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Assessment of furcation defects in hypertensive patients with chronic periodontitis - an institutional based retrospective study

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Abstract: Periodontal disease is characterised by the loss of connective tissue attachment induced by the presence of putative periodontal pathogens within the gingival sulcus. The presence of furcation involvement is one clinical finding that can lead to a diagnosis of advanced and severe form of periodontitis and potentially to a less favorable prognosis for the affected teeth. The aim of the study is to assess the various types of furcation defects in hypertensive patients with chronic periodontitis. Among a sample of 42110 patients under the age group of 30 to 90 years in the Chennai population who visited a private dental college, a total of 858 patients who had met the inclusion criteria were selected for the study. Demographic details such as age and sex and grades of furcation involvement for all the patients were recorded. The required data was collected and analysed using SPSS(Statistical Package For The Social Sciences) Software. Chi-square test was used to study association between the parameters. The results were considered to be of statistical significance if $p < 0.05$. In the present study, there were more males (55.4%) than females (44.6%) in the study population and majority of patients were in the age group of 51-60 years of age (36.5%). Generalised chronic gingivitis (46.17%) was predominantly seen among the subjects followed by generalised chronic periodontitis (35.11%) and localised chronic periodontitis (18.72%). The association between the age groups and furcation in maxillary and mandibular posteriors, also association between the periodontal disease and furcation in maxillary and mandibular posteriors was evaluated, which was statistically significant.($p < 0.05$) Within the limitations of the present retrospective analysis, it can be concluded that chronic periodontitis was more prevalent in hypertensive patients. There was lesser prevalence of furcation defects in maxillary and mandibular posteriors in hypertensive patients with chronic periodontitis. Additionally, grade 2 furcation of maxillary posteriors and grade 1 furcation of mandibular posteriors was most seen in the age group of 51-60 years.

Keywords: Chronic Periodontitis, Furcation, Hypertension innovative technique

INTRODUCTION

Periodontitis is a chronic and destructive disease of the periodontium, it causes inflammation and bleeding of the gingival tissues as a result of the accumulation of microbial dental plaque, and in its destructive form, periodontitis results in progressive destruction of the supporting structures of the teeth leading to looseness of the teeth and ultimately tooth loss.(Page *et al.*, 1997) Periodontitis is the result of complex interrelationships between infectious agents and host factors. The etiology of the disease involves interplay between both intrinsic and extrinsic factors such as genetic susceptibility, diet, oral hygiene, and inflammatory response to exposure to complex pathogens.(Van Dyke and Sheilesh, 2005) As stated by the glossary of terms of the American Academy of Periodontology, a furcation involvement exists when periodontal disease has caused resorption of bone into the bi- or trifurcation area of a multi-rooted tooth.(Bower, 1979) The furcation is an area of complex anatomic morphology that may be difficult or impossible to debride by routine periodontal instrumentation. Detailed knowledge about the morphology of the multirooted teeth like molars and their position in the dental arch is a fundamental prerequisite for a proper and better understanding of problems or complications, which may occur when such teeth is affected with destructive periodontal diseases.(Goldman, 1958) Routine home care methods may not keep the molar furcation area free of dental plaque.

The presence of furcation involvement is one clinical finding that can lead to a diagnosis of advanced and severe form of periodontitis and potentially to a less favorable prognosis for the affected teeth.(Heins and Canter, 1968) Periodontal furcation involvement represents a challenge in the treatment of periodontally compromised molars. Different treatment modalities are advocated for the treatment of FI, including nonsurgical maintenance, resective and regenerative treatment, according to subject and site factors and degree of involvement of individual affected molars.(Nibali *et al.*, 2018) The treatment of multi-rooted molars with a furcation involvement is still a challenge

and the risk for tooth loss is also one of the common issue in such situations. The presence of furcation defects in molars approximately doubles the risk of tooth loss for molar teeth maintained in supportive periodontal treatment for upto 10-15 years.(Nibali *et al.*, 2016)

Periodontitis is linked to cardiovascular diseases (CVD). The chronic inflammatory process of periodontitis and the host response provide between periodontitis and CVD(Humphrey *et al.*, 2008). Hypertension and periodontitis have risk factors, such as smoking, stress, increased age, and socioeconomic factors(Ekuni *et al.*, 2008) American Heart Association (AHA) studies support an association between periodontal disease and cardiovascular disease, independent of shared risk factors.(Lockhart *et al.*, 2012) Hypertension is defined when a patient has an elevated systolic blood pressure greater than 140 mmHg and/or diastolic blood pressure greater than 90 mmHg. Hypertension is a prime global health disorder affecting about 972 million adult populations in the year 2000. This number is expected to increase to 1.56 billion by the year 2025 (Elliott, 2006). Hypertension appears to be associated with periodontitis. Many recent studies have shown that systolic and diastolic blood pressures are higher among patients with periodontitis when compared to those without periodontitis(Higashi *et al.*, 2008; Desvarieux *et al.*, 2010).

Our department is passionate about research we have published numerous high quality articles in this domain over the past years (Abraham *et al.*, 2005; Devaki, Sathivel and BalajiRaghavendran, 2009; Neelakantan *et al.*, 2010, 2015; Arja *et al.*, 2013; Ramshankar *et al.*, 2014; Sumathi *et al.*, 2014; Surapaneni and Jainu, 2014; Surapaneni, Priya and Mallika, 2014; Ramamoorthi, Nivedhitha and Divyanand, 2015; Manivannan *et al.*, 2017; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; J *et al.*, 2018; Ravindiran and Praveenkumar, 2018; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Krishnaswamy *et al.*, 2020; Samuel, Acharya and Rao, 2020; Sathish and Karthick, 2020)

Hence, the aim of the study is to assess the various types of furcation defects in hypertensive patients with chronic periodontitis.

MATERIALS AND METHODS

Study design: The retrospective study was carried out by the analysis of the patients' records, who had visited the department of Periodontics from June 2019-March 2020. Inclusion criteria involved hypertensive patients, both male and female patients with chronic periodontitis under the age group of 30 to 90 years, Whereas, exclusion criteria includes patients who had previously undergone periodontal treatment, smoking habits, pregnancy, presence of other chronic systemic diseases such as diabetes mellitus, epileptic patients and hematological disorders.

Ethical approval: Before scheduling of the retrospective study, the official permission was obtained from the Institutional ethical committee (ethical approval number- SDC/ SIHEC/ 2020/ DIASDATA/ 0619-0320).

Data collection: Among a sample of 42110 patients under the age group of 30 to 90 years in the Chennai population who visited Saveetha Dental College for dental check up, a total of 858 patients who had met the inclusion criteria were selected for the study. Data collection includes various parameters such as age, gender (male or female), type of periodontal disease and grades of furcation. Based on the severity of periodontal disease the patients were categorised into localised chronic periodontitis and generalised chronic periodontitis. Furcation defects in the current study were examined using Nabers probe. It was recorded in the first and second molars of maxilla and mandible. The grades of furcation involvement were recorded based on Glickman(1953) classification of furcation. It was recorded as Grade 1, Grade 2, Grade 3 and Grade 4 furcation. These data were retrieved from dental records from June 2019 to March 2020.

Statistical analysis: The Data collected was tabulated in excel sheets. The data was obtained and analysed using statistical software SPSS version 23.0 (Statistical Package For The Social Sciences). Chisquare test was used to study association between the parameters. The association between the age groups and furcation in maxillary and mandibular posteriors, also association between the periodontal disease and furcation in maxillary and mandibular posteriors was evaluated. The results were considered to be of statistical significance if $p < 0.05$. The results were demonstrated in the form of bar graphs.

RESULTS AND DISCUSSION

A total of 858 hypertensive patients with chronic periodontitis were included in the study. Among the study population male patients were 55.4% and female patients were 44.6% (Figure 1). Majority of the patients were at the age group of 51-60 (36.5%), followed by 61-70 years of age (27.8%) followed by <=50 years of 30-50 years of age (26.4%) and >70 years of age of 70-90 years of age (9.3%) (Figure2).

Furcation defects in maxillary posteriors (16,17,26,27) were assessed, absence of furcation was seen predominantly higher (87.5%) followed by grade 2 furcation (5.3%), grade 1 furcation (4.7%), grade 3 furcation (2.5%) and grade 4 was the least observed (0.1%) (Figure 3). Furcation defects in mandibular posteriors (36,37,46,47) were assessed, absence of furcation was seen predominantly higher (87.9%) followed by grade 1 furcation (5.0%), grade 2 furcation (4.4%), grade 3 furcation (2.0%) and grade 4 was the least observed (0.7%) (Figure 4). Based on periodontal diseases, generalised chronic gingivitis (46.17%) was predominantly seen among

the subjects followed by generalised chronic periodontitis (35.11%) and localised chronic periodontitis (18.72%).(Figure 5).

The association between the age groups and furcation in maxillary posteriors, showed that in all the age groups, absence of furcation was more commonly seen. There were more number of grade 1 furcation (1.8%) in the age group of <=50 years of 30-50 years, more number of grade 2 (2%) furcation in the age group of 51-60 years, more number of grade 3 and 4 furcation in the age group of 61-70 years. (1.2%,0.1%) Association between the age groups and furcation involvement in maxillary posteriors, was statistically significant (Chi square test done, p value=0.037 ($p < 0.05$) (Figure 6). When comparing the age group with furcation in mandibular posteriors, in all the age groups, absence of furcation was more commonly seen. More number of grade 1 furcation (1.5%) is seen in the age group of 51-60 years. Association between the age groups and furcation involvement in mandibular posteriors, was statistically significant (Chi square test done, p value=0.011 ($p < 0.05$) (Figure 7).

When comparing the periodontal disease with furcation in maxillary posteriors, in hypertensive patients, absence of furcation in maxillary posteriors was more commonly seen in both localised and generalised chronic periodontitis. More number of grade 2 furcation (4.7%) is seen in generalised chronic periodontitis patients. Association between the periodontal disease and furcation involvement in maxillary posteriors, was statistically significant (Chi square test done, p value=0.000 < 0.05) (Figure 8). When comparing the periodontal disease with furcation in mandibular posteriors, in hypertensive patients, absence of furcation in mandibular posteriors was more commonly seen in both localised and generalised chronic periodontitis. More number of grade 1 and 2 furcation (4.3% both) is seen in generalised chronic periodontitis patients. Association between the periodontal disease and furcation involvement in mandibular posteriors, was statistically significant (Chi square test done, p value=0.000 $<$ 0.05) (Figure 9)

Invasion of the bifurcation and trifurcation of the multi rooted teeth resulting in furcation involvement is one of the serious complications of periodontitis. Previously our team had conducted various studies on treatment modalities for periodontal diseases and periodontal procedures(Khalid *et al.*, 2017), (Panda *et al.*, 2014) (Ramamurthy and Mg, 2018);(Ramesh, Ravi and Kaarthikeyan, 2017) (Ravi *et al.*, 2017) (Thamaraiselvan *et al.*, 2015)(Varghese *et al.*, 2015)(Avinash, Malaippan and Dooraiswamy, 2017), studies correlating various diseases and factors related to periodontal diseases (Priyanka *et al.*, 2017);(Ramesh *et al.*, 2016) and in-vitro & radiological studies (Kavarthapu and Thamaraiselvan, 2018) and reviews (Khalid *et al.*, 2016),(Mootha *et al.*, 2016); (Ramesh *et al.*, 2019)(Ramesh *et al.*, 2016) over the past 5 years. Now we are focusing on the various other conditions that will guide us and give a deeper understanding in managing periodontal problems. In the present study, there were more males (55.4%) than females (44.6%) in the study population. Grassos C et al also found that hypertension was associated with periodontitis in male patients(Grassos *et al.*, 2010). Contradictory to this, Ahn et al stated that hypertension showed a significant positive association with periodontitis in the fully adjusted model in female adults aged 30–59 years. (Ahn *et al.*, 2015)

It was found that in the present study, the majority of patients are in the age group of 51-60 years of age (36.5%). Rivas-Tumanyan et al stated that severe periodontitis was associated with high blood pressure, with odds ratio of 2.93, after adjusting for factors such as sex, age, smoking, and alcoholic habits. They concluded that periodontitis may contribute to poor blood pressure control among the older adults(Rivas-Tumanyan *et al.*, 2013). Contradictory to this,D Aiuto et al, from the analysis of the 11,029 U.S. adults population, stated that there was no significant association between severity of periodontitis and high blood pressure among adults aged older than 44 years,(D'Aiuto *et al.*, 2008).

Generalised chronic gingivitis (46.17%) was predominantly seen among the subjects followed by generalised chronic periodontitis (35.11%) and localised chronic periodontitis (18.72%). Thus a higher prevalence of chronic periodontitis is observed. Vidal et al found that the percentage of sites with clinical attachment loss was more in hypertensive patients when compared with systemically healthy patients.They found significant associations with arterial hypertension in cases of generalized chronic periodontitis with odds ratio of 2.18. Hence, proving that generalized chronic periodontitis seems to be a risk indicator for hypertensive patients. The inflammatory response coexisting with periodontitis has been suggested as a key factor that may exert adverse effects on the regulation of blood pressure. Periodontitis may be capable of inducing vascular inflammation which can lead to endothelial dysfunction, a primary step seen in initiation of cardiovascular disorders(Vidal *et al.*, 2011). Vidal et al. found that periodontal therapy reduces the levels of C-reactive proteins, interleukin-6 and fibrinogen in severe periodontitis patients with hypertension. Thus, it can be stated that inflammation might act as a potential link between hypertension and periodontitis(Vidal *et al.*, 2009). Several periodontal pathogens from periodontitis lesions may enter into the circulation and deliver the various virulent factors to the arterial wall, this might promote the foam cell formation in macrophages, thus allowing the development of cardiovascular diseases(Roth *et al.*, 2007).

In the present study, absence of furcation defects was seen predominantly higher in maxillary and mandibular posteriors. Additionally, grade 2 furcation was the most common type present in maxillary posteriors and grade 1 furcation was the most common type present in mandibular posteriors. The association between the age groups

and furcation in maxillary and mandibular posteriors, showed that in all the age groups, absence of furcation was more commonly seen. Additionally, grade 2 furcation of maxillary posteriors and grade 1 furcation of mandibular posteriors was most seen in the age group of 51-60 years. Lockhart et al stated periodontal interventions may reduce the load of systemic inflammation and endothelial dysfunction(Lockhart *et al.*, 2012). Also observational studies support an association between periodontitis and cardiovascular diseases independent of known confounding factors, however they do not support a causative relationship.

The association between the periodontal disease and furcation in maxillary and mandibular posteriors, showed that in hypertensive patients, absence of furcation was more commonly seen in both localised and generalised chronic periodontitis. Additionally, grade 2 furcation of maxillary posteriors, grade 1 and 2 furcation of mandibular posteriors was most seen in generalised chronic periodontitis patients. Thus, in our study there was lesser prevalence of furcation defects in maxillary and mandibular posteriors in hypertensive patients with chronic periodontitis. Furcation involvement therefore presents both diagnostic and therapeutic dilemmas. Potential differences in assessments of degree of furcation defects can also be a drawback of this current retrospective analysis. In future long term clinical studies comparing the furcation defects with systemically healthy individuals should be performed.

CONCLUSION

Within the limitations of the present retrospective analysis, it can be concluded that chronic periodontitis was more prevalent in hypertensive patients. There was lesser prevalence of furcation defects in maxillary and mandibular posteriors in hypertensive patients with chronic periodontitis. Additionally, grade 2 furcation of maxillary posteriors and grade 1 furcation of mandibular posteriors was most seen in the age group of 51-60 years.

AUTHOR CONTRIBUTION

Saravanan and Balaji Ganesh contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Conflict of interest: The authors declare no potential conflict of interest.

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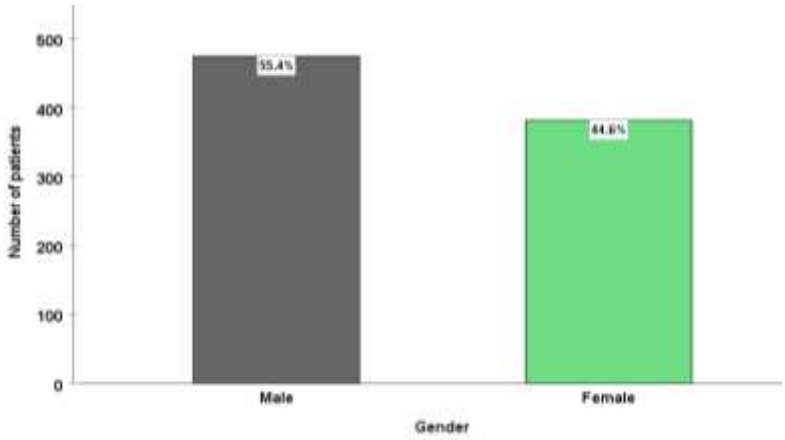

Fig.1: This graph represents the percentage of gender distribution among the study population, where X axis denotes Gender criteria and Y axis denotes number of patients. There were more males (Dark grey)(55.4%) than females(Light green)(44.6%) in the study population.

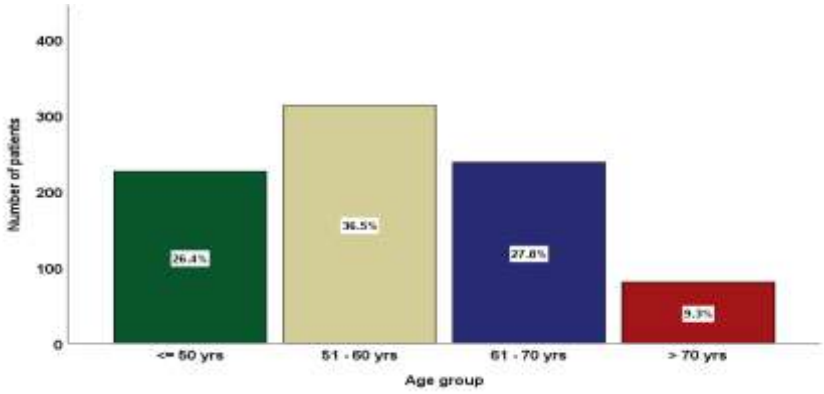

Fig.2: This bar graph represents the percentage distribution of different age group of the study population, where X axis denotes age group and Y axis denotes number of patients. Majority of patients are in age group of 51-60 years of age (Grey)(36.5%) followed by 61-70 years of age (Blue)(27.8%) followed by <=50 years of 30-50 years of age (Green)(26.4%) and >70 years of age of 70-90 years of age (Marron)(9.3%)

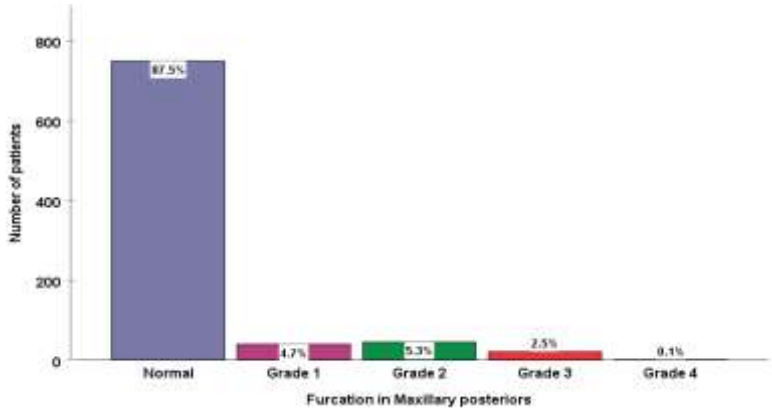

Fig.3: This bar graph represents the furcation defects in maxillary posteriors of the study subjects, where X axis denotes the grades of furcation in maxillary posteriors and Y axis denotes number of patients. Absence of furcation was seen predominantly higher (Navy blue) (87.5%) followed by grade 2 furcation (Green) (5.3%), grade 1 furcation (Purple) (4.7%), grade 3 furcation (Red) (2.5%) and grade 4 (Orange) (0.1%)

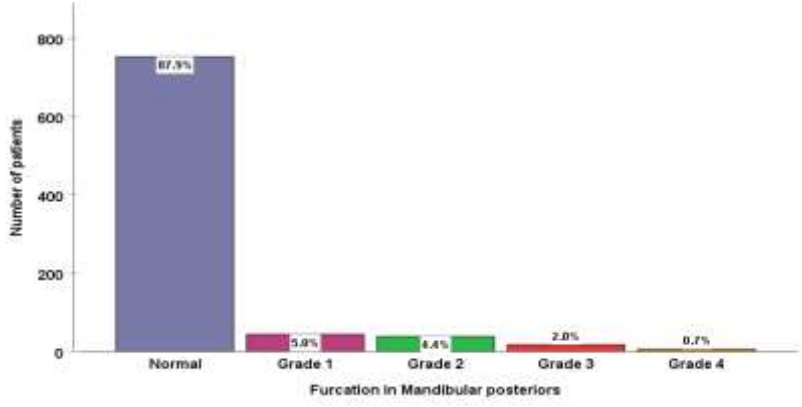

Fig.4: This bar graph represents the furcation defects in mandibular posteriors of the study subjects, where X axis denotes the grades of furcation in mandibular posteriors, Y axis denotes number of patients. Absence of furcation was seen predominantly higher (Navy blue) (87.9%) followed by grade 1 furcation (Purple) (5.0%), grade 2 furcation (Green) (4.4%), grade 3 furcation (Red) (2.0%) and grade 4 (Orange) (0.7%)

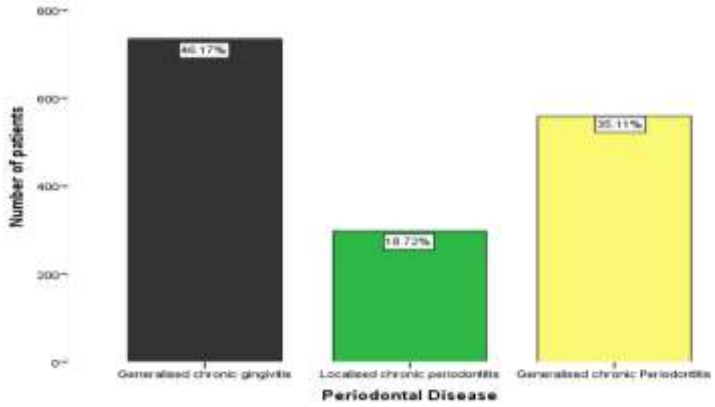

Fig.5: This bar graph represents the periodontal status of the study subjects, where X axis denotes periodontal disease and Y axis denotes number of patients. Generalised chronic gingivitis (Black)(46.17%) was predominantly seen among the subjects followed by generalised chronic periodontitis (Yellow)(35.11%) and localised chronic periodontitis (Green)(18.72%)

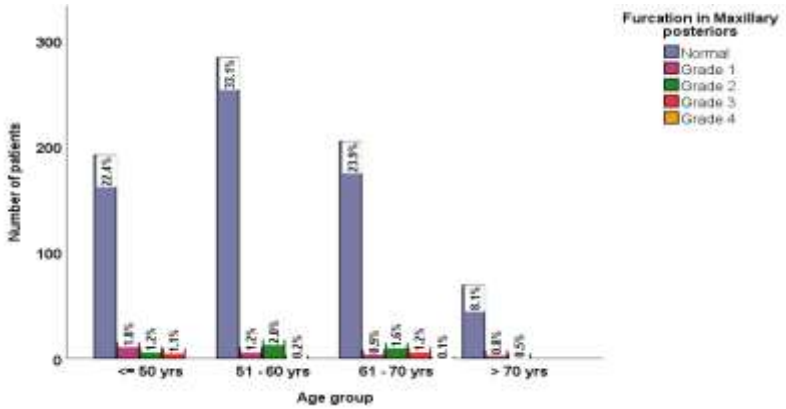

Fig.6: This graph represents the association between the age groups and furcation in maxillary posteriors, where X axis denotes age group and Y axis denotes number of patients. In all the age groups, absence of furcation was more commonly seen. More number of grade 2 furcation is seen in the age group of 51-60 years. Chi square test done, p value=0.037 (p < 0.05), hence statistically significant.

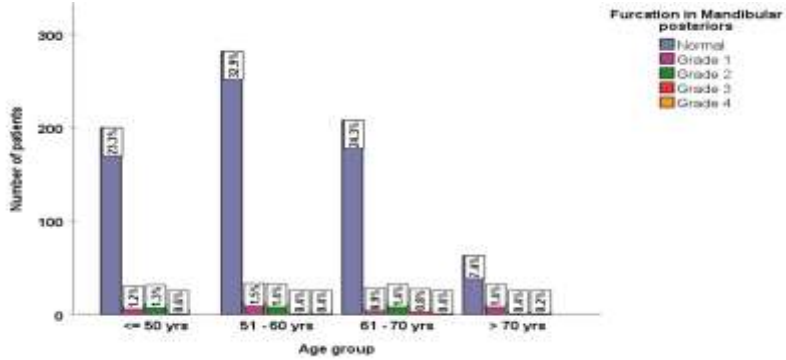

Fig.7: This graph represents the association between the age groups and furcation in mandibular posteriors, where X axis denotes age group and Y axis denotes number of patients. In all the age groups, absence of furcation was more commonly seen. More number of grade 1 furcation is seen in the age group of 51-60 years. Chi square test done, p value=0.011 (p < 0.05), hence statistically significant.

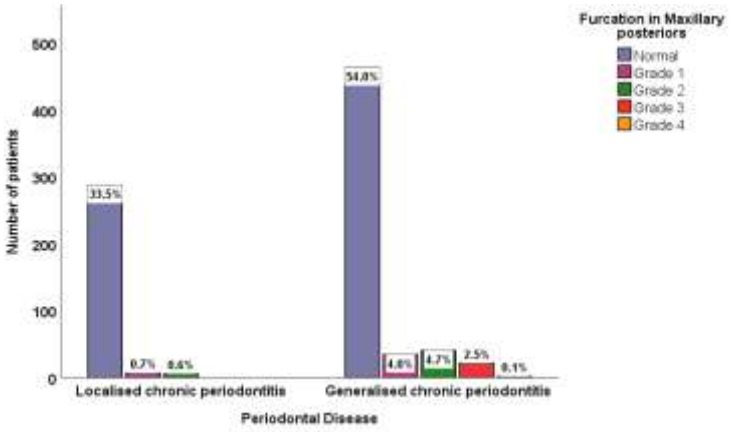

Fig.8: This graph represents the association between the periodontal disease and furcation in maxillary posteriors, where X axis denotes the periodontal disease and Y axis denotes number of patients. In hypertensive patients, absence of furcation was more commonly seen in both localised and generalised chronic periodontitis. More number of grade 2 furcation is seen in generalised chronic periodontitis patients. Chi square test done, p value=0.000 (p < 0.05), hence statistically significant.

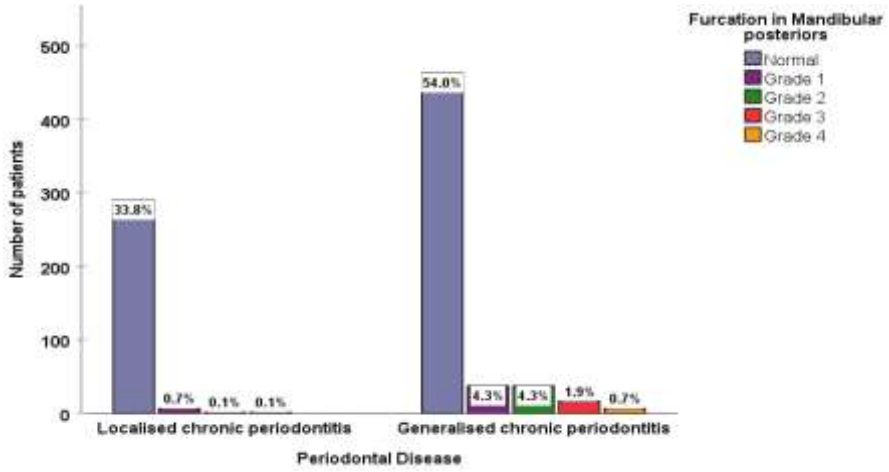

Fig.9: This graph represents the association between the periodontal disease and furcation in mandibular posteriors, where X axis denotes the periodontal disease and Y axis denotes number of patients. In hypertensive patients, absence of furcation was more commonly seen in both localised and generalised chronic periodontitis. More number of grade 1 and 2 furcation is seen in generalised chronic periodontitis patients. Chi square test done, p value=0.000 (p< 0.05), hence statistically significant.