e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(10); 43-49

Original Research Article

Clinicopathological Analysis of Mandibulectomy Specimens in Oral Squamous Cell Carcinoma: A Retrospective Study from a Tertiary Care Center in Central India

Firoz Sheikh[1], Dilshad Quraishi[2], Chandni Krishnani[3], Abhishek Agrawal[4]

[1]Associate Professor, Department of Pathology, Raipur Institute of Medical Sciences (RIMS), Raipur, Chhattisgarh, India

[2]Assistant Professor, Department of Dentistry, Raipur Institute of Medical Sciences (RIMS), Raipur, Chhattisgarh, India

[3]Associate Professor, Department of Pathology, Raipur Institute of Medical Sciences (RIMS), Raipur, Chhattisgarh, India

[4]Professor, Department of Dentistry, Raipur Institute of Medical Sciences (RIMS), Raipur, Chhattisgarh, India

Received: 01-08-2025 / Revised: 30-08-2025 / Accepted: 30-09-2025

Corresponding Author: Dr. Firoz Sheikh

Conflict of interest: Nil

Abstract

Background: Oral squamous cell carcinoma (OSCC) is a common head and neck malignancy with a high prevalence in South and Southeast Asia, particularly India, where late-stage presentation and mandibular involvement are frequent. Mandibulectomy remains a cornerstone in management not only to achieve complete tumor clearance but also to provide vital insights through margin status and detailed histopathological evaluation of prognostic features, which are critical for guiding therapy and predicting patient outcomes.

Aim: To evaluate the demographic profile, TNM staging, and histopathological prognostic features of oral squamous cell carcinoma in mandibulectomy specimens at a tertiary care center.

Methods: A retrospective study was conducted on 50 mandibulectomy specimens of OSCC received over two years at a tertiary care center in Raipur, India. Demographic and clinical data were retrieved from medical records. The histopathological parameters assessed included tumor differentiation, bone invasion, margin status, perineural invasion (PNI), lymphovascular invasion (LVI), and TNM staging. Data were analyzed using descriptive statistics.

Results: The study population comprised of 31 males (62%) and 19 females (38%), with a mean age of 46.9 years. The gingivobuccal sulcus and buccal mucosa were the most commonly involved sites of the disease. Histologically, 50% of the tumors were moderately differentiated, 46% were well-differentiated, and 4% were poorly differentiated. Adverse features included PNI in 36%, LVI in 28%, and cortical bone invasion in 30% of the cases. Advanced T-stage (T3-T4) was observed in 84% of patients and advanced nodal disease (N2–N3) in 34%. The surgical margins were clear in 64% of the cases and positive in 36% of the cases. Prognostic stage distribution revealed Stage IVA in 66% of cases.

Conclusion: Mandibular OSCC predominantly affects males and most commonly involves the alveolus and gingivobuccal sulcus. Most cases present at advanced stages with adverse histopathological features, such as bone invasion, PNI, and margin involvement, which are key prognostic indicators. Routine clinicopathological correlation, achieving tumor-free margins, and early detection are essential for optimal treatment. Further studies incorporating molecular and imaging biomarkers may enhance prognostication and guide individualized therapies.

Keywords: Bone invasion, Clinicopathological correlation, Mandibulectomy, Margin status, Oral squamous cell carcinoma.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Oral squamous cell carcinoma (OSCC) is the sixth most common cancer worldwide, with a particularly high incidence in South and Southeast Asia, largely attributable to the widespread use of tobacco, betel quid, and alcohol [1-2]. Globally, oral cancers constitute approximately 5% of all malignancies; however, in India, they account for up to 40% of the total cancer burden. Each year, an estimated 60,000 new cases of oral cancer are reported in India, highlighting its significance as a

major public health challenge [2-3]. Surgery remains the primary and most effective treatment for oral cancers, enabling complete tumor excision with adequate margins, regional lymph node clearance through neck dissection, and accurate pathological assessment of disease extent [5].

In cases involving or closely abutting the mandible, mandibulectomy is crucial to achieve negative margins, the single most important determinant of local control and survival in oral squamous cell carcinoma. Marginal mandibulectomy is performed for tumors confined to cortical bone, while segmental mandibulectomy is indicated in extensive or medullary involvement. By ensuring adequate resection, mandibulectomy reduces local recurrence, improves long-term outcomes, and provides essential histopathological information to guide adjuvant therapy [5-7].

Histopathological examination of mandibulectomy specimens not only confirms the diagnosis but also provides information on tumor differentiation, depth and pattern of bone invasion, margin status, and the presence of adverse features such as perineural invasion (PNI), lymphovascular invasion (LVI)& TNM staging. These parameters have significant prognostic value and influence decisions regarding adjuvant therapy [8-9].

Despite the extensive literature on OSCC, few studies have specifically examined mandibulectomy specimens from buccal mucosa and gingivobuccal sulcus carcinomas. Systematic evaluation of the clinicopathological parameters of these cases can provide valuable insights into disease presentation, tumor biology, and prognostic factors in this high-risk subsite, informing risk stratification and individualized patient management.

Aim: To evaluate the clinicopathological features, including demographic profile, TNM staging, and histopathological prognostic factors, in oral squamous cell carcinoma patients undergoing mandibulectomy at a tertiary care center.

Materials and Methods

Study Design and Setting: This retrospective observational study was conducted at the Department of Pathology, Raipur Institute of Medical Sciences, a tertiary care hospital situated at Raipur, Chhattisgarh, India, over a period of two years.

Sample Selection: All mandibulectomy specimens, histologically diagnosed with oral squamous cell carcinoma (OSCC) during the study period were included. Patients with recurrent tumors previously treated with radiotherapy or chemotherapy, inadequate tissue samples, or specimens lacking complete clinical records were excluded from the analysis.

Clinical Data Collection: Demographic details, including age and sex, relevant clinical history, and tumor site, were retrieved from surgical records and patient case files obtained from the medical record department.

Data were systematically extracted using structured data collection sheets that incorporated demographic information, presenting complaints, and clinical examination findings. The histopathology reports of all the included cases were reviewed in detail.

Histopathological Reports & Slide Review: In this retrospective study, the histopathological reports and slides of 50 mandibulectomy specimens were reviewed. Gross examination documented the tumor site, tumor dimensions, extent of bone involvement, and surgical margin status.

Microscopic evaluation was performed on hematoxylin-and-eosin stained sections and included histological grading according to the 5th edition of World Health Organization (WHO) classification (well, moderately, and poorly differentiated), pattern of bone invasion, and margin status categorized as free (>5 mm), close (<5 mm), or positive (tumor at margin). Additional parameters, including perineural invasion (PNI), lymphovascular invasion (LVI), and TNM staging, were systematically assessed to provide a comprehensive clinicopathological evaluation.

Statistical Analysis: The collected data were compiled and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the demographic, clinical, and pathological parameters.

Results

Demographic Data

Age Distribution: The study population included 50 patients, aged 25–75 years, with a mean age of 46.9 years. Most patients (48%, n = 24) were in the 41–50 years age group, followed by 31–40 years and 51–60 years groups (18% each, n = 09 each). The remaining cases were distributed as follows: 21–30 years (6%, n = 03), 61–70 years (8%, n =04), and 71–80 years (2%, n = 01).

Table 1: Age distribution of patients with oral squamous cell carcinoma undergoing mandibulectomy

Age group (Years)	Number (n)	Percentage (%)
21-30	03	06
31-40	09	18
41-50	24	48
51-60	09	18
61-70	04	08
71-80	01	02
Total	50	100

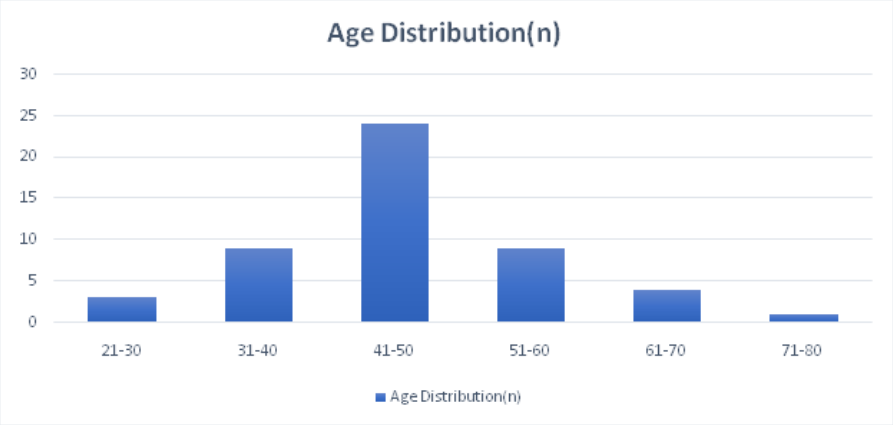

Figure 1: Age-wise distribution of patients with oral squamous cell carcinoma

Sex ratio: With respect to sex distribution, males constituted 62% (n = 31) and females 38% (n = 19), yielding a male-to-female ratio of 1.63:1.

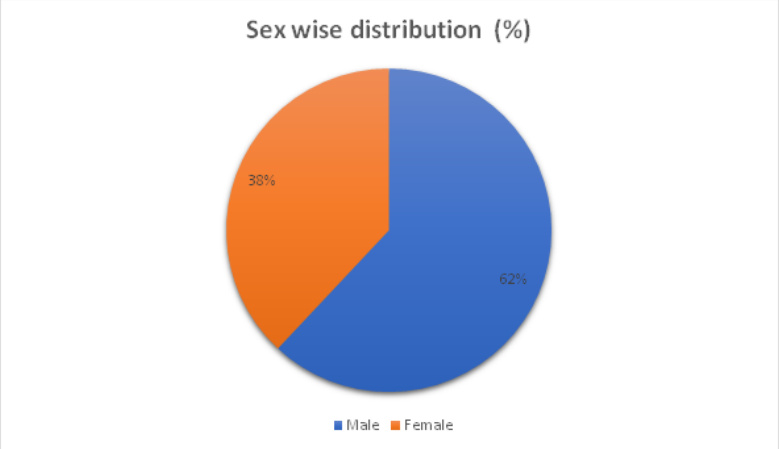

Figure 2: Sex distribution of patients

Histological Grading: Histopathological evaluation revealed that most cases were classified as moderately differentiated squamous cell carcinoma, comprising 25 cases (50%).Well-differentiated tumors accounted for 23 cases (46%), whereas only two cases (4%) demonstrated poorly differentiated morphology.

Table 2: Histological grading of oral squamous cell carcinoma in mandibulectomy specimens

Histological Grading	Number (n)	Percentage (%)
Well	23	46
Moderate	25	50
Poor	02	04
Total	50	100

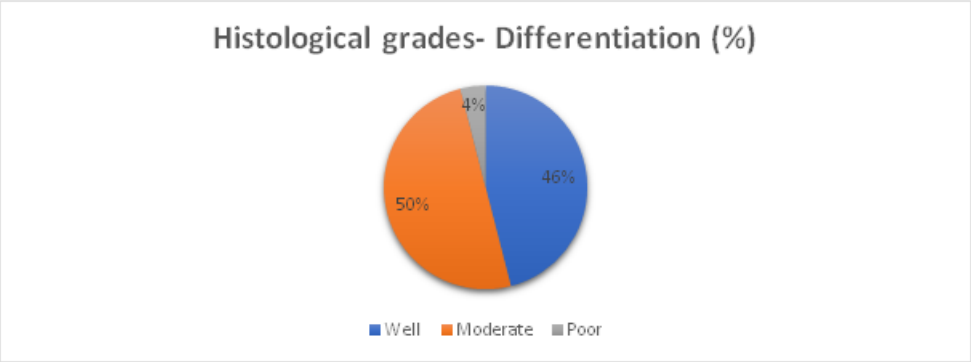

Figure 3: Histological grading of oral squamous cell carcinoma

Adverse Features: Several adverse pathological features were observed in the study group. Bone invasion was observed in 15 cases (30%), all of which were limited to cortical involvement, whereas 35 cases (70 %) showed no osseous infiltration. Perineural invasion was present in 18 (36%) patients, lymphovascular invasion in 14 (28%), and skin involvement in 10 (20%).

Table 3: Adverse pathological features observed in mandibulectomy specimens (n = 50)

Adverse Feature	Cases (n)	Percentage (%)
Bone invasion	15	30
Perineural invasion	18	36
Lymphovascular invasion	14	28
Skin involvement	10	20

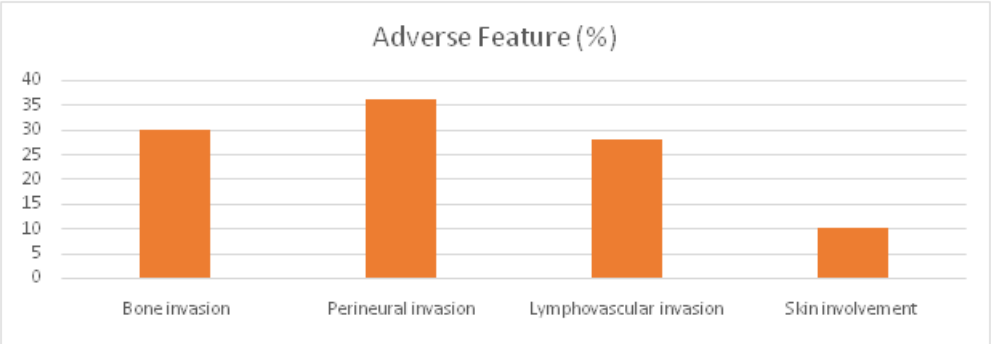

Figure 4: Distribution of adverse pathological features

TNM staging: Analysis of the primary tumor (T) stage showed that advanced disease was common. Among 50 cases, T2 was observed in 8 cases (16%), T3 in 17 cases (34%), and T4a in 25 cases (50%), making T4a the most frequent category. Nodal involvement was present in 24 patients (48%), with N1 in 6 cases and N2 (N2A, N2B, N2C) in 16 cases; two patients had N3B disease. Distant metastasis could not be assessed in any case (Mx).

Surgical margin assessment revealed 32 cases (64%) with clear margins (R0) and 18 cases (36%) with involved margins (R1).Among the 50 cases evaluated, as per the TNM Prognostic Stage Distribution the majority were categorized as Stage IVA (33 cases; 66%).

Table 4: TNM staging and surgical margin status of patients

Parameter	Category	Cases (n)	Percentage (%)
T Stage	Tx	00	-
	Tis	00	-
	T1	00	-
	T2	08	16
	T3	17	34
	T4a	25	50
	T4b	00	-
N Stage	Nx	00	-

	N0	26	52
	N1	06	12
	N2A	02	04
	N2B	10	20
	N2C	04	08
	N3B	02	04
M Stage	Mx	50	100
Margin Status	R0 (Clear)	32	64
	R1 (Involved)	18	36
	R2 (Grossly involved)	00	-

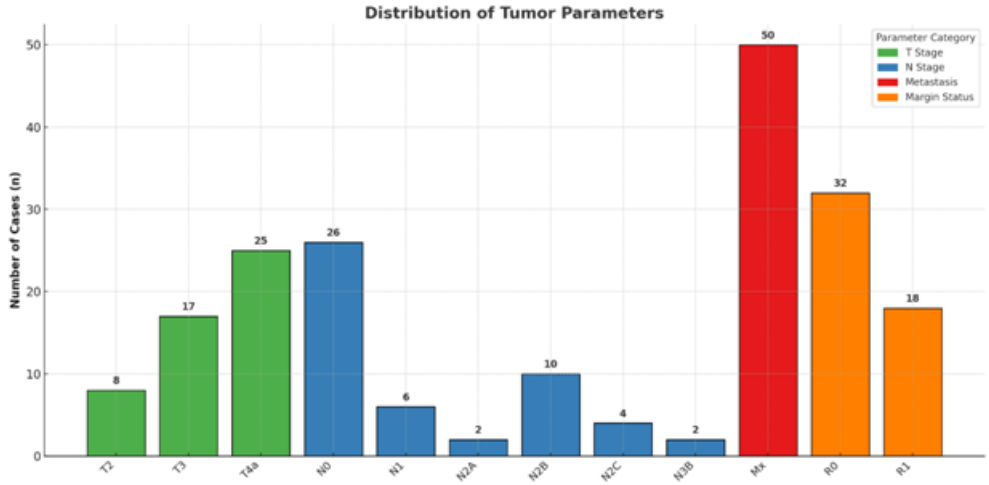

Figure 5: TNM-stage & Status of resection margin distribution among patients

Discussion

Demographic Profile: In our study, males accounted for 62% of cases, with a male-to-female ratio of 1.63:1. This male predominance is consistent with established epidemiological trends, as OSCC occurs more frequently in men [10-11]. The higher burden among males is largely attributed to greater exposure to risk factors, such as tobacco and alcohol use [12]. The age distribution showed a peak incidence in the 41–50-year age group, with a mean age of 46.9 years, closely aligning with previous reports by Ahmad et al in 2019 that place OSCC onset in a similar age range [13]. Comparable findings have also been documented in Indian studies done by M.P. Singh et al in 2015 where a mean age of 47.8 years and a higher male-to-female ratio of 4.18:1 have been reported [14]. These demographic patterns highlight the need for targeted screening and early detection strategies, particularly among middle-aged men with established risk factors.

Histological Grading & Adverse Features: In our study, the majority of OSCC cases were moderately differentiated (50%), followed by well-differentiated (46%) and poorly differentiated tumors (4%). This pattern is consistent with previous Indian studies by Abdulla et at in 2018 and Qiu et al in 2018 which also reported moderately differentiated OSCC as the predominant subtype [15-16]. Histological grading remains a key determinant of tumor behavior and prognosis. While well- and moderately differentiated tumors generally exhibit a more favorable course, poorly differentiated tumors are often aggressive and associated with worse outcomes, highlighting the need for close surveillance and timely aggressive management in such cases [17].

Adverse Histopathological Features: In our study, bone invasion was observed in 30% of cases, all of which were restricted to cortical involvement. Adverse histopathological features, such as perineural invasion (PNI, 36%) and lymphovascular invasion (LVI, 28%), were also prominent. These parameters are well-recognized prognostic indicators closely associated with an increased risk of recurrence and metastatic spread [18]. Among them, PNI has been consistently linked to poorer survival outcomes in OSCC [19].The reported prevalence of PNI in the literature varies from 12% to 50%, with an average of approximately 30% [20]. LVI shows an even wider variation, ranging from 8% to 90%, although most studies report incidences in the 15–35% range [21]. Our findings (PNI, 36%; LVI, 28%) align closely with international data, highlighting their consistent prognostic significance across diverse populations. Recognition of these adverse features

is critical for accurate prognostication and tailoring therapeutic strategies for OSCC.

TNM Staging, Surgical Margin Status& Prognostic Stage Distribution

In our study, a predominance of advanced T stages was noted, with T4a comprising 50% of the cases. Nodal involvement was observed in 48% of cases, with N2B being the most common. The status of surgical margins remains a critical determinant of local control and survival [22].Surgical margin positivity (R1) was observed in 36% of the cases. These findings are consistent with the study done by Bellini et al in 2025 reporting high rates of advanced-stage disease and margin positivity in patients with OSCC [23].Most patients were classified as Stage IVA (66%), as per TNM prognostic stage distribution, this underscores the late-stage presentation of OSCC in this study group, which is a common challenge in clinical practice[24]. Advanced stages are often associated with an increased risk of recurrence and decreased survival rates [25].

Clinical and Surgical Considerations: Dental and maxillofacial surgeons play a crucial role in the management of OSCC cases requiring mandibulectomy. Preoperative assessment of tumor extent, dentition status, and functional considerations such as occlusion and mastication are key factors influencing surgical planning.

The decision between marginal and segmental mandibulectomy is guided by the extent of bone involvement and the need to balance oncological clearance with preservation of mandibular continuity, which has direct implications for postoperative function and rehabilitation. Intraoperative margin assessment by the surgical team, complemented by histopathological confirmation, strengthens oncological safety.

Additionally, the dental team contributes significantly to postoperative rehabilitation through prosthetic reconstruction and functional restoration, thereby enhancing quality of life. This seamless collaboration between surgery and pathology underscores the importance of multidisciplinary care in achieving optimal outcomes for OSCC patients

Limitations: The limitations of this study include its single-center, retrospective design and the absence of long-term follow-up data. A larger multicentric prospective study with survival analysis would provide more definitive conclusions.

Conclusion

This study highlights the clinicopathological characteristics and prognostic factors associated with OSCC in a study group from Chhattisgarh, India. These findings emphasize the need for early detection, accurate staging, and meticulous surgical planning to improve patient outcomes.Routine clinicopathological correlation and further research are warranted to explore prognostic indicators and optimize treatment strategies.

Acknowledgement: None.

Funding: None

Data Availability: Collected data are available at the Department of Dentistry, Raipur Institute of Medical Sciences (RIMS, Raipur, Chhattisgarh India.

References

1. Sharma P, Saxena S, Aggarwal P. Trends in the epidemiology of oral squamous cell carcinoma in Western UP: An institutional study. Indian J Dent Res. 2010 Jul;21(3):316–9.
2. Gupta B, Ariyawardana A, Johnson NW. Oral cancer in India continues in epidemic proportions: Evidence base and policy initiatives. Int Dent J. 2013;63:12–25.
3. Roy S, Mandal T, Das S, Srinivas S, Agarwal A, Gupta A, et al. Demography and pattern of care of patients with head-and-neck carcinoma: Experience from a tertiary care center in North India. Cancer Res Stat Treat. 2020 Sep;3(4):730–5.
4. National Oral Cancer Registry [Internet]. [cited 2025 Sep 13]. Available from: https://nocr.org.in/NOCR/OralCancerinIndia.
5. Gou L, Yang W, Qiao X, Ye L, Yan K, Li L, et al. Marginal or segmental mandibulectomy: treatment modality selection for oral cancer: a systematic review and meta-analysis. Int J Oral Maxillofac Surg [Internet]. 2018 Jan;47(1):1–10. Available from: https://pubmed.ncbi.nlm.nih.gov/28823905/.
6. Nair S, Singhavi HR, Mestry V, Shetty R, Joshi P, Chaturvedi P. Marginal Mandibulectomy in Oral Cavity Cancers — Classification and Indications. Indian J Surg Oncol. 2025 Apr;16(2):581–6.
7. Shah JP. The Role of Marginal Mandibulectomy in the Surgical Management of Oral Cancer. Arch Otolaryngol Head Neck Surg [Internet]. 2002 May;128(5):604–5. Available from: https://jamanetwork.com/journals/jamaotolaryngology/fullarticle/482827.
8. Liu SA, Wang CC, Jiang RS, Lee FY, Lin WJ, Lin JC. Pathological features and their prognostic impacts on oral cavity cancer patients among different subsites - A single institute's experience in Taiwan. Sci Rep. 2017 Dec;7(1).
9. Binmadi N, Alsharif M, Almazrooa S, Aljohani S, Akeel S, Osailan S, et al. Perineural

Invasion Is a Significant Prognostic Factor in Oral Squamous Cell Carcinoma: A Systematic Review and Meta-Analysis. Diagnostics. 2023;13.
10. Altwerger G, Menderes G, Black JD, Azodi M. Should we continue intra-peritoneal chemotherapy in advanced ovarian cancer patients? Integr Cancer Sci Ther. 2016;3(5).
11. Janović A, Bracanović Đ, Antić S, Marković-Vasiljković B. Demographic and imaging features of oral squamous cell cancer in Serbia: a retrospective cross-sectional study. BMC Oral Health. 2024 Dec;24(1).
12. Borse V, Konwar AN, Buragohain P. Oral cancer diagnosis and perspectives in India. Sensors Int [Internet]. 2020 Jan 1 [cited 2025 Sep 25]; 1:100046. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7515567/
13. Ahmad JG, Namin AW, Jorgensen JB, Zitsch RP, Layfield LJ. Mandibular Invasion by Oral Squamous Cell Carcinoma: Clinicopathologic Features of 74 Cases. Otolaryngol Head Neck Surg [Internet]. 2019 Jun;160(6):1034–41. Available from: https://pubmed.ncbi.nlm.nih.gov/30598057/.
14. Singh MP, Misra S, Rathanaswamy SP, Gupta S, Tewari BN, Bhatt MLB, et al. Clinical profile and epidemiological factors of oral cancer patients from North India. Natl J Maxillofac Surg [Internet]. 2015 [cited 2025 Sep 25];6(1):21-4.
15. Abdulla R, Adyanthaya S, Kini P, Mohanty V, D'Souza N, Subbannayya Y. Clinicopathological analysis of oral squamous cell carcinoma among the younger age group in coastal Karnataka, India: A retrospective study. J Oral Maxillofac Pathol [Internet]. 2018 May;22(2):180.
16. Qiu Y, Lin L, Shi B, Zhu X. Does Different Mandibulectomy (Marginal vs Segmental) Affect the Prognosis in Patients with Oral Squamous Cell Carcinoma? J Oral Maxillofac Surg [Internet]. 2018 May;76(5):1117–22.
17. Pandya JA, Natarajan S. A study on histological grading systems of oral squamous cell carcinoma and comparison of their efficacy in determining the nature (clinical and histopathological) and prognosis of oral squamous cell carcinoma. J Cancer Res Ther [Internet].2023Apr;19(Suppl):S198–205.
18. Pandit P, Patil R, Palwe V, Gandhe S, Manek D, Patil R, et al. Depth of Invasion, Lymphovascular Invasion, and Perineural Invasion as Predictors of Neck Node Metastasis in Early Oral Cavity Cancers. Indian J Otolaryngol Head Neck Surg [Internet]. 2023 Sep;75(3):1511–6. Available from: https://pubmed.ncbi.nlm.nih.gov/37636778/.
19. Alim N, Elsheikh M, Satti AA, Tabassum N, Suleiman AM. Recurrence of oral squamous cell carcinoma in surgically treated patients at Khartoum Teaching Dental Hospital: retrospective cross-sectional study. BMC Cancer [Internet]. 2024 Dec;24(1):781.
20. Fan KH, Kang CJ, Lin CY, Ng SH, Wang HM, Hsieh CH, et al. Quantitative Measurement of Perineural Invasion for Prognosis Analysis of Oral Cavity Cancer Treated by Radical Surgery With or Without Adjuvant Therapy. Technol Cancer Res Treat [Internet]. 2023 Jan;22.
21. Adel M, Kao HK, Hsu CL, Huang JJ, Lee LY, Huang Y, et al. Evaluation of Lymphatic and Vascular Invasion in Relation to Clinicopathological Factors and Treatment Outcome in Oral Cavity Squamous Cell Carcinoma. Medicine [Internet]. 2015;94(43):e1510. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4985367/.
22. Jain PV, Sharan R, Manikantan K, Clark GM, Chatterjee S, Mallick I, et al. Redefining adequate margins in oral squamous cell carcinoma: outcomes from close and positive margins. Eur Arch Otorhinolaryngol [Internet]. 2020 Apr;277(4):1155–65. Available from: https://pubmed.ncbi.nlm.nih.gov/31897720/.
23. Bellini E, Pace GM, Marchi F, Paderno A, Zimello C, Pennacchi A, et al. Impact of surgical margins status on survival outcomes in oral cavity squamous cell carcinoma: a systematic review and meta-analysis. Acta Otorhinolaryngol Ital [Internet]. 2025;45(2 Suppl 1):S2. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC12115406/.
24. Bakshi J, Kaur N, Tiwana H, Verma RK, Panda NK, Patro SK. Survival Analysis of Oral Squamous Cell Carcinoma Patients Attending Tertiary Care Centre of North India. Indian J Surg Oncol [Internet]. 2020 Mar;14(1):234. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9986144/.
25. Singh J, Gupta S, Sajeevan S, Sikdar D, Chakravarty A, Singh S, et al. Analysis of clinicopathological factors associated with recurrence after post operative radiotherapy in oral cavity squamous cell carcinoma. J Cancer Res Ther [Internet]. 2025. Apr;21(3):558–66. Available from: https://pubmed.ncbi.nlm.nih.gov/40616537/.