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# Pattern and Site Distribution of Oral Squamous Cell Carcinoma

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## ABSTRACT

**Background:** Oral squamous cell carcinoma is a prevalent malignancy with diverse site distributions influenced by demographic factors. Understanding these distributions aids in effective management and prognosis.

**Objective:** To determine the frequency and demographic associations of Oral squamous cell carcinoma site distributions among patients at a tertiary care center.

**Materials and Methods:** This descriptive cross-sectional study included 110 patients diagnosed with Oral squamous cell carcinoma, selected through non-probability consecutive sampling. Clinical evaluations, radiographic studies, and incisional biopsies were conducted. Data on age, gender, tumor site, type, and grade were collected and analyzed. OSCC grading followed tumor nodes and meta-stasis staging criteria, with stratification by site distribution across gender, age, and grade using Fisher's exact test.

**Results**: The mean age of patients was 53.74±12.79 years, with males comprising 70% (n=77) and females 30% (n=33). The most prevalent OSCC site was the Alveolar Ridge (54.55%), followed by the Buccal Mucosa (15.45%) and Hard Palate (2.73%). The predominant clinical manifestation was non-healing ulcers (70.00%). Histologically, well-differentiated OSCC was most common (55.45%). Significant associations were found between site distribution and gender, age group, presentation, and grade (P<0.001).

**Conclusion**: Alveolar ridge predominance highlights its vulnerability to Oral squamous cell carcinoma. Site distribution varies significantly by demographic factors, emphasizing the need for tailored diagnostic and therapeutic approaches.

**Keywords:** Histopathological grading, Oral squamous cell carcinoma, Site distribution, Type of oral squamous cell carcinoma.

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## INTRODUCTION

Squamous cell carcinoma is a common form of cancer that occurs in the oral cavity, which is constantly exposed to harmful agents like microorganisms, irritants, toxins, and carcinogens due to its function in receiving food.[1,2] The oral mucosa serves as both a mechanical and immunological barrier, with mechanisms such as increased epithelial regeneration and keratinization to protect against these harmful agents.[3] However, with the loss of normal control mechanisms, precancerous states and eventually oral carcinoma can develop. Endogenous factors like genetics, hormones, and metabolic diseases can also contribute to these changes.[4,5]

Oral cancer is a common form of cancer worldwide, with its prevalence varying across different countries. It is less common in the United States, accounting for less than 3% of all cancers. However, globally, it affects around 575,000 new people each year and leads to about 320,000 deaths.[6] In some countries like India, it is the most common type of cancer.[7] Oral squamous cell carcinoma is the fifth most common cancer in men and the twelfth most common in women.[8] It usually affects individuals over the age of 60 and is rare in young people under 45 years old. Males are more commonly affected by OSCC than females.[9]

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Oral cancer, specifically squamous cell carcinoma (SCC), originates from the mucosal epithelium and accounts for 94% of all oral malignancies.[10] The exact cause of SCC is not fully understood, but various factors such as tobacco and alcohol use, age, genetic predisposition, poor nutrition, chronic irritation, exposure to industrial products or heavy metals, viruses, and ionizing radiation have been associated with varying degrees of risk for developing SCC in the head and neck region.[11]

Early oral squamous cell carcinoma can appear as white (leukoplakia), red (erythroplakia), or mixed red and white lesions (erythroleukoplakia), which may develop superficial ulceration over time. The lesion may grow into an exophytic or endophytic mass and may present as an indurated erythematous papule or a sessile, polypoid, or verrucous tumor. Pain is not a reliable indicator, as some oral cancers may be asymptomatic or associated with minor discomfort.[12]

Diagnostic imaging plays a crucial role in evaluating and managing patients with OSCC, complementing clinical and pathological data. CT and MRI are commonly used for pre-treatment evaluation.[13] The TNM classification system, which considers tumor size (T), lymph node involvement (N), and metastasis (M), provides a useful framework for understanding the features and behavior of the disease. Staging is essential for determining prognosis and guiding treatment decisions based on evidence-based approaches.[14]

A cross-sectional study was conducted at tertiary care hospitals in Lahore to analyze the demographic and

clinical information of 89 patients who were histologically diagnosed with oral squamous cell carcinoma (OSCC). The tongue was found to be the most commonly affected site, accounting for 37.1% of cases, followed by the buccal mucosa at 30.3% and lip 9%. The most frequently reported symptom was a non-healing ulcer, which was observed in 50.6% of patients.[12]

The rationale for this study is to determine the site distribution of squamous cell carcinoma (SCC) among patients in Peshawar, Pakistan. SCC is a common type of cancer in the oral cavity and can occur at different sites within the mouth. The site of involvement may affect the prognosis and treatment outcomes for patients. Therefore, understanding the site distribution of SCC can help healthcare providers to diagnose and manage the disease more effectively. This study aims to provide information on the most common age, gender, site, type, and grade involved in SCC in Peshawar, which may contribute to the development of better treatment strategies and improve patient outcomes.

## MATERIALS AND METHODS

This descriptive cross-sectional study was conducted on 110 patients with diagnosed cases of squamous cell carcinoma using non-probability consecutive sampling technique from February 25th, 2022 to August 5th, 2023. Ethical approval was obtained from research review committee of Saidu College of Dentistry, Swat (9098/scd/ethical, dated 2/2/202). The sample size was 88 calculated by WHO calculator at 95% confident level and 6% margin of errors using previous frequency of OSCC at lip (9%),[15] to further increase the power of our study we included 110 participants.

After in detailed explanation about the study verbal informed consent was obtained from all participants. The study participants were selected from patients with diagnosed cases of squamous cell carcinoma. The inclusion criteria were patients of either gender and any age with a confirmed diagnosis of squamous cell carcinoma. The exclusion criteria were patients diagnosed with oral malignancies other than OSCC and individuals who declined to provide informed consent for participation in the study.

A detailed patient history was obtained, followed by clinical examination, radiographic assessment, and incisional biopsy performed by consultant Oral and Maxillofacial Surgeons at the SCD. The biopsy specimens were subsequently submitted to the Department of Histopathology, Shaukat Khanam, Peshawar, for evaluation by a qualified histopathologis, specializing in oral pathology. The most common age, gender, site, type, and grade involved in squamous cell carcinoma were noted.

Oral squamous cell carcinoma was defined as a malignant neoplasm of the oral cavity that is characterized by the presence of atypical squamous cells within the epithelium, confirmed through a series of diagnostic measures. These diagnostic measures include a detailed medical history, clinical examination, radiographic study, and incisional biopsy. The grading and staging of OSCC were conducted according to the TNM staging system as outlined by the American Joint Committee on Cancer (AJCC). This system evaluates tumor size and local extent (T), regional lymph node involvement (N), and the presence of distant metastasis (M) to classify the disease. Tumor grade was determined based on histopathological differentiation, categorized as well, moderately, or poorly differentiated.[14]

The collected data was analyzed using SPSS version 22. The mean and SD were computed for continuous data like age, and frequency and percentages were computed for categorical data like gender, site, grade, chief complaint, and presentation. Stratification was performed for site distribution among gender, age, and grade using Fisher exact test. A p-value of less than 0.05 was considered significant.

## RESULTS

The mean age of the participants were 53.74±12.79 years, ranging from 31 to 88 years. The males (n=77, 70%) were more than females (n=33, 30%). The study included a total of 110 participants. The distribution of participants based on age groups is as follows: 15 participants (13.64%) were in the age group 31-40, 36 participants (32.73%) were in the age group 41-50, 25 participants (22.73%) were in the age group 51-60, 23 participants (20.91%) were in the age group 61-70, and 11 participants (10.00%) were in the age group 70 and above. (Fig 01)

Regarding the site of OSCC, the majority of cases were found in the Alveolar Ridge, accounting for 60 cases (54.55%). Buccal mucosa accounted for 17 cases (15.45%), while hard palate accounted for 3 cases (2.73%). labial mucosa and tongue had 6 (5.45%) and 4 (3.64%) cases, respectively. The Retromolar region accounted for 20 cases (18.18%). In terms of presentation, the most common manifestation was a no-healing ulcer, observed in 77 cases (70.00%). Growth was observed in 15 cases (13.64%), while pain and ulcer with pain were reported in 8 (7.27%) and 10 (9.09%) cases, respectively. The grade distribution of OSCC revealed that well differentiated OSCC was the most prevalent, accounting for 61 cases (55.45%). Moderately differentiated OSCC was observed in 42 cases (38.18%), and a smaller proportion of cases were classified as poorly differentiated OSCC, with 7 cases (6.36%). (Table 01)

Table 02 presents that in terms of gender, all cases in the alveolar ridge site were found in males, with a frequency of 60(100%). Similarly, the buccal mucosa site exclusively showed cases in males, with a frequency of 17(100%). In contrast, all cases in the

hard palate, labial mucosa, retromolar, and tongue sites were observed in females, with frequencies of 3 (100%), 6 (100%), 20 (100%), and 4 (100%), respectively. Regarding presentation, the Alveolar Ridge and Buccal Mucosa sites were predominantly associated with a no-healing ulcer, with frequencies of 60 (100%) and 17 (100%), respectively. The Labial Mucosa site showed a predominance of cases with an ulcer with pain (n=3, 100%). The Retromolar site demonstrated an even distribution among a no-healing ulcer, growth, and an ulcer with pain, with frequencies of 5 (25.00%), 6 (100%), and 7 (35.00%) respectively. In terms of grade distribution, the Alveolar Ridge site primarily consisted of well-differentiated OSCC cases (n=60, 100%). The Buccal Mucosa and Retromolar sites had a higher proportion of moderately differentiated OSCC cases, with frequencies of 16 (94.12%) and 16 (80%) respectively. Poorly differentiated OSCC cases were specifically observed in the Hard Palate site (n=3, 100%).Regarding age group, the highest frequency of cases in the Alveolar Ridge site was observed in the 41-50 age group (n=29, 48.33%). The Buccal Mucosa and Retromolar sites showed a higher frequency of cases in the 51-60 age group, with frequencies of 8 (47.06%) and 8 (40%) respectively. The age group distribution showed a significant association with the site distribution for OSCC ($p < 0.001$)

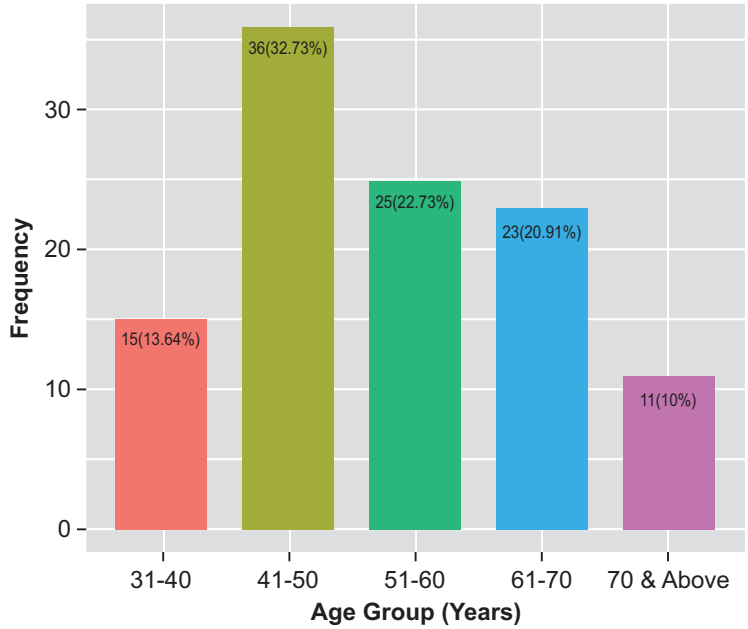



**Figure 01. Age distribution of the participants**

**Table 01. Site, presentation and grade of OSCC**

| Variable | Characteristic | n(%) |
|---|---|---|
| Site | Alveolar Ridge | 60 (54.55) |
| | Buccal Mucosa | 17 (15.45) |
| | Hard Palate | 3 (2.73) |
| | Labial Mucosa | 6 (5.45) |
| | Retromolar | 20 (18.18) |
| | Tongue | 4 (3.64) |
| Presentation | Growth | 15 (13.64) |
| | No-healing ulcer | 77 (70.00) |
| | Pain | 8 (7.27) |
| | Ulcer with pain | 10 (9.09) |
| Grade | Moderately differentiated | 42 (38.18) |
| | Poorly differentiated | 7 (6.36) |
| | Well differentiated | 61 (55.45) |

**Table 02. Comparison of site distribution of OSCC with respect to gender, age group, presentation and grade**

| Variable | Characteristic | Alveolar Ridge, N = 60 | Buccal Mucosa, N = 17 | Hard Palate, N = 3 | Labial Mucosa, N = 6 | Retromolar, N = 20 | Tongue, N = 4 | P-value* |
|---|---|---|---|---|---|---|---|---|
| Gender | Female | 0 (0) | 0 (0) | 3 (100) | 6 (100) | 20 (100) | 4 (100) | <0.001 |
| | Male | 60 (100) | 17 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | |
| Presentation | Growth | 0 (0) | 0 (0) | 0 (0) | 6 (100) | 5 (25.00) | 4 (100) | <0.001 |
| | No-Healing Ulcer | 60 (100) | 17 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | |
| | Pain | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 8 (40) | 0 (0) | |
| | Ulcer with Pain | 0 (0) | 0 (0) | 3 (100) | 0 (0) | 7 (35.00) | 0 (0) | |
| Grade | Moderately Differentiated | 0 (0) | 16 (94.12) | 0 (0) | 6 (100) | 16 (80) | 4 (100) | <0.001 |
| | Poorly Differentiated | 0 (0) | 0 (0) | 3 (100) | 0 (0) | 4 (20) | 0 (0) | |
| | Well Differentiated | 60 (100) | 1 (5.88) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | |
| Age Group | 31-40 | 14 (23.33) | 1 (5.88) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | <0.001 |
| | 41-50 | 29 (48.33) | 5 (29.41) | 0 (0) | 1 (16.67) | 0 (0) | 1 (25.00) | |
| | 51-60 | 12 (20) | 8 (47.06) | 0 (0) | 3 (50) | 1 (5.00) | 1 (25.00) | |
| | 61-70 | 5 (8.33) | 3 (17.65) | 3 (100) | 2 (33.33) | 8 (40) | 2 (50) | |
| | 70 & Above | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 11 (55.00) | 0 (0) | |

*Fisher exact test

## DISCUSSION

This study was aimed to determine the frequency of sites distribution of oral squamous cell carcinoma. Our main findings showed that most common site for OSCC was Alveolar Ridge (54.55%) and retromolar (18.18%).

The incidence of oral squamous cell carcinomas (OSCCs) varies significantly worldwide, with the Indo-Pak subcontinent having the highest prevalence. Identifying and analyzing trends in OSCC incidence rates, considering factors like age, gender, site distribution, and tumor stage, is of utmost importance. These findings are instrumental in guiding therapeutic decisions for individuals affected by OSCC, contributing to improved treatment strategies.[15]

In our study, we found that the Alveolar Ridge (54.55%) and retromolar area (18.18%) were the most common sites for oral squamous cell carcinoma (OSCC). These results differ from previous research conducted in Pakistan, where the tongue was reported as the site with the highest frequency of involvement (37.1%), followed by the buccal mucosa (30.3%). Another study conducted in Mexico by Hernandez-Guerrero et al.[16], which also identified the tongue as the predominant site of involvement (44.7%). However, Bhurgri reported different findings from South Karachi, where the buccal mucosa was the most frequently involved site in oral malignancy (55.9%), followed by the tongue (28.4%).[17] These variations in site preference can be observed across different regions worldwide. For example, in Iraq, the lip is the preferential site for individuals exposed to ultraviolet radiation,[18] while in Hungary, the floor of the mouth is the most frequently affected site in OSCC patients.[19] These variations can be attributed to the varying intensity of exposure to different risk factors prevalent globally. In our population, the higher prevalence of Oral Squamous Cell Carcinoma (OSCC) on the alveolar ridge can be attributed to the practice of snuff dipping. Snuff dipping, combined with periodontitis, can result in the formation of soft tissue craters. These craters provide a conducive environment for snuff deposits to accumulate over a prolonged duration, increasing the risk of developing OSCC on the alveolar ridge. The results of this study differ from previous research conducted in Pakistan, where the tongue was identified as the site most frequently affected by oral squamous cell carcinomas (OSCCs), accounting for 37.1% of cases, followed closely by the buccal mucosa at 30.3%. Another study conducted in Mexico by Hernandez-Guerrero et al. also supported the tongue as the predominant site of involvement, reporting a frequency of 44.7%. However, contrasting findings were reported by Bhurgri in South Karachi, where the buccal mucosa took precedence, being the most frequently involved site in oral malignancies at 55.9%, followed by the tongue at 28.4%. These variations in site preference are not unique to a specific region but can be observed globally. For instance, in Iraq, the lip is identified as the preferential site for individuals exposed to ultraviolet radiation, while in Hungary, the floor of the mouth is reported as the most frequently affected site in OSCC patients. In the population under study, the higher prevalence of OSCC on the alveolar ridge is attributed to the practice of snuff dipping. This habit, combined

with periodontitis, contributes to the formation of soft tissue craters. These craters create an environment conducive to the accumulation of snuff deposits over an extended duration, thereby increasing the risk of developing OSCC on the alveolar ridge. This highlights the localized impact of specific risk factors on the anatomical distribution of OSCC, emphasizing the importance of considering regional practices and habits in understanding the patterns of oral cancer incidence.

Gender plays a significant role, as all cases in the alveolar ridge and buccal mucosa sites were exclusively observed in males, while the hard palate, labial mucosa, retromolar, and tongue sites were predominantly affected in females. This can be attributed to different habits among males and females like in our society almost males do smoking and in the same way most of the males are snuff dipper. Previous study also reported variations in habits and site of OSCC among genders.[20]

The presentation of OSCC also varies across sites, with the alveolar ridge and buccal mucosa sites commonly associated with a no-healing ulcer, while the Labial Mucosa site exhibits a higher prevalence of ulcers with pain. The Retromolar site shows an even distribution among a no-healing ulcer, growth, and an ulcer with pain. Grade distribution indicates that well-differentiated OSCC cases are predominantly found in the alveolar ridge site, while moderately differentiated cases are more prevalent in the buccal mucosa and retromolar sites. Poorly differentiated cases are specifically observed in the hard palate site. The variation in grade distribution across different sites may be influenced by site-specific molecular and genetic characteristics, as well as variations in exposure to carcinogens and environmental factors.[21]

Furthermore, age group demonstrates an association with site distribution, with the highest frequency of cases in the alveolar ridge site observed in the 41-50 age group, while the buccal mucosa and retromolar sites show higher frequencies in the 51-60 age group. Previous studies also showed significant association of age and OSCC.[22,23]

The study has several limitations that should be considered when interpreting the findings. Firstly, the use of a non-probability consecutive sampling technique introduces selection bias, potentially limiting the generalizability of the results to the wider population. The relatively small sample size of 110 patients also restricts the robustness and generalizability of the findings. Additionally, being a single-center study, the results may not be applicable to other geographical locations or healthcare settings, as the prevalence and characteristics of oral squamous cell carcinoma can vary. The absence of a control group hampers the assessment of specific associations with the disease's development and distribution. Moreover, the descriptive and cross-sectional design of the study limits the establishment of causal relationships or determination of temporal associations. The reliance on limited examination techniques, such as clinical examination and biopsy, may restrict the comprehensive understanding of the disease and its characteristics without advanced diagnostic tools or molecular analysis. Reporting bias and limited generalizability further impact the reliability and applicability of the findings to other populations or healthcare settings.

## CONCLUSION

Alveolar ridge is the common site involved in oral squamous cell carcinoma. Site distribution of OSCC has significant association with age, gender, age and grade of OSCC. These findings emphasize the importance of considering gender, presentation, grade, and age group in the diagnosis and management of oral squamous cell carcinoma.

### Ethical consideration

This study was approved by Institutional Review Board of Saidu College of Dentistry, Swat, Pakistan.

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There is no role of any funding agency in this study.

### Conflict of Interest

Authors declared no conflict of interest.

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**DATA SHARING STATEMENT:** The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

**AUTHORS' CONTRIBUTION**

The following authors fulfill authorship criteria as per ICMJE guidelines;

**Ismail, Masooma S:** Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.

**Shah A, Uddin Z:** Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

**Akhtar R:** Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.

**Kumar T:** Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

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