Assessment of Furcation Defects in Diabetic Patients with Chronic Periodontitis - An Institutional Based Retrospective Study

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Abstract: Diabetes Mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism. Poorly controlled DM has been associated with increased susceptibility to oral infections including periodontal diseases. It is well documented that one of the main causes of diabetes mellitus is that it leads to periodontal destruction which eventually leads to furcation exposure. This leads to poor prognosis of the affected tooth. Thus the aim of this study is to determine the most common furcation site involved in patients with diabetes. Completed case sheets were collected from June 2019 to April 2020. Data was retrieved and evaluated by 2 reviewers. This university setting study involved 700 sample sizes. Data is tabulated the parameters which are age groups, gender, RBS value and furcation grade. Ranges of RBS values are from 150mg/dl to >551mg/dl. A total of 700 patients case sheets were evaluated and their periodontal status was evaluated. 500 molars were affected (3rd molars exempted). It was found that among all the age groups the most number of participants were seen in 41-60 years (66%). Majority of the affected molars has a grade II furcation involvement (45%). 35.40% had grade I furcation involvement followed by 15.60% of affected teeth with grade III furcation involvement and finally 4% had grade IV furcation involvement. Amongst the teeth with grade I and grade III it was found that 16 was the mostly affected. For grade II furcation involvement it was seen that 46 was mostly affected. Association between grade I, II and III furcation and age groups was statistically insignificant. Finally, 37 was the most affected among the teeth with grade IV furcation involvement. Association between grade IV furcation and age groups was statistically significant (p value=0.006) Thus we can conclude that diabetes mellitus is associated with periodontal disease and in this study it is evident that it involves the furcation area of molars. Diabetic patients are more prone to severe periodontitis with multiple furcation involvement.

Keywords: Chronic periodontitis; Diabetes mellitus; Furcation; Innovation

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism (Alberti and Zimmet, 1998; Mohamed et al., 2013), Type I DM is most common in children and adolescents whereas Type II DM affects adults. Type II DM constitutes about 90-95% of all patients having the disease (Mealey and Ocampo, 2007). Both types I and II have a genetic predisposition, the aetiology of type II is related to lifestyle factors such as fat and sugar intakes, physical inactivity and obesity (Mealey and Ocampo, 2007) Worldwide; 346 million people suffer from DM (Organization and Others, 2013). Periodontitis is a chronic inflammatory condition which is initiated by gram negative organisms, which affects the tooth supporting structures (Löe, 1981; Mootha et al., 2016; Ramesh, Sheeja Saji Varghese, et al., 2016; Ramesh, Sheeja S. Varghese, et al., 2016; Priyanka et al., 2017). It can also be said as an interaction between pathogenic bacteria and the immune and inflammatory response of host.(Khalid et al., 2016, 2017) Periodontitis is characterized by persistent inflammation, which causes loss of periodontal tissues (Froum, Gomez and Breault, 2002; Panda et al., 2014; Varghese et al., 2015). It leads to destruction of periodontal tissues namely the gingiva, periodontal ligament, cementum and alveolar bone (Avinash, Malaippan and Dooraiswamy, 2017; Ravi et al., 2017; Ramamurthy and Mg, 2018).

The association between periodontal diseases and diabetes mellitus (DM) is well documented(Gopalakrishnan et al., 2018). There has found to be a link between DM, tooth loss and periodontal prognosis. There are various prognostic factors, local site-related factors such as probing depth (PD), mobility and furcation involvement

which may be controlled by periodontal therapy however there are certain patient level factors such as smoking, plaque control and DM control. Poorly controlled DM has been associated with increased susceptibility to oral infections including periodontal diseases (Mohamed et al., 2013). Loe (Loe, 1993) stated that periodontal disease is the sixth most common complication of DM whereas Lalla et al (Lalla and Lamster, 2012) reported that DM is the strongest risk factor for periodontal infection compared to the other systemic condition such as hypertension. Periodontal therapy aids in eliminating the disease and maintaining the function, healthy dentition and supporting tissues (Thamaraiselvan et al., 2015), (Ramesh et al., 2019) Due to a rise in periodontal disease which are left untreated, it leads to an increase in loss of teeth. Thus various replacements methods are available such as dental implants (Ramesh, Ravi and Kaarthikeyan, 2017; Kavarthapu and Thamaraiselvan, 2018)

Furcation involvement is when there is an exposure of interradicular areas to the periodontal pocket in bifurcated or trifurcated roots. (Hou and Tsai, 1987; Gusmão et al., 2014) Furcation involvement can be due to many reasons which are inflammation caused by microorganisms in the subgingival biofilm, predisposing factors such as enamel projections into the furcation; proximity of the furcation to the cemento-enamel junction; accessory canals extending the pulp inflammation to the furcation and the presence of interradicular canals on the floor of the pulp cavity and finally modifying factors which are trauma from occlusion which leads to greater bone loss (Goldberg et al., 1987; Hou and Tsai, 1987; Svärdström and Wennström, 2000) Furcation involvement often affects the molar teeth but less frequently involves the upper premolars. (Larato, 1970) Nabers probe is the instrument of choice when clinically examining the interradicular region. Radiographic examination is also an aid in determining the furcation involvement. Improved radiographic techniques will indicate the existence or absence of bone loss although it only provides a two dimensional image of the upper and lower jaw. There are some cases in which surgical intervention is required to further appreciate the extension of bone destruction in the interradicular region in addition to clinical and radiographic examination (Gusmão et al., 2014). Based on the literature, we can deduce that diabetes mellitus has an influence on the furcation involvement of molars. Our department is passionate about research we have published numerous high quality articles in this domain over the past years ((Kavitha et al., 2014) , (Praveen et al., 2001),(Devi and Gnanavel, 2014), (Putchala et al., 2013), (Vijayakumar et al., 2010), (Lekha et al., 2014a, 2014b) (Danda, 2010) (Danda, 2010) (Parthasarathy et al., 2016) (Gopalakannan, Senthilvelan and Ranganathan, 2012), (Rajendran et al., 2019), (Govindaraju, Neelakantan and Gutmann, 2017), (P. Neelakantan et al., 2015), (PradeepKumar et al., 2016), (Sajan et al., 2011), (Lekha et al., 2014a), (Neelakantan, Grotra and Sharma, 2013), (Patil et al., 2017), (Jeevanandan and Govindaraju, 2018), (Abdul Wahab et al., 2017), (Eapen, Baig and Avinash, 2017), (Menon et al., 2018), (Wahab et al., 2018), (Vishnu Prasad et al., 2018), (Uthrakumar et al., 2010), (Ashok, Ajith and Sivanesan, 2017), (Prasanna Neelakantan et al., 2015). Thus the aim of the study is to assess the various types of furcation involvement in chronic periodontitis patients with diabetes mellitus.

MATERIALS & METHODS

This is a retrospective study regarding common furcation sites in diabetic patients who have visited Saveetha Dental College and Hospitals , from a given period of time which is June 2019 to April 2020. The approval for this university setting was obtained from the Institution of Ethics Board. Institutional ethical committee approval was obtained for the study (SDC/SIHEC/2020/DIASDATA/0619-0320).Among patients who have visited the dental facility, the records of the patients were obtained from a given time period of June 2019 to April 2020. The sample size for this study was 700 patients. Inclusion criteria for this study were diabetes mellitus patients, gender (male/female), age above 17 years, presence of localised or generalised chronic periodontitis. Exclusion criteria were patients with smoking or other adverse habits, pregnancy and history of periodontal therapy done 6 months prior. All available data was collected and sorted. The patients detailed case sheets were analysed using the parameters included are: name, age, gender, random blood sugar values (RBS value), furcation grade (Grade I, Grade II, Grade III, and Grade IV). Age groups were grouped into (17-40 years, 41-60 years and >61 years). RBS values were grouped into (150-250mg/dl, 251-350mg/dl, 351-450mg/dl, 451-550mg/dl and >551mg/dl).

Statistical analysis

Once the results have been tabulated based on the parameters, the data is then exported to SPSS software. Frequency and percentage were employed in the analysis. Chi square test was used to detect the significance between the age, gender, RBS value and furcation grade. P value less than 0.05 was considered to be statistically significant.

RESULTS AND DISCUSSION

A total of 700 patients with diabetes mellitus with RBS ranges of 150 to >551 mg/dl participated in this study. It was found that the majority of the patients were males (66.2%) whereas the remaining were females (33.8%) which is depicted in Figure 1. Ages of patients were divided into three age groups which are 17-40 years, 40-61 years and >61 years, it was found that among all the age groups the most number of participants were seen in

41-60 years (66%) [Figure 2] Based on all 700 patients, it was found that 500 molars were affected. First and second molars in the upper and lower jaw were included in this study. Third molars were exempted from this study. Figure 3 shows that among all the affected molars, 45% of the molars had grade II furcation involvement. 35.40% had grade I furcation involvement followed by 15.60% of affected teeth with grade III furcation involvement and finally 4% had grade IV furcation involvement. Association between age group and RBS value was depicted in figure 4. Highest number of patients with 150-250mg/dl was seen in the 41-60 years age group with 33.10%. Patients with RBS of >551 mg/dl were only seen in 17-40 years (0.10%). This was found to be statistically significant (p value=0.003). Association between gender and RBS value was also determined and depicted in figure 5. Majority of males (35.09%) have an RBS range of 150-250mg/dl. Similarly in females, 20.97% have an RBS value of 150-250mg/dl. >551 mg/dl, was only seen in males with 0.10%. This association was found to be statistically significant (p value =0.008)

Association between age groups and grades of furcation was depicted from figure 6 to 9. As we know the age group that has the most affected molars are patients in the 41-60 years age group. Firstly, association between the teeth grade I furcation defect and age group was depicted in Figure 6. 16 was the most affected teeth (11.30%) among patients in the 41-60 years age group. Among patients in the 17-40 years age group, 36 and 37 were the most affected teeth (2.82%) and it was found that 27 was not affected in this age group. Finally in patients >61 years of age, 16 was mostly affected with 3.95%. This was found to be statistically insignificant (p value- 0.638). Figure 7 shows the association between teeth with grade II furcation defects and age groups. 46 was the most affected teeth in patients in the 41-60 years age group (11.56%). Patients in the 17-40 years age group, 27, were mostly affected (3.56%). 26 was the mostly affected teeth among patients >61 years of age with 2.22%. P value was found to be statistically insignificant (p value-0.830). Next, the association is between teeth with grade III furcation defects and age groups [Figure 8] 16 was the most affected teeth in patients in the 41-60 years age group (16.67%). Patients in the 17-40 years age group, 47, were mostly affected (3.85%). 26 was the mostly affected teeth among patients >61 years of age with 5.13%. This association was found to be statistically insignificant (p value=0.827) Finally, Figure 9 shows the association between teeth with grade IV furcation defects and age groups. 37 was the most affected teeth in patients in the 41-60 years age group (25%). Patients in the 17-40 years age group, only 26 and 27 were affected with 5% each. 16 and 47 were the only affected teeth among patients >61 years with 16 being the mostly affected (15%). P value was found to be statistically significant. (p value=0.006)

Based on our study, there was a male predilection in the number of patients with type II diabetes. However there is a study that suggests that diabetes (type II) is more frequently at risk seen in females due to the increased cases of obesity in females (Kautzky-Willer, Harreiter and Pacini, 2016) There was a female predilection in patients with T2DM and chronic periodontitis in a study by Gusmao et al(Gusmão et al., 2014) . Mohamed et al (Mohamed et al., 2013) also had a female predilection in among their participants with type II diabetes. In our study, the association between gender and RBS value were found to be statistically significant with a higher male predilection. (p<0.05). The participants with the highest number of affected molars belong to 41-60 years of age. About 66% of diabetic patients are 41-60 years of age and they have the highest number of affected molars. Gopalakrishnan et al, had found that patients above 40 years of age were the majority of their participants (n=22) and had the most number of affected teeth (176 teeth). However he suggested that the hazard rate was 2.5 times lower in the age group of above 40 years as compared to those below 40 years (Gopalakrishnan et al., 2018). In our study, the association between age groups and RBS values were found to be statistically significant (p<0.05). This proves that patients above 40 years of age are more prone to diabetes when compared to patients below 40 years. However patients of younger age are at greater risk for loss of molars if they do not control their blood sugar levels.

Furcation involvement is mainly seen in the upper posteriors and lower posteriors. As discussed, diabetes has an effect on the periodontal status of a patient and leads to bone destruction, leading to exposed furcation of molars. In our study among the 700 patients, 500 molars were affected. Only first and second molars in the upper and lower jaw were included in this study. Third molars were exempted from this study. Among the 500 affected molars, 45% of the teeth have a grade II furcation involvement. A study showed that mandibular molars had a higher risk for loss than maxillary molars (Gopalakrishnan et al., 2018) A study which found similar results are from Miller et al (Miller et al., 2014) who found that there is a higher risk in maxillary molars. In a study (Mohamed et al., 2013), it was found that out of 447 patients, 23% of the participants had furcation involvement. Most of the patients in this study were poorly controlled. There are patients who were unaware of the diabetic status and are not under medications. There is a similar study which agrees with this statement. In that study (Mohamed et al., 2013) majority (70%) of the T2DM patients were poorly controlled. This statement agrees with the data of other studies and illustrates the difficulties in maintaining good glycaemic control (Hodge, Robertson and Paterson, 2012). It has also stated that other studies reported that a significant worse periodontal condition among poorly controlled DM patients compared to patients with good metabolic control (Tsai, Hayes and Taylor, 2002; Campus et al., 2005; Lim et al., 2007)

This study assesses the extent of furcation defects among patients with diabetes. Comparison between the ages groups of patients with diabetes and was done. Among all the furcation grading, patients in the 41-60 years age group have the most number of affected teeth. Amongst the teeth with grade I and grade III it was found that 16 was the mostly affected. For grade II furcation involvement it was seen that 46 was mostly affected. Finally, 37 was the most affected among the teeth with grade IV furcation involvement. Gusmao et al found that a total of 45.7% of the molars had furcation involvement whereas the remaining 54.3% had no furcation involvement despite the diagnosis of chronic periodontitis. In this same study they have found that a large portion of their cases (56.9%) exhibited degree II and III furcation involvement. Thus, the importance of periodontal intervention of these affected molars is needed before further periodontal destruction takes place and thereby preventing tooth loss (Gusmão et al., 2014)

This study is unique as there are no previous studies which have determined the association between furcation involvement in patients with diabetes mellitus. Limitations of this study is that it is done among patients from a given period of time and does not represent a larger scale of diabetic patients.

CONCLUSION

Overall, 41-60 year old diabetic patients were mostly affected with chronic periodontitis which lead to furcation involvement. This study showed that, grade I and grade III furcation involvement was mostly seen in 16, grade II furcation involvement was seen mostly in 46 and finally, 37 was the most affected with grade IV furcation involvement. Thus this study proves that diabetic patients are more prone to severe periodontitis with multiple furcation involvement. Importance of oral health intervention should be emphasized among diabetic patients with chronic periodontitis.

Author Contribution

Reshma Thirunavakarasu : Data collection and interpretation, Drafting the article
Dr.Balaji Ganesh S: Critical revision of the article and final drafting of the article

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Conflict of Interest

The authors declare no conflict of interest

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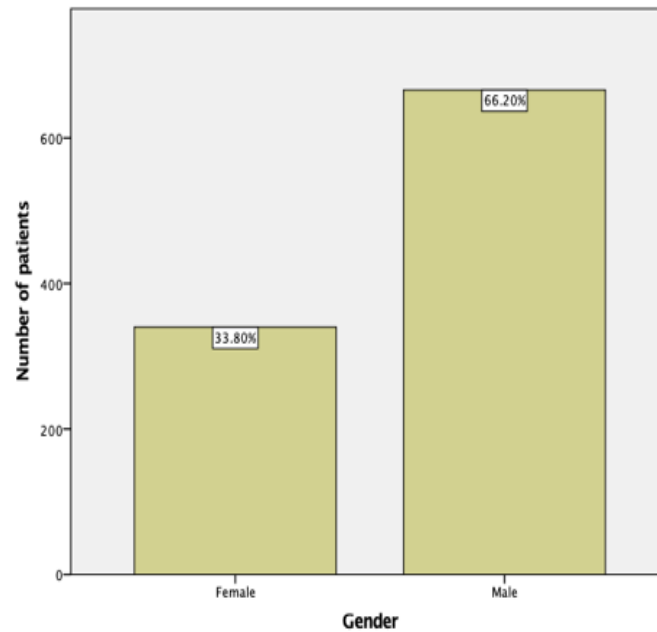
Fig.1: Bar graph shows the number of patients based on gender. It was found that majority of the patients were males (66.2%) whereas the remaining were females (33.8%)
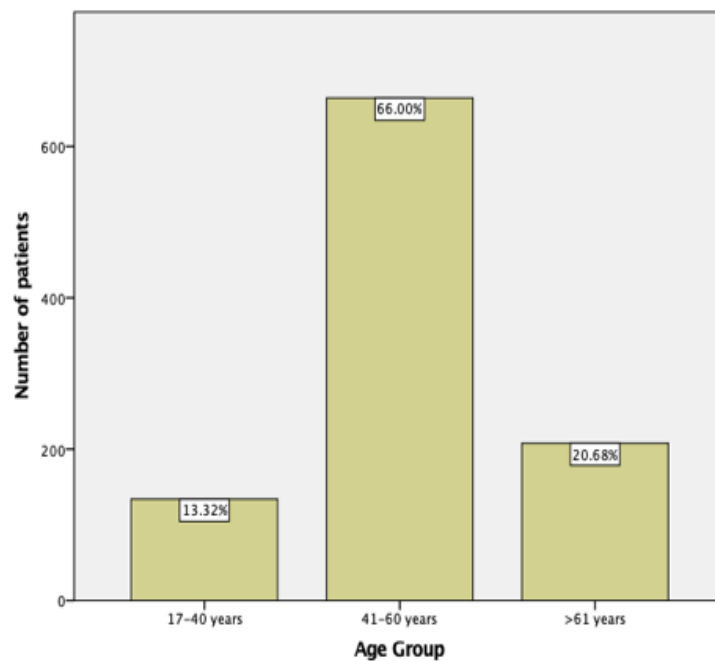

Fig.2: Bar graph shows the distribution of patients based on age groups. Highest number of patients was seen in 41-60 years (66%) followed by >61 years with 20.68% and finally 17-40 years with 13.32%.
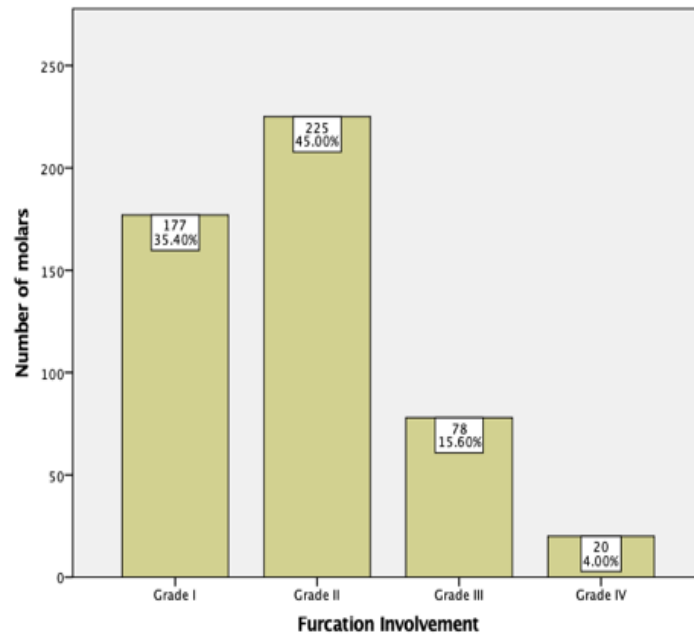
Fig.3: Bar graph shows the frequency of the number of affected molars with furcation involvement. 45% of the affected molars have a Grade II furcation involvement, 35.40% of the affected molars have a Grade I furcation involvement, 15.60% have a Grade III furcation involvement and the least is Grade IV furcation involvement with 4% of affected molars.
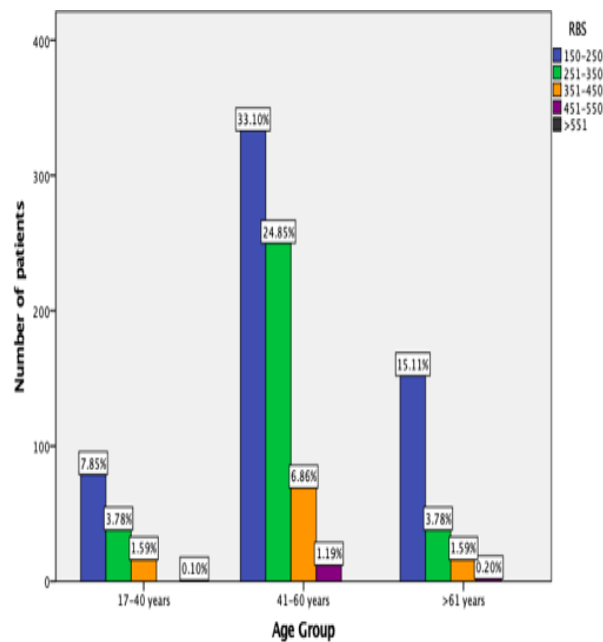
Fig.4: Bar graph shows the association between age groups and RBS values. X axis represents the age groups and Y axis represents the number of patients with diabetes. 150-250mg/dl (blue) was found to be more in all three age groups compared to 251-350mg/dl (green), 351-450mg/dl (orange) 451-550 (purple) and >551mg/dl (black). Highest number of patients with 150-250mg/dl was seen in the 41-60 years age group with 33.10%. Patients with RBS of >551 mg/dl were only seen in 17-40 years (0.10%). Chi square test, p value=0.003 (<0.05), hence statistically significant.
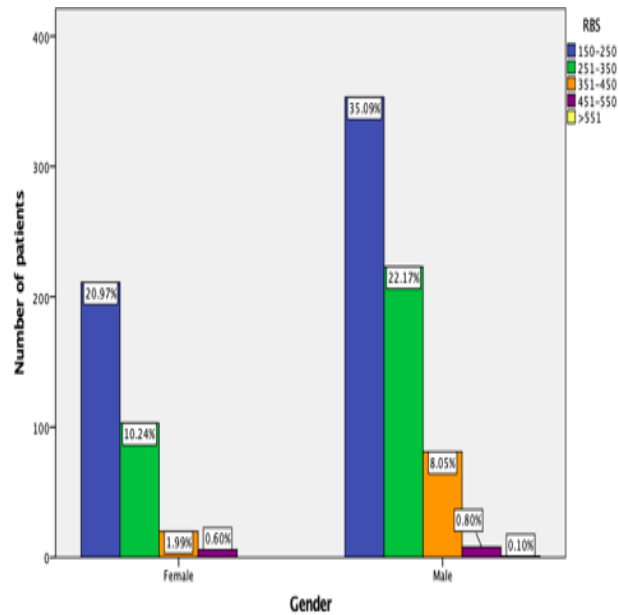
Fig.5: Bar graph shows the association between gender and RBS values. X axis represents the gender and Y axis represents the number of patients with diabetes. 150-250mg/dl (blue) was found to be the highest in males and females compared to 251-350mg/dl (green), 351-450mg/dl (orange) 451-550 (purple) and >551mg/dl (black). Majority of males (35.09%) have an RBS range of 150-250mg/dl. Similarly in females, 20.97% have an RBS value of 150-250mg/dl. >551 mg/dl, was only seen in males with 0.10%. Chi square test, p value=0.008 (<0.05), hence statistically significant
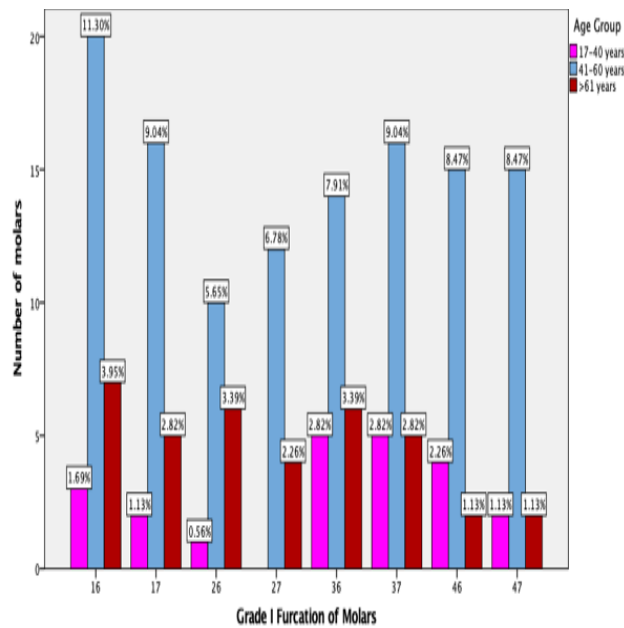

Fig.6: Bar graph shows the association between the teeth with grade I furcation defects and age groups. X axis represents the teeth with grade I furcation involvement and Y axis represents the number of molars affected. Patients in the 41-60 years age group (light blue) had more number of grade I furcations when compared to other age groups. 16 was the most affected teeth (11.30%) among patients in the 41-60 years age group. Among patients in the 17-40 years age group, 36 and 37 were the most affected teeth (2.82%) and it was found that 27 was not affected in this age group. Finally in patients >61 years of age, 16 was mostly affected with 3.95%. Chi square test, p value=0.638 (>0.05), hence statistically not significant.
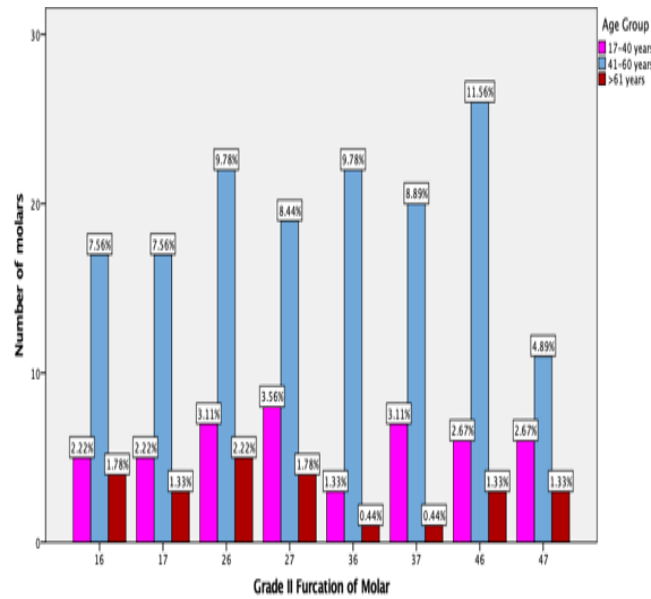
Fig.7: Bar graph shows the association between the teeth with grade II furcation defects and age groups. X axis represents the teeth with grade II furcation involvement and Y axis represents the number of molars affected. Patients in the 41-60 years age group (light blue) had more number of affected teeth compared to other age groups. 46 was the most affected teeth in patients in the 41-60 years age group (11.56%). Patients in the 17-40 years age group, 27, were mostly affected (3.56%). 26 was the mostly affected teeth among patients >61 years of age with 2.22%. Chi square test, p value=0.830 (>0.05), hence statistically not significant.
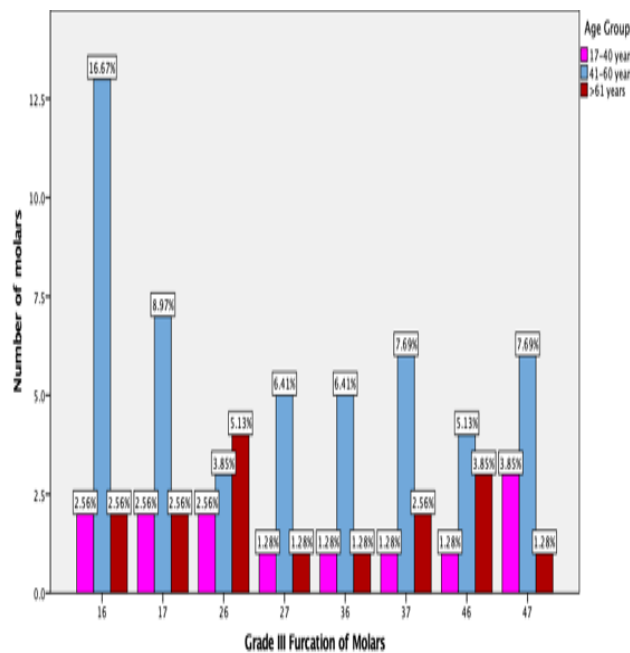

Fig.8: Bar graph shows the association between the teeth with grade III furcation defects and age groups. X axis represents the teeth with grade III furcation involvement and Y axis represents the number of molars affected. Patients in the 41-60 years age group (light blue) had more number of affected teeth compared to other age groups. 16 was the most affected teeth in patients in the 41-60 years age group (16.67%). Patients in the 17-40 years age group, 47, were mostly affected (3.85%). 26 was the mostly affected teeth among patients >61 years of age with 5.13%. Chi square test, p value=0.827 (>0.05), hence statistically not significant.
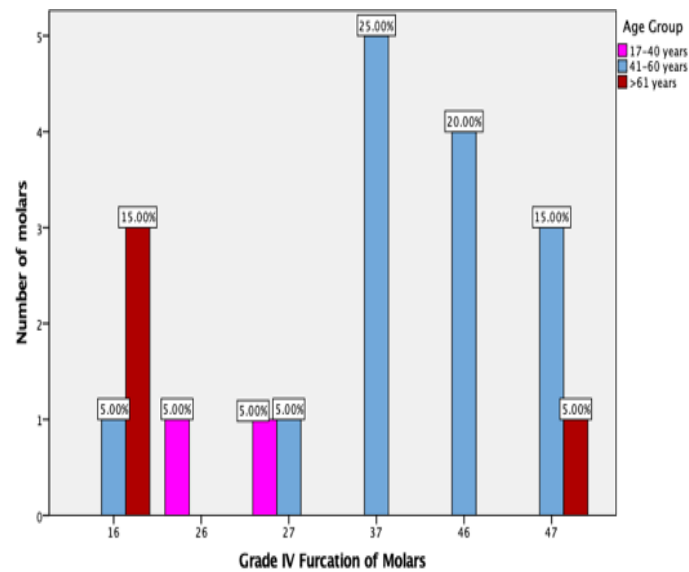
Fig.9: Bar graph shows the association between the teeth with grade IV furcation defects and age groups. X axis represents the teeth with grade IV furcation involvement and Y axis represents the number of molars affected. Patients in the 41-60 years age group (light blue) had more number of affected teeth compared to other age groups. 37 was the most affected teeth in patients in the 41-60 years age group (25%). Patients in the 17-40 years age group, only 26 and 27 were affected with 5% each. 16 and 47 were the only affected teeth among patients >61 years with 16 being the mostly affected (15%). Chi square test, p value=0.006 (<0.05), hence statistically significant