobacco smoking', *Journal of clinical periodontology*. Wiley Online Library, 32, pp. 180–195. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1600-051X.2005.00786.x>.
- [24] Panda, S. et al. (2014) 'Platelet rich fibrin and xenograft in treatment of intrabony defect', *Contemporary clinical dentistry*. Wolters Kluwer--Medknow Publications, 5(4), p. 550. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4229771/>.
- [25] Priyanka, S. et al. (2017) 'Detection of cytomegalovirus, Epstein--Barr virus, and Torque Teno virus in subgingival and atheromatous plaques of cardiac patients with chronic periodontitis', *Journal of Indian*

Society of Periodontology. Wolters Kluwer--Medknow Publications, 21(6), p. 456. Available at:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5846241/>.

[26] Ramamurthy, J. and Mg, V. (2018) 'COMPARISON OF EFFECT OF HIORA MOUTHWASH VERSUS CHLORHEXIDINE MOUTHWASH IN GINGIVITIS PATIENTS: A CLINICAL TRIAL', Asian J Pharm Clin Res. [pdfs.semanticscholar.org](https://pdfs.semanticscholar.org/1c22/6e98fc99e9fb99bc749ae5d553024fa93052.pdf), 11(7), pp. 84–88. Available at:
<https://pdfs.semanticscholar.org/1c22/6e98fc99e9fb99bc749ae5d553024fa93052.pdf>.

[27] Ramesh, A., Varghese, S. S., et al. (2016) 'Chronic obstructive pulmonary disease and periodontitis--unwinding their linking mechanisms', Journal of oral biosciences / JAOB, Japanese Association for Oral Biology. Elsevier, 58(1), pp. 23–26. Available at:
<https://www.sciencedirect.com/science/article/pii/S1349007915001103>.

[28] Ramesh, A., Varghese, S. S., et al. (2016) 'Herbs as an antioxidant arsenal for periodontal diseases', Journal of intercultural ethnopharmacology. SAGEYA, 5(1), p. 92. Available at:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4805154/>.

[29] Ramesh, A. et al. (2019) 'Esthetic lip repositioning: A cosmetic approach for correction of gummy smile--A case series', Journal of Indian Society of Periodontology. Wolters Kluwer--Medknow Publications, 23(3), p. 290. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6519099/>.

[30] Ramesh, A., Ravi, S. and Kaarthikeyan, G. (2017) 'Comprehensive rehabilitation using dental implants in generalized aggressive periodontitis', Journal of Indian Society of Periodontology. Wolters Kluwer--Medknow Publications, 21(2), p. 160. Available at:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5771115/>.

[31] Rani, M. et al. (2003) 'Tobacco use in India: prevalence and predictors of smoking and chewing in a national cross sectional household survey', Tobacco control. BMJ Publishing Group Ltd, 12(4), pp. e4–e4. doi: 10.1136/tc.12.4.e4.

[32] Ravi, S. et al. (2017) 'Additive Effect of Plasma Rich in Growth Factors With Guided Tissue Regeneration in Treatment of Intrabony Defects in Patients With Chronic Periodontitis: A Split-Mouth Randomized Controlled Clinical Trial', Journal of periodontology. Wiley Online Library, 88(9), pp. 839–845. Available at: <https://aap.onlinelibrary.wiley.com/doi/abs/10.1902/jop.2017.160824>.

[33] Rosa, G. M., Lucas, G. Q. and Lucas, O. N. (2008) 'Cigarette Smoking and Alveolar Bone in Young Adults: A Study Using Digitized Radiographs', Journal of periodontology. Wiley Online Library, 79(2), pp. 232–244. doi: 10.1902/jop.2008.060522.

[34] Schenkein, H. A. et al. (1995) 'SMOKING and its Effects on Early-Onset Periodontitis', The Journal of the American Dental Association. Elsevier, 126(8), pp. 1107–1113. doi: 10.14219/jada.archive.1995.0327.

[35] Shah, P. M., Geetha, R. V. and Thangavelu, L. (2019) 'Prevalence of periodontitis among smokers and non-smokers', International Journal of Research in Pharmaceutical Sciences. International Journal of Research in Pharmaceutical Sciences, Sponsored by JK Welfare & Pharmascope Foundation, 10(2), pp. 1161–1166. doi: 10.26452/ijrps.v10i2.398.

[36] Shuler, R. L. (1968) 'Effect of Cigarette Smoking on the Circulation of the Oral Mucosa', Journal of dental research. SAGE Publications Inc, 47(6), pp. 910–915. doi: 10.1177/00220345680470065201.

[37] Thamaraiselvan, M. et al. (2015) 'Comparative clinical evaluation of coronally advanced flap with or without platelet rich fibrin membrane in the treatment of isolated gingival recession', Journal of Indian Society of Periodontology. Wolters Kluwer--Medknow Publications, 19(1), p. 66. Available at:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4365161/>.

[38] Tonetti, M. S. (1998) 'Cigarette smoking and periodontal diseases: etiology and management of disease', Annals of periodontology / the American Academy of Periodontology. Wiley Online Library. Available at: <https://aap.onlinelibrary.wiley.com/doi/abs/10.1902/annals.1998.3.1.88>.

[39] Varghese, S. S. et al. (2015) 'Estimation of salivary tumor necrosis factor-alpha in chronic and aggressive periodontitis patients', Contemporary clinical dentistry. Wolters Kluwer--Medknow Publications, 6(Suppl 1), p. S152. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4632215/>.

TABLES

Age groups	Frequency	Percentage
Below 25	87	17.4
25-35	157	31.4
36-45	105	21
46-55	92	18.4
56-65	53	10.6
66-75	6	1.2
Total	500	100

Table 1: Age distribution of patients who had various forms of tobacco usage, showing highest prevalence in the age group of 25-35 years (31.4 %) and the least among the age group of 65-75 years (1.2%).

FIGURES

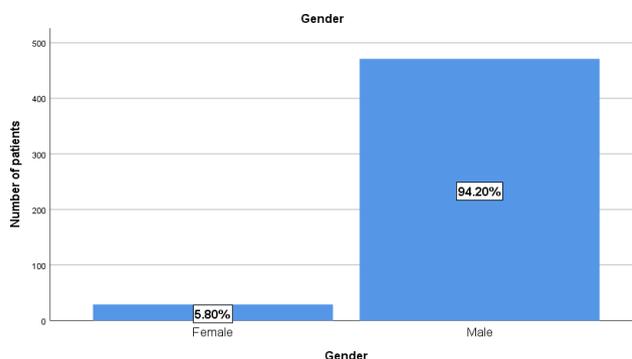


Figure 1: Gender distribution of tobacco use. Graph depicts the distribution of gender among tobacco users (N=500). X axis represents the gender and Y axis represents the number of patients. Male gender was predominant (94.2%), whereas females were 5.8% only.

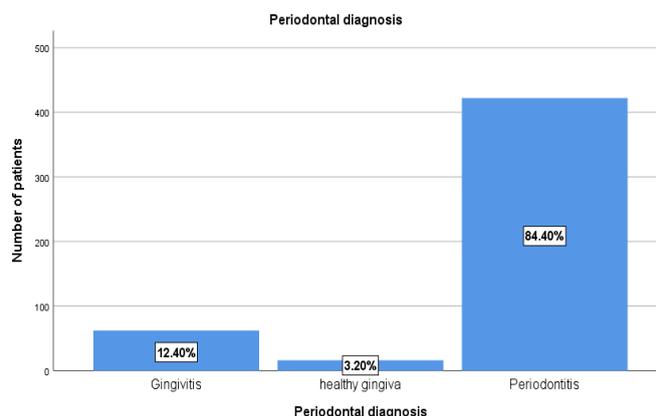


Figure 2: Distribution of periodontal health status among tobacco users (N=500). X axis represents the periodontal diagnosis and Y axis represents the number of patients diagnosed. 84.4% of them were diagnosed with periodontitis, followed 12.4% with gingivitis and 3.2% had a clinically healthy gingiva.

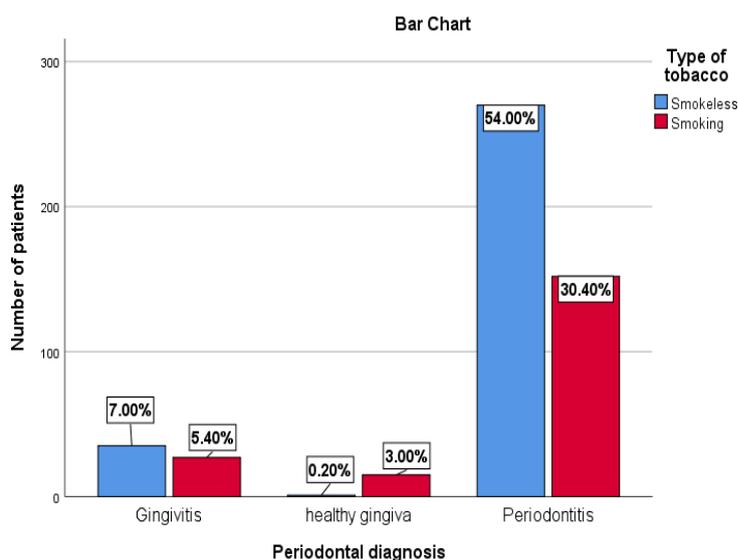


Figure 3: Bar graph depicting the association between type of tobacco usage and periodontal diagnosis. X-axis represents the periodontal diagnosis and y-axis represents the number of patients using smokeless (blue) or smoking (red) forms of tobacco. Among 306 (61.2%) smokeless tobacco users, 270 patients had periodontitis. Whereas, among 194 (38.8%) patients who smoked cigarettes, 152 of them had periodontitis. Overall, smokeless tobacco users were diagnosed with periodontitis more frequently. (Pearson Chi-Square test, p value- 0.000, $p < 0.05$, statistically significant).