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RADIOGRAPHIC ANALYSIS OF OSSEOUS CHANGES IN ORAL SQUAMOUS CELL CARCINOMA

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ABSTRACT:

Oral squamous cell carcinoma(OSCC) primarily affects the soft tissues,but involvement of jaw bones is seen in about 12–56% of patients.In these cases,radiographic analysis is essential inorder to observe the pattern of bone involvement.A retrospective study was conducted on patients who visited the department of oral medicine from march 2019 to march 2020.The clinical findings,histopathological diagnosis of OSCC patients who showed bone involvement in the digital panoramic radiographs were reviewed from electronic database.Descriptive statistics were used to analyse the radiographic findings.We observed that the majority of patients presenting with oral squamous cell carcinoma involving the jaw bone belonged to the age group 40-50 years with male predilection(76.9%).Mandible was most commonly involved with the right posterior alveolar region being the most commonly affected site.The radiographic changes observed predominantly in the lesions were smooth borders(53.85%) with an altered trabecular pattern (46.15%).The effect of the lesion on the surrounding structures were spiked root appearance in 84.62% and floating tooth appearance in 69.23% of cases.Presence of saucerization was seen in 76.92%.Hence digital panoramic radiographs are valuable aids in diagnosing the involvement of jaw bones in oral malignancy and thereby help in devising the treatment plan.

Keywords: Digital panoramic radiograph;Oral squamous cell carcinoma;Oral cancer;Orthopantomograph.

INTRODUCTION:

Oral cancer can be defined as a neoplasm involving the oral cavity which begins at lips and ends at anterior pillar of fauces.Oral cancer is a serious growing problem in many parts of the world.Oral and pharyngeal cancer grouped together is the sixth most common cancer in the world(Warnakulasuriya, 2009).Majority of the oral cancers are related to the use of tobacco and tobacco related products(Venugopal and Uma Maheswari, 2016; Muthukrishnan and Bijai Kumar, 2017; Muthukrishnan and Warnakulasuriya, 2018).Primary oral squamous cell carcinoma is the most prevalent oral malignancy,but secondary malignancy from distant sites have also been reported(Misra *et al.*, 2015; Muthukrishnan, Bijai Kumar and Ramalingam,

2016).Oral squamous cell carcinoma represents 95% of all forms of head and neck cancer and its incidence has increased by 50% in last decade(Bray *et al.*, 2002; Parkin *et al.*, 2005).

Pain may be one of the symptom in oral cancer and is a common complaint presented by these patients(Subha and Arvind, 2019).Maintenance of proper oral hygiene is also a major concern in patients who are diagnosed or treated with oral cancer(Dharman and Muthukrishnan, 2016; Subashri and Maheshwari, 2016).A range of salivary metabolites are found to be significantly altered in oral premalignant condition and in oral squamous cell carcinoma. Salivary biomarkers such as micro RNA,MMP-9,chemerin,glutathione,malondialdehyde and TNF alpha can be used for early detection of oral squamous cell carcinoma(Maheswari *et al.*, 2018).Despite the currently available advanced diagnostic and therapeutic strategies,the disease remains a challenge for medical professionals(Steele *et al.*, 2015).

Treatment for oral cancer includes surgery,radiation therapy,targeted drug therapy and chemotherapy.Oral mucositis is a major complication which may develop post chemotherapy or radiotherapy.Radiotherapy to the head and neck region causes xerostomia and salivary gland dysfunction which dramatically increases the risk of dental caries.Hence,every effort should be made on prevention and to manage patients with severe caries(Chaitanya *et al.*, 2017). This can be accomplished through preoperative evaluation, frequent dental visits and consistent home care that includes self-applied fluorides(Rohini and Kumar, 2017).The management of postoperative pain remains a hideous task for health-care providers(Chaitanya *et al.*, 2018).

In the advanced stages of OSCC, there is involvement of bone which significantly affects the prognosis of disease.On radiographs,they present with some features which may not not be characteristic to these lesions but can be of diagnostic value(Choudhury *et al.*, 2015). They may present with an ill-defined margin with lack of cortication.The internal structure is usually radiolucent with occasional presence of residual islands of bone. The teeth involved become mobile, migrate or show root resorption. The anatomic structure which is in close proximity to the lesion might show evidence of invasion or infiltration by the lesion.The surrounding bone may show saucer-shaped bone defects or may show pathological fractures in extreme cases. The overall radiographic appearance and the effects on the structures surrounding the lesion mirrors the destructive behavior of the malignant lesion(Worth, 1963).

Considering the low radiation dose and easy availability of panoramic radiography, they can be combined with routine intra-oral radiographs.Digital panoramic radiographs can play a crucial role in the detection of bony changes in the jaws. They can be used to identify if the lesion has involved or invaded the bone. Rao et al conducted a study, in which he found that the digital panoramic radiographs have 92% sensitivity for the detection of mandibular involvement by the malignancies(Pandey *et al.*, 2007).

The aim of the study is to analyze the radiographic features of osseous changes seen in oral squamous cell carcinoma.

MATERIALS & METHODS:

A retrospective study was conducted on patients who were histopathologically diagnosed with oral squamous cell carcinoma and had underwent digital panoramic imaging.The study included 40 OSCC patients who had undergone digital panoramic imaging in the radiology department of saveetha dental college and hospital during the period of march 2019 to march 2020.A primary researcher and reviewer were involved in the study. The details of each case were retrieved from an electronic database.The criteria involved for the selection of patients were as follows.

Inclusion criteria:

The patients who were histopathologically diagnosed with oral squamous cell carcinoma,above the age of 35 years were included in the study.Patients diagnosed only with primary oral carcinoma were included.

Exclusion criteria:

Oral cancer patients but not histopathologically diagnosed were excluded.Patients below the age of 35 years and had already undergone treatment for oral squamous cell carcinoma were excluded from the study.Patients with recurrent carcinomas were not included in the study.

After selection of patients,further information on age,sex,affected site,histopathological grading of squamous cell carcinoma and digital panoramic radiographs were obtained.The acquired panoramic radiographs were analysed and the following details were recorded.The border of the lesion,internal structure of the lesion,its effect on surrounding structures such as presence of saucerization and pathological fractures.The obtained data was tabulated in SPSS software and analyzed statistically.Chi-square test was used to assess the association between oral squamous cell carcinoma and radiographic feature seen in digital panoramic radiographs.

RESULTS & DISCUSSION:

Out of 40 patients who were diagnosed with oral squamous cell carcinoma during the study period,osseous changes were seen only in 13 cases.The digital panoramic radiographs of these 13 cases were analyzed in detail.

95% of oral cancers occur in individuals over 40 years of age.In this study predominantly affected age group was between 40-50 years (38.46%)(figure 1).Studies have shown that there is male predominance for oral cancer with male to female ratio ranging from 6:1 to 2:1.These findings are in concordance with our study results,which shows male predominance (76.92%)(figure 2)(Neville and Day, 2002; Pires *et al.*, 2013).

Of the 13 cases,7 cases were moderately differentiated oral squamous cell carcinoma and 6 cases were well-differentiated oral squamous cell carcinoma(figure 3).

Studies have found mandibles are more commonly affected than maxilla.Similar to the literature,in our study only mandible was affected,there was no involvement of maxilla.On assessing the site of involvement in mandible,the right posterior alveolar region was the predominantly affected site presenting in 76.92% of study population,followed by the left retro- molar region (15.38%)(figure 4).

On evaluating the borders of the lesions,smooth borders were seen in 53.85% and ragged borders were seen in 46.15% of the study population(figure 5).There was statistically no significant association between borders and osseous changes in oral squamous cell carcinoma(figure 10)(p value > 0.05).

On analyzing the internal structure of the lesions,an alteration in the trabecular pattern (46.15%) was most predominantly seen change followed by radiolucent with soft tissue shadow (38.46%) and only radiolucency in 15.38%(figure 6).There was a statistically significant association between the internal structure of the lesion and the oral squamous cell carcinoma(figure 11)(p value < 0.05).

When the radiographs were analyzed for the effects of the lesion on the surrounding structure,the presence of spiked root appearance was seen in 84.62% and floating teeth appearance was seen in 69.23%(figure 7 & figure 8).But statistically there was no significant association between spiked root appearance and floating tooth appearance with oral squamous cell carcinoma respectively(figure 12 & figure 13)(p value < 0.05).

Presence of saucerization was seen in 76.92% of the study population(figure 9).There was a statistically significant association between saucerization and oral squamous cell carcinoma(figure 14)(p value >0.05).Out of 13 cases there were no involvement or destruction of the inferior alveolar nerve canal and mental nerve.No pathological fractures associated with the lesions were seen.

Primary carcinomatous lesions can involve the jaw bone by two types.The most common presentation is involvement of bone through infiltration by a mucosal lesion.The second type jaw involvement by malignant lesion is very rare and it is through primary intraosseous carcinoma.The management of these cases are difficult,treatment results are poor and quality of life is significantly affected.The incidence of invasion of jaw bone by oral malignancies ranges from 12 to 56%.In our study out of 40 patients, 13 ie 32.5% of the patients demonstrated jaw bone involvement.

The border of the malignant lesion shows a wide zone of transition i.e. they lack sharp or clear demarcation from the surrounding normal bone.They might be ragged (irregular) suggestive of invasive nature of the lesion or smooth suggestive of erosive nature. In our study ragged types of borders were seen in 46.15% and smooth borders were seen in 53.85%(figure 5).

The internal structure of most OSCC lesions shows the presence of an area of bone destruction without any evidence of bone formation within the lesion. Hence these lesions are osteolytic nature,which is demonstrated by the radiolucent internal structure with or without the presence of a few radiopaque flecks suggestive of residual trabecular bone.A soft tissue mass often associated with the oral squamous cell carcinoma,which may present as faintly increased density in the radiographs,standing above the level of the alveolar bone of the lesion.In our study altered trabecular pattern was seen in 46.15% of the lesions followed by radiolucency with soft tissue shadow with 38.46% and only radiolucency in 15.38%. There was no radiopacity presentation in our study finding(figure 6).

In our study there was a presentation of spiked root appearance in about 84.62% of cases(figure 7).This finding was similar to the study conducted by Kawai el al in which 37% of cases demonstrated spiking of roots.The rapidly growing malignant lesion destroys the supportive alveolar bone around the teeth which gives the appearance of teeth floating in space.In our study floating tooth appearance was seen in 69.23% of cases(figure 8).The finding of our study was similar to the study findings conducted by Shah et. al(Kawai *et al.*, 2000; Shah *et al.*, 2016).

Destruction of bone is one of the most commonly presenting features of oral carcinomas. Saucerization is a saucer-shaped erosion into the bone surface with uneven osteolytic invasion. In our study,saucerization was seen in 76.92% of cases(figure 9). In advanced cases of oral cancers, due to large amounts of bone destruction,there might be pathological fractures of the jaw. In our study there was no presentation of lesions with pathological fractures.

CONCLUSION:

An examination of malignant lesions present in close proximity to jaws should always include radiological examination to detect involvement of bone. Digital panoramic radiographs are very useful in detecting preliminary osseous changes. Hence a radiographic examination using panoramic radiograph for the detection of bone involvement followed by which advanced imaging modalities such as CT or CBCT can be used for further assessment(Patil *et al.*, 2018).

AUTHORS CONTRIBUTION:

Dr.J.Abarna contributed in the research design,collection and interpretation of data,drafting the manuscript.

Dr.G.Maragathavalli contributed in the conception,data analysis,data interpretation and critically revising the manuscript.
Dr.Manjari has contributed to the final drafting of the manuscript.

CONFLICT OF INTEREST:

There was no potential conflict of interest as declared by the authors.

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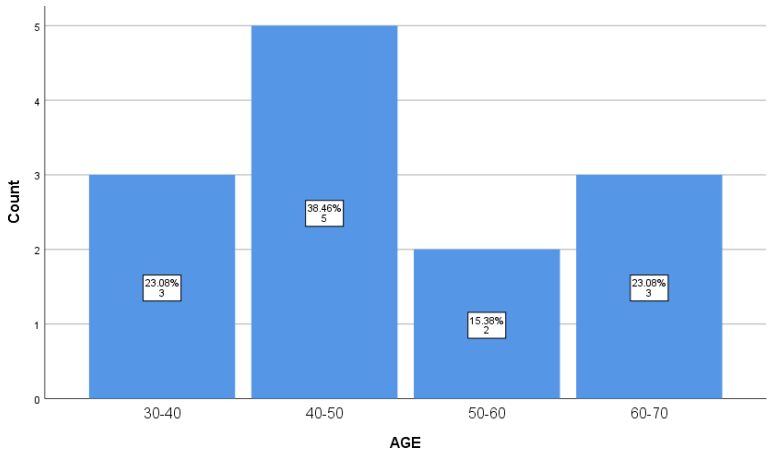

Figure-1: This graph shows age distribution of the study population where X axis denotes age in years and Y axis denotes frequency in numbers.In our study the maximum patients belonged to the age group of 40-50 years(38.46%).

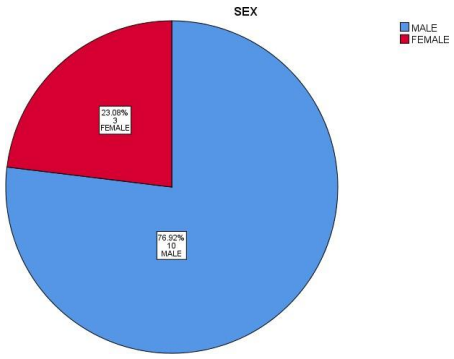

Figure-2: This pie-chart shows sex distribution of the study population, where blue colour denotes male and red colour denotes female.In our study 10 patients (76.92%) were males and 3 patients were female (23.08%).

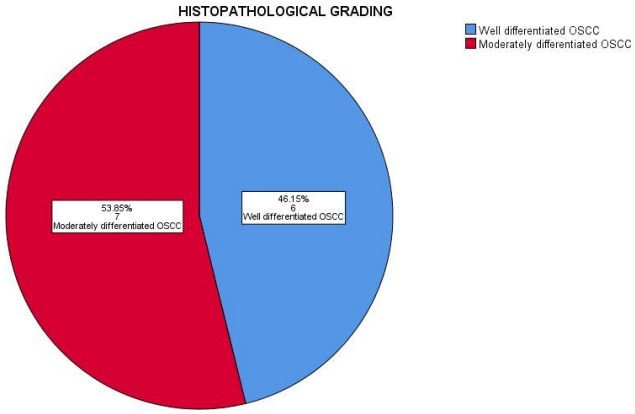

Figure-3 : This pie-chart shows histopathological grading of the study population, where red colour denotes moderately differentiated oral squamous cell carcinoma and blue colour denotes well differentiated oral squamous cell carcinoma. In our study 53.85% patients had moderately differentiated OSCC and 46.15% had well differentiated OSCC.

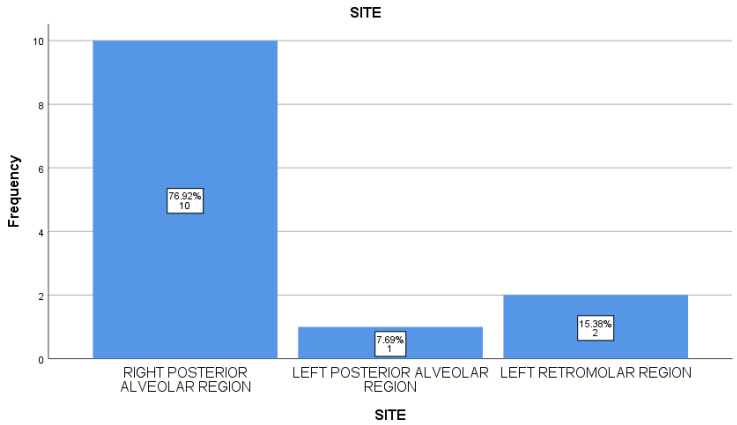

Figure-4: This graph shows the site distribution in the study population,where X axis represents the site and Y axis represents frequency in numbers. In our study the maximum patients presented in the right posterior alveolar region (76.92%) followed by the left retromolar region (15.38%).

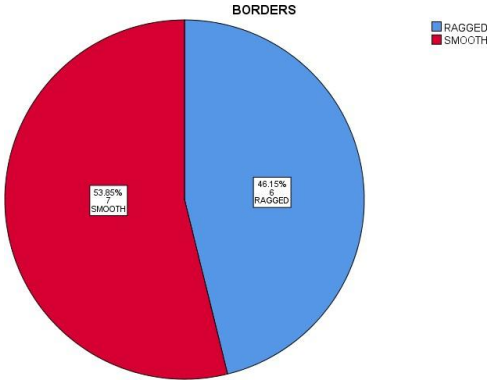

Figure-5 : This pie-chart shows borders of the study population, where red colour denotes smooth borders and blue colour denotes ragged borders. In our study 53.85% had smooth borders and 46.15% had ragged borders.

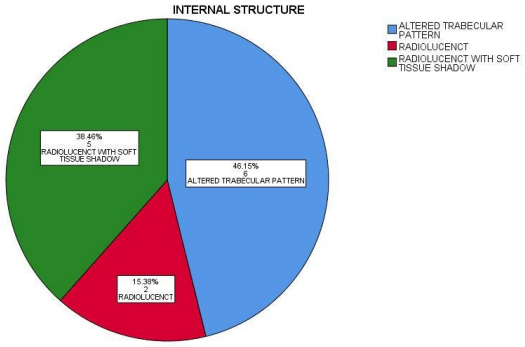

Figure-6 : This pie-chart shows internal structure observed in the study population, where blue colour denotes altered trabecular pattern, red colour denotes radiolucent and green colour denotes radiolucent with soft tissue shadow. In our study altered trabecular pattern was seen 46.15%,radiolucent with soft tissue shadow in 38.46% and only radiolucent in 15.38%.

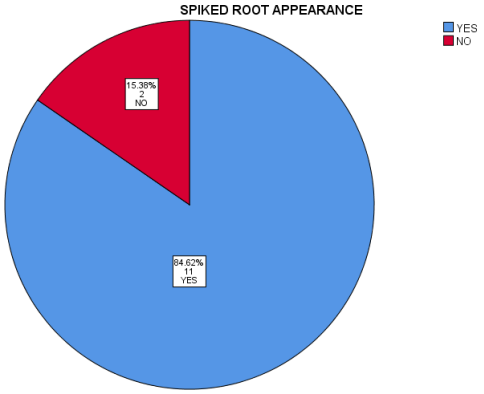

Figure-7 : This pie-chart shows the presence of spiked root appearance in the study population, where blue colour denotes presence of spiked root appearance and red colour denotes absence of spiked root appearance. In our study spiked root appearance was seen in 84.62%.

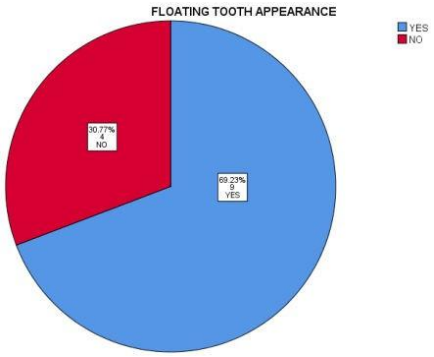

Figure-8 : This pie-chart shows the presence of floating tooth appearance in the study population, where blue colour denotes presence of floating tooth appearance and red colour denotes absence of floating tooth appearance. In our study floating tooth appearance was seen in 69.23%.

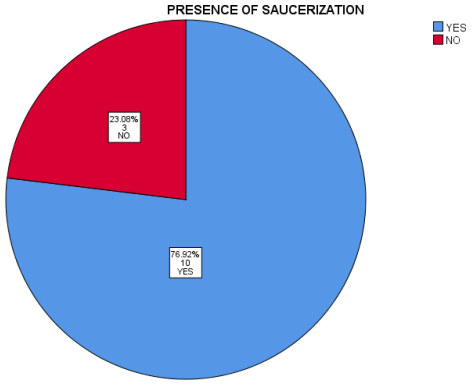

Figure-9 : This pie-chart shows the presence of saucerization in the study population, where blue colour denotes presence of saucerization and red colour denotes absence of saucerization. In our study floating tooth appearance was seen in 76.92%.

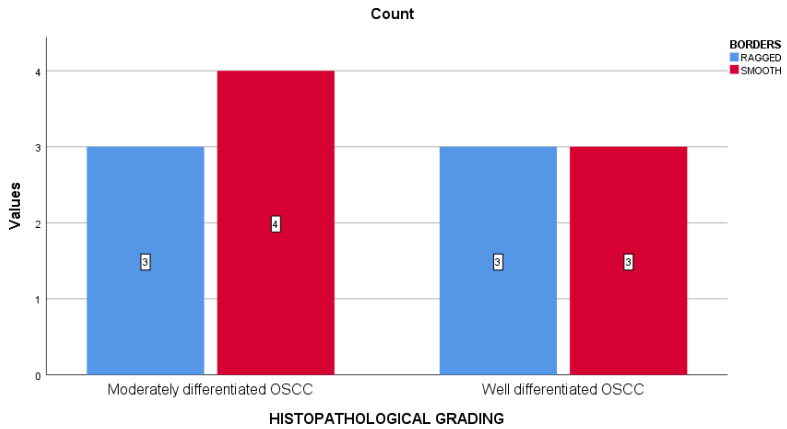

Figure-10: This graph represents the correlation of OSCC and borders,where blue colour denotes ragged border and red colour denotes smooth border.X axis denotes histopathologically graded oral squamous cell carcinoma and Y axis denotes frequency in number.Graph shows that most number of smooth borders were seen in moderately differentiated OSCC and ragged borders were seen equally in both moderately differentiated and well differentiated OSCC.Chi-square test was done and was not statistically significant .Pearson chi square=0.66 p value = 0.79(>0.05)

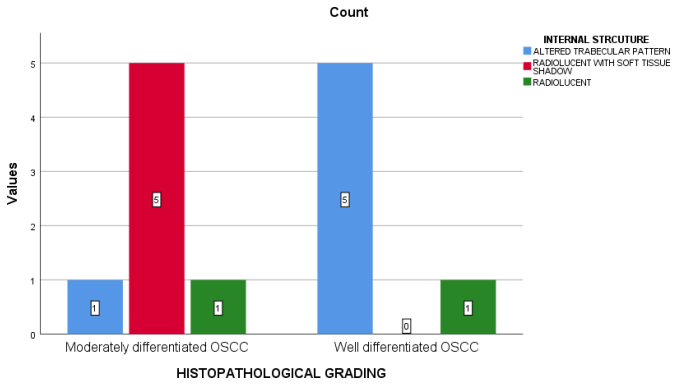

Figure-11: This graph represents the correlation of OSCC and internal structure appearance, where blue denotes altered trabecular pattern,red denotes radiolucent with soft tissue shadow and green denotes only radiolucency.X axis denotes histopathologically graded oral squamous cell carcinoma and Y axis denotes frequency in number. Graph shows that maximum number of altered trabecular pattern were seen in well differentiated OSCC and least in moderately differentiated OSCC.Radiolucent with soft tissue shadow were seen only in moderately differentiated OSCC.Only radiolucency was seen equally in both moderately differentiated OSCC and well differentiated OSCC. Chi-square test was done and correlation was found to be statistically significant. Pearson Chi square=7.365 p value=0.02(<0.05).

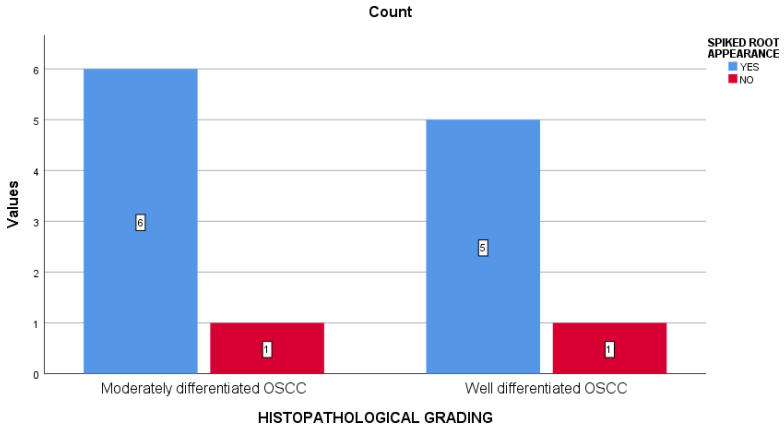

Figure-12: This graph represents the correlation of OSCC and internal structure appearance where blue denotes presence of spiked root appearance and red denotes absence of spiked root appearance. X axis denotes histopathologically graded oral squamous cell carcinoma and Y axis denotes frequency in number. Graph shows that most numbers of spiked root appearance were seen in moderately differentiated OSCC. Chi square test was done and there was no statistically significant correlation.Pearson chi square=0.14 p value=0.90.(>0.05)

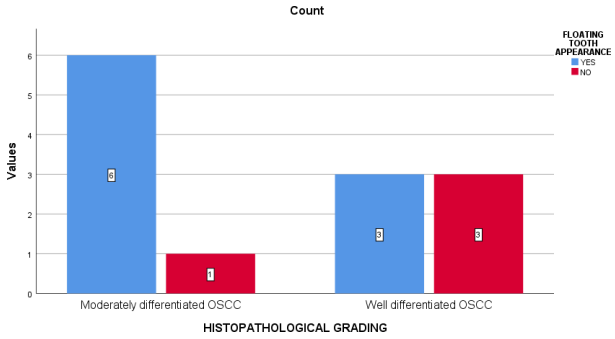

Figure-13: This graph represents the correlation of OSCC and floating tooth appearance where blue denotes presence of spiked root appearance and red denotes absence of spiked root appearance. X axis denotes histopathologically graded oral squamous cell carcinoma and Y axis denotes frequency in number. Graph shows that most number of floating tooth appearance were seen in moderately differentiated OSCC.Chi square test was done and there was no statistically significant correlation.Pearson chi square=1.935 p value=0.16(>0.05)

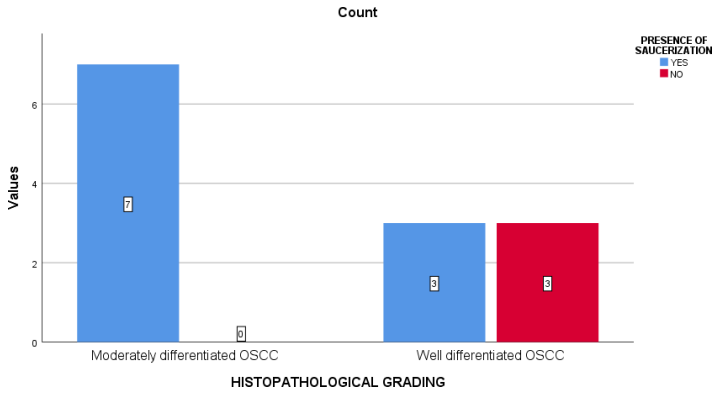

Figure-14: This graph represents the correlation of OSCC and presence of saucerization where blue denotes presence of saucerization and red denotes absence of saucerization.Graph shows that maximum presence of saucerization were seen in moderately differentiated OSCC.Chi-square test was done and correlation was found to be statistically significant.Pearson chi square=4.55 p value=0.03(<0.05).