Oro-facial malignancy in north of Iraq: a retrospective study of biopsied cases

Sura Ali Ahmed Fuoad1, Dena Nadhim Mohammad2*, Marwa Abdul-Salam Hamied2 and Balkees Taha Garib2

Abstract

Background: Identifying the prevalence of orofacial malignancies is essential to provide health-care programs and services for a specific population. This study aimed to specify the prevalence, clinical and histopathological features of oral malignancies in Sulaimani for over 12 years.

Methods: All archived reports for orofacial specimens from 2008 to 2019 were collected from three major centers in Sulaimani governorate. The demographic data, date, type of surgery, lesion's site, and diagnosis were recorded. The ICD-10 coding was specified for each case. A Chi-square test was used to assess differences between genders. A one-way ANOVA test was applied to analyze the differences in mean age distributions among different sites of oral malignancies and oral squamous cell carcinoma histopathological grades. \( P < 0.05 \) was considered significant.

Results: Orofacial malignant lesions account for 14.53% of the total sample. Patients' mean age was \( (55.46 \pm 18.48) \) years, and they were predominantly males (M: F ratio = 1.15:1). The tongue was the frequently affected site (14.8%). A Chi-square test showed no significant difference between genders concerning age \( (P = 0.118) \), years of registration \( (P = 0.28) \), and site \( (P = 0.29) \). The C06 (represents; cheek mucosa C06.0, the vestibule of mouth C06.1, retromolar area C06.2, and other unspecified parts of mouth C06.8) was the most frequent topographical ICD-code (18.1%). Carcinoma was a frequent malignancy (63.2%). OSCC was the most common lesion (56.4%). It commonly affects males, and the tongue was the frequent site (24.1%) followed by lip (17.8%).

Conclusions: There is a slight increase in the registered oral malignancies in Sulaimani city over 12 years; they were predominated in males, in 61–70 years old patients, and being oral squamous cell carcinoma types.

Keywords: Oral cancer, Squamous cell carcinoma, Tongue, ICD-10, Sulaimani

Background

The oral mucosa can be affected by non-neoplastic and neoplastic lesions. It reflects or manifests the underlying systemic disease as oral health is integral with general health [1]. Oral cancer is increasing in the annual incidence of >300,000 cases, with a high mortality rate reported in less developing countries. It is attributed to the accumulative factors throughout population aging and cancer-provoking factors expansion [2].

Malignant lesions in the orofacial region vary in their causative factors, genetic predisposition, origin, location, and histopathological differentiation [3]. Furthermore, the demographic variation (age and gender) and site preference are crucial to determine their characteristics [4]. Annual estimation of orofacial malignancy prevalence is essential to identify the risk population and emphasize health-care programs and services [4].

Taking biopsy is essential to establish a definitive diagnosis based on the lesion histological characteristics and in correspondence to their clinical presentation. It gives baseline information about the disease distinction, prognosis, and prevalence. Thereby it facilitates planning a proper management strategy. Biopsy acknowledges the
categorization of lesions in a coherent and higher systematic way. Besides, the biopsy is considered undeniable medico-legal merit [5].

A limited number of studies were conducted in different Middle East countries regarding histopathologically confirmed orofacial lesions, and few studies estimated oral malignancies relative frequency [6–14]. Oral squamous cell carcinoma (OSCC) is the commonest oral malignancy. It is prevalent in middle-aged and elderly, although it has been reported in young adults [15]. Analysis of data from the Iraqi Cancer Registry includes all cases reported in Iraq except the Kurdistan region (north of Iraq), revealed that oral cancer accounts for 2% of all cancers reported in 2000–2008, and 91% of cases were OSCC [16]. In 2008, a large epidemiological retrospective study was conducted on 1,425 biopsy reports in Iraq. It showed that OSCC was frequently reported in over 50 years old patients with a male predilection [17]. Another epidemiological study in Basrah city- south of Iraq, OSCC reported in 21 cases with males preference, and the tongue was the commonly affected site [18]. Histopathological record studies were done in Sulaimani, Mosul, Baghdad, and Basrah cites of Iraq, in which different oral malignancies frequencies were registered [19–23].

From a systematic review of 82 hospital records over 26 years in Saudi Arabia, data revealed a high prevalence of oral cancer, ranging from 21.6% to 68.6% [24]. The present study aimed to determine the orofacial malignancies surgical specimen distributions concerning age, gender, year of registration, lesion’s site, disease ICD classification, and histopathological typing in Sulaimani governorate. Besides the estimation of gender variations in these different parameters. Then specify those parameters in OSCC alone.

**Materials and methods**

The current retrospective study analyzed the clinico-pathological reported archives of surgical specimens excised for confirming the diagnosis of orofacial lesions. The data was collected from three major centers in Sulaimani governorate, north of Iraq, Kurdistan region; College of Dentistry-Sulaimani University, and two primary referral histopathological laboratories in government hospitals (Shorsh Hospital- Ministry of Military Defense) and Shahid Saifaldeen Hospital—Ministry of Health). The Research Ethics Committee in the College of Dentistry/Faculty of Medical Sciences, Sulaimani University approved the study (Proposal No. 199, 20/9/2020). All methods were performed following the relevant guidelines and regulations. Informed consent had been waived by the Research Ethics Committee in the College of Dentistry/Faculty of Medical Sciences, Sulaimani University.

A total of 2319 histopathological archive reports of oral lesion surgical specimens recorded between 2008 and 2019 were retrieved. The inclusion criteria include all malignant lesions of the orofacial region and neck. Duplicated cases, re-excised surgical samples, unclear or incomplete data, and inconclusive diagnosis were the exclusion criteria. All data generated or analyzed during this study were included in this published article is shared as supplementary information files.

Information about age, gender, laboratory name, year of registration, type of surgical biopsy, site. The authors specified the topographic code of ICDO classification for oncology. It was identified for all cases based on the World Health Organization International Statistical Classification of Diseases for Oncology ICD-10 (WHO 2016a) and Related Health Problems 10th Revision 2010- II Neoplasms [25]. Finally histopathological diagnosis (with grading if present) was registered.

The data set was tabulated in an Excel worksheet and statistically analyzed using the Statistical Package for the Social Sciences software (SPSS Version 16.0. Chicago, SPSS Inc.). The frequency and percentage distributions were calculated for nonparametric variables (age-group, gender, years of registration, site, ICD coding system, and malignant histological groups) and analyzed by Pearson Chi-square ($\chi^2$) test for gender’s differences. The mean and standard deviation of the age was calculated. A one-way ANOVA and Post Hoc Tukey test was used to analyze the variances in mean age among different sites and OSCC grades. A $P$ value of 0.05 was used as a cut-off point for the test significance.

**Results**

Out of 2319 histopathological archive reports of orofacial specimens recorded, there were 337 (14.5%) reports with definitive orofacial malignancy over the twelve years (2008–2019) in Sulaimani city. The age ranged from 1–90 years old, with a mean (55.46±18.48) years. The majority of cases (22.3%, n=75) located in the (61–70) age group, followed by 18.4% (n=62) in the age group (51–60). (Fig. 1a). Malignancy occurred in males 53.4% (n=180) more than in females 46.6% (n=157).

Sixty-one samples (18.1%) were incisional biopsy; the remaining included excisional surgical samples. The peak number of recorded orofacial malignancies was in 2014 (17.2%, n=58), followed by 2015 (13.4%, n=45). The least were in 2008 (1.5%, n=5) (Fig. 1b). Furthermore, younger patients aged less than 20 years were more frequent in males (10 cases versus 5). Detailed analysis showed that patients within 41–60 years had frequent malignant neoplasms of the tongue.
The tongue was the most frequently affected site 14.8% (n=50), then lip 11.6% (n=39), and 10.4% (n=35) of cases in major salivary glands. Females showed slightly more frequent malignancies in the cheek (M: F ratio = 1:1.6), and male predominance was seen in the lip, face, and floor of mouth with male to female ratio (2.25:1), (2:1), and (1.66:1), respectively (Fig. 1c). The Chi-square test showed no significant difference between genders concerning age-groups (P=0.118), the years of registration (P=0.28), and anatomical site (P=0.29) (Fig. 1).

Concerning the topographical code of malignant lesions showed that (C06) (represented; cheek mucosa C06.0, the vestibule of mouth C06.1, retromolar area C06.2, and other and unspecified parts of mouth C06.8) was the most frequently involved site 18.1% (n=61). Tongue malignancy (C02) was the next frequently detected 14.2% (n=48). It included; C02.0 dorsal surface, C02.1 border of the tongue, C02.2 ventral surface, C02.8 overlapping sites, and C02.9 unspecified site of the tongue. The predominant sub-site was the border of the tongue (7.7%, n=26). The lip accounted (10.1%, n=34), followed by the palate 9.8% (n=33). Secondary malignancy accounted for 36 cases (10.7%), mainly in lymph nodes (C77.0) 22 cases. C43 (malignant melanoma of skin) was the least 0.3% (n=1) (Fig. 1d, Table 1).

All anatomical sites of malignant lesions showed an almost similar mean of age except those at the jaws. They occurred at a significantly younger age (one-way ANOVA and post Hoc test P=0.000) (Fig. 2).

Regarding the malignancy histogenesis, carcinoma was the most frequent malignancy (63.2%), followed by salivary gland tumors (17.5%). Soft tissue sarcomas and melanotic neoplasm were the lowest orofacial malignancy, 1.8%. Accordingly, OSCC was the most common lesion 56.4% (n=190), followed by adenoid cystic carcinoma 7.1% (n=24) (Table 2). Orofacial malignancies had a highly significant difference in their distribution with patients’ age-groups (Chi-Square test, P=0.000). Thus, carcinomas had a peak of (61–70) years age-group (n=51). Salivary gland tumors had two peaks (each included 13 patients); an earlier one at (31–40) years
group and a later one at group (61–70) years. The hematogenic neoplasms’ peak was seen in the age-group (41–50) years (n = 9) (Fig. 3).

Detailed information about OSCC indicated that it was frequently found in males (109 versus 81 in females). The mean age of the patients was (61.03 ± 14.24) (Table 3), most of the cases registered in 2014, and the tongue is on the top of affected sites (46, 24.1%), followed by the lip (34, 17.8%) (Fig. 4). There were significant statistical differences between genders concerning age and year.

| Table 1 | Topography distribution according to the ICD-10-CM Diagnosis Code in the definition of oral malignant neoplasms for 337 cases |
|---------|--------------------------------------------------------------------------------|
| ICD     | Topographic location               | No  | %   | ICD                     | No  | %   |
| C00     | Lip                                 | 34  | 10.1| C00.0                  | 1   | .3  |
|         |                                     |     |     | C00.1                  | 22  | 6.5 |
|         |                                     |     |     | C00.3                  | 1   | .3  |
|         |                                     |     |     | C00.4                  | 5   | 1.5 |
|         |                                     |     |     | C00.5                  | 1   | .3  |
|         |                                     |     |     | C00.6                  | 4   | 1.2 |
| C01     | Base of tongue                      | 2   | .6  | C01.0                  | 2   | .6  |
| C02     | Other and unspecified parts of the tongue | 48  | 14.2| C02.0                  | 5   | 1.5 |
|         |                                     |     |     | C02.1                  | 26  | 7.7 |
|         |                                     |     |     | C02.2                  | 1   | .3  |
|         |                                     |     |     | C02.8                  | 4   | 1.2 |
|         |                                     |     |     | C02.9                  | 12  | 3.6 |
| C03     | Gum and alveolar mucosa             | 15  | 4.5 | C03.0                  | 4   | 1.2 |
|         |                                     |     |     | C03.1                  | 5   | 1.5 |
|         |                                     |     |     | C03.9                  | 6   | 1.8 |
| C04     | Floor of mouth                      | 16  | 4.7 | C04.0                  | 1   | .3  |
|         |                                     |     |     | C04.9                  | 15  | 4.5 |
| C05     | Palate                              | 33  | 9.8 | C05.0                  | 10  | 3.0 |
|         |                                     |     |     | C05.1                  | 6   | 1.8 |
|         |                                     |     |     | C05.9                  | 17  | 5   |
| C06     | Other and unspecified parts of the mouth | 61  | 18.1| C06.0                  | 20  | 5.9 |
|         |                                     |     |     | C06.2                  | 6   | 1.8 |
|         |                                     |     |     | C06.8                  | 31  | 9.2 |
|         |                                     |     |     | C06.9                  | 4   | 1.2 |
| C07     | Parotid gland                       | 29  | 8.6 | C07.0                  | 29  | 8.6 |
| C08     | Other and unspecified major salivary glands | 4   | 1.2 | C08.0                  | 2   | .6  |
|         |                                     |     |     | C08.1                  | 1   | .3  |
|         |                                     |     |     | C08.9                  | 1   | .3  |
| C10     | Oropharynx                          | 2   | 0.6 | C10.2                  | 2   | .6  |
| C31     | Maxillary sinuses                   | 3   | 9   | C31.0                  | 3   | 9   |
| C41     | Bone                                | 29  | 8.6 | C41.0                  | 16  | 4.7 |
|         |                                     |     |     | C41.1                  | 13  | 3.9 |
| C43     | Malignant melanoma of skin          | 1   | 3   | C43.9                  | 1   | .3  |
| C44     | Other malignant neoplasms of the skin | 24  | 7.1 | C44.0                  | 5   | 1.5 |
|         |                                     |     |     | C44.31                 | 9   | 2.7 |
|         |                                     |     |     | C44.320                | 8   | 2.4 |
|         |                                     |     |     | C44.399                | 1   | .3  |
| C77     | Secondary                           | 22  | 6.5 | C77.0                  | 22  | 6.5 |
| C79     |                                     | 14  | 4.2 | C79.2                  | 2   | .6  |
|         |                                     |     |     | C79.51                 | 1   | .3  |
|         |                                     |     |     | C79.89                 | 11  | 3.3 |
of registration. Although the peak of the age of occurrence was nearly equal in both genders, females were less at (41–50) and (81–90) age-groups (chi-square test, \( P = 0.02 \)) (Fig. 4a). Again females express a high frequency in 2014 (\( n = 25 \)), while males showed a high frequency in 2015 (16.5%, \( n = 18 \)) (chi-square test \( P = 0.038 \)) (Fig. 4b). Although SCC of the lip was a common site in males (22.9%, \( n = 25 \)), there were no gender differences in OSCC site distribution (chi-square test \( P = 0.197 \)) (Fig. 4c).

Nearly half of OSCC cases were well-differentiated (59.5%, \( n = 113 \)), only 9.9% were poorly-differentiated. The statistical analysis showed no significant relationship between histopathological grading of OSCC between genders (Chi-square test \( P = 0.45 \)) or mean age (\( P = 0.92 \), one-way ANOVA test) (Table 3).

**Discussion**

A wide range of lesions can affect the orofacial region. They may have a similar clinical presentation, even though some of them being malignant and life-threatening. In many cases, a biopsy is essential to establish an accurate diagnosis and subsequent proper management. Also, retrieving the reports of surgical biopsies for malignant neoplasm can direct vision to assess this health problem. The majority of our cases underwent excisional removal to establish a definitive diagnosis. However, different pathologists used different words to describe similar lesions. Reevaluation of histopathological description was essential to unify the diagnostic terms.

Our result indicated a slight increase in the rate of oral malignancies over time (14.5%) compared to a five-year (2004–2009) retrospective study (12.3%) in Sulaimani [19] and another previous study in Baghdad during 1991–2000 (9.97%) [26]. This could be attributed to pollution and recurrent explosions, and wars in Iraq. Our result was similar to that reported in UAE (14.9%) [8], but lesser than that reported in Basrah-south of Iraq (19.1%) [23], and higher than in KSA (5.7%) [13], Iran (2.39%) [27], (3.88%) [28].

Oral malignancy occurred at a wide age range. In this study, it ranged from 1–90 years old. The highest age-group (61–70) was similar to results from Sulaimani [19] and Basrah cities [23]. However, the patients were older than those reported in two other Iraqi studies of OSCC (51–60) [29], (50–69) [30].

In this study, the mean age of oral malignancy (55.46 ± 18.48) was similar to the mean age of SCC patients in UAE (54.9 ± 12.9) [8] but higher than in KSA (49.5 ± 20.7) [13]. The present study showed that carcinomas were seen in the fifth to seventh decades. In comparison, a Saudi Arabian study reported higher mean age of oral malignancy (64.8) [11]. This variation could be due to variable reactions in older people [10, 18, 24] prolonged and accumulative, intense exposure to various provoking factors.

This study also showed that specific demographical findings might characterize different age-groups. Younger patients with age less than 20 years were twice as frequent males, which agrees with Al- Reyahi’s study [26]. However, our cases aged within (41–60) years showed tongue malignancy and contradicted the above Iraqi study as teenage patients suffered predominantly from tongue and lip cancers [26].

Biopsy records revealed that the male gender predominated [26, 28]. The current study also showed male predominance (M: F ratio =1.15:1), which disagreed with the finding in Sulaimani in Khudier’s study concerning
oral malignancy (M: F ratio = 0.9:1) [19]. Studies from different Iraqi governorates declared a higher male ratio (M: F ratio = 1.37:1) [16], (1.38:1) [23], OSCC study (1.71:1) [29], (1.4: 1) [30]. In KSA, the M: F ratio in Jeddah varied from (0.8:1) [24] to (1.26:1) [13]. In Sudan, the ratio was 3:2 [10]. Such findings might be attributed to the expanded presentation to risk factors by the males [23] like smoking, alcohol, sun exposure, or even hormonal factors. Further analysis of the gender variation of the affected site showed differences. Cheek was the predominant site in females, while lip, face, and mouth floor were predominant in males. On the contrary, Museedi and Younis found men significantly more affected with lip cancer, tongue, gum, mouth palate, and other sites of mouth than women [16]. However, lip and palatal malignancies were more in females, and tongue cancer was more in males [26].

The current study result aligned with the most Iraqi studies stated that the tongue was the mainly affected site (42.7%) [16], (46.7%) [23]. In Sudan, the location of
overlap areas of the oral cavity was on the top (38.7%), then tongue (9.2%), lip (5.4%) [10]. Moreover, Dhanut-hai et al. reported that the tongue was the most frequently involved site (25.4%) then labial/buccal mucosa (21.7%) [28]. The recorded clinical features of different studies that depend on biopsied oral-facial malignancies in different countries were shown in Table 4.

![Fig. 3](image)

**Fig. 3** Frequency distribution of different oral-facial histological malignant groups according to the age group. Pearson Chi-Square test ($P = 0.000$)

difference in frequency among age-groups

| Histopathological grading | No  | %    | Age            | ANOVA* | Male       | Female       | X² test** |
|---------------------------|-----|------|----------------|--------|------------|--------------|-----------|
|                           |     |      | Mean ± SD      |        | Male (%)   | Female (%)   | x²-value  |
| Well                      | 113 | 59.5 | 60.7 ± 14.7    | 0.92   | 60 (53.1)  | 53 (46.9)    | 0.45      |
| Moderate                  | 37  | 30   | 61.2 ± 14.05   | 0.92   | 36 (63.2)  | 21 (36.8)    |           |
| Poor                      | 19  | 9.9  | 62.4 ± 12.28   | 0.92   | 12 (63.2)  | 7 (36.8)     |           |
| Undifferentiated          | 1   | 0.5  | 54             | 0.92   | 1 (100)    | 0 (0)        |           |
| Total                     | 190 | 100  | 61.03 ± 14.24  | 0.92   | 109 (57.4) | 81 (42.6)    |           |

* One-way ANOVA test, among the mean age values of different histopathological grades groups
** Pearson Chi square test, variation in gender distribution among different histopathological grades groups

indicated that the C06 (represents; cheek mucosa C06.0, the vestibule of mouth C06.1, retromolar area C06.2, and other unspecified parts of mouth C06.8) was the most frequently coded site (61, 18.1%) and tongue malignancy (2nd most affected site) since the later was divided into a base of the tongue (C01, 0.6%) and others and unspecified parts of the tongue (C02, 14.2%) (Dorsal surface C02, border C02.1, ventral surface C02.2, Overlapping sites C02.8, unspecified C02.9). Most of the previous local and global studies depend on the neoplasm’s anatomical localization and did not follow the ICD coding. Except for Al-Reyahi [26], who found that the lip (C00) was the most frequent site, while Museedi and Younis [16] in their study reported that the tongue and other (ICD-02) is the predominant site.
Regarding OSCC, in UAE (51.9%) of cases located in tongue followed by cheeks (19.48%), lips (11.6%) [8]. A previous study in Sulaimani found (50%) of cases affected the lip and (20%) detected in the tongue [19], whereas in our study, SCC of the tongue is ahead (24.21%) of the lip (17.89%). Iraqi studies showed different frequencies of OSCC (91%) [16], (16.1%) from all other lesions, and 84.1% from malignant lesions [23].

Regarding malignant origin, in the present study, carcinomas had the commonest origin (63.24%), followed by glandular parenchyma (17.51%). Thus, OSCC was the most common (56.4%) malignancy, then adenoid cystic carcinoma (7.1%). Our results confirmed previous studies for the rank of the diagnosed histopathological malignancy. Khudier [19] found OSCC in (56.1%) cases, then salivary gland carcinoma (19.6%), similar to our finding.

Dhanuthai et al. showed that the majority of oral cancer arose from epithelial, which was (85.09%) and (80.05%) of them were OSCC [28]. In Sudan, OSCC accounts (73.6%) of all oral malignancies, followed by verrucous carcinoma [10]. In UAE [8] registered (77%) SCC cases from oral malignancies. Al-Hindi et al. [13] reported SCC in (65.7%). Moridani et al. found OSCC in (1.52%) of oral cancer, followed by salivary gland malignancies (0.86%) [27]. The clinicopathological distributions of OSCC in middle east countries were shown in Table 4. Another study on East African pathological records reported that OSCC was (15.22%) of all the oral maxillofacial neoplasms [31].

In the current study, most OSCC cases were well-differentiated (59.5%), followed by moderately differentiated SCC (30%). In UAE, (62.3%), (20.8%), (6.5%) accounted for well, moderate, and poorly differentiated OSCC, respectively [8]. In Sudan, the well-differentiated SCC was the most prevalent (62.3%), followed by moderately differentiated SCC (20.8%) [10]. This grading finding supports other studies in Iraq [17], UAE [8].

According to this study, there was an increase in the registered orofacial malignancies in Sulaimani city. This rise may indicate a good health service in the
region that attracts the surgeons to submit their surgical samples to these centers and do not send them to the capital Baghdad. Besides, the accumulative effects of pollutions, which is considered an additive provoking factor, are expressed over time. Thus, people in the north of Iraq might have orofacial malignancies risk and need educational programs to promote preventive measures and early detection and management.

Acknowledgements
Not applicable.

Authors’ contributions
S.A.F.: validation, resources, writing—original draft, writing—review and editing, project supervision; D. N.M. data entering and analyzing and validation of the data, writing—review and editing, M. A. H. collecting and data entering; B. T.G.: investigation, statistical analysis, writing—review and editing. All authors read and approved the final manuscript.

Funding
Not applicable.

Availability of data and materials
Material form all archived data of patients reports from 2008 to 2019 with orofacial malignancies were recorded; Location of material The data was collected from three major centers in Sulaimani governorate, north of Iraq, College of Dentistry-Sulaimani University, and two primary referral histopathological laboratories in government hospitals (Shorsh Hospital - Ministry of Defence Affairs) and Shahid Saifaldeen Hospital—Ministry of health; the material can be accessed The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations
Ethics approval and consent to participate
IBR approval, the Research Ethics Committee in the College of Dentistry/Faculty of Medical Sciences, Sulaimani University approved the study (Proposal No. 199, 20/9/2020). All methods were performed following the relevant

Table 4 The clinical features of biopsied oral-facial malignancies in different countries in the Middle East

| Country   | Author(s)          | Year | M:F | Prevalence | Age | Most affected oral site |
|-----------|--------------------|------|-----|------------|-----|------------------------|
| Oral malignancies | Iraq Al–Niaimi [20] | 2006 | 1.2:1 | 2% | 58.3 | Lip 41.1%, tongue 23.5% |
|           | Khudier [19]      | 2012 | 0.9:1 | 12.3% | – | – |
|           | Hassawi et al. [21] | 2010 | – | 12.8% | – | – |
|           | Mohammed [22]     | 2014 | 1.56:1 | 0.12% | 39.1 | Perioral 39.5%, buccal mucosa 18.6% |
|           | Museedi and Younis [16] | 2014 | 1.37:1 | 2% | > 60 | Tongue > lip |
|           | Aljazaeri et al. [23] | 2020 | 1.38:1 | 19.1% | > 69 | Tongue 46.7% |
| UAE       | Anis and Gaballah [8] | 2013 | – | 14.9% | – | – |
| Yemen     | Halboub et al. [9] | 2011 | 1:1 | 4% | 58.4 | Tongue 29.9%, floor 10.2% |
| Sudan     | Osman et al. [10] | 2010 | 3.2 | 50% | > 50 | Overlap 38.7%, tongue 9.2% |
| Saudi Arabia | Ali et al. [12] | 2013 | 142:1 | 9.9% | 45.4 | |
|           | Saleh et al. [11] | 2017 | 0.6:1 | 38.8% | 64.8 | Tongue 43.7%, buccal mucosa 26.4% |
|           | Al–Hindi et al. [13] | 2019 | 1.26:1 | 5.7% | 49.52 | – |
| Kuwait    | Ali and Sundaram [6] | 2012 | – | 55.6% | – | – |
|           | Joseph et al. [7] | 2019 | 1.4:1 | 3.6% | 51.29 | – |
| Jordan    | Telfah and Hammouri [14] | 2014 | 1.6:1 | 1.5% | – | – |
| OSCC       | Iraq Al–Niaimi [20] | 2006 | 1.2:1 | 80% | – | Lip 51.5%, tongue 29.4% |
|           | Khudier [19]      | 2012 | 1.2:1 | 56.1% | 50–70 | Lip 50%, tongue 20% |
|           | Hassawi et al. [21] | 2010 | 3.1 | 58.9% | – | – |
|           | Mohammed [22]     | 2014 | – | 49% | – | – |
|           | Museedi and Younis [16] | 2014 | – | 91% | – | – |
|           | Aljazaeri et al. [23] | 2020 | 1.36:1 | 84.1% | – | – |
| UAE       | Anis and Gaballah [8] | 2013 | 4:13:1 | 77% | 54.9 | Tongue 51.9%, buccal mucosa 19.48% |
| Yemen     | Halboub et al. [9] | 2011 | – | 93.2% | – | – |
| Sudan     | Osman et al. [10] | 2010 | – | 73.6% | > 50 | – |
| Saudi Arabia | Ali et al. [12] | 2013 | 1.37:1 | 18.2% | 60.39 | – |
|           | Saleh et al. [11] | 2017 | 0.54:1 | 93.1% | 65.1 | Tongue 43.7%, buccal mucosa 26.4% |
|           | Al–Hindi et al. [13] | 2019 | 1.4:1 | 65.7% | 56.6 | – |
| Kuwait    | Ali and Sundaram [6] | 2012 | 1:1 | 44.4% | 53.9 | Buccal mucosa 39%, tongue 28.5% |
|           | Joseph et al. [7] | 2019 | – | 64% | – | – |
| Jordan    | Telfah and Hammouri [14] | 2014 | 1:2:1 | 67.3% | – | Lip 23.7%, tongue 18.6% |

\[1\] Mean of age, – not mentioned
guidelines and regulations. Informed consent had been waived by the Research Ethics Committee in the College of Dentistry/Faculty of Medical Sciences, Sulaimani University, Kurdistan region, Iraq. Consent to participate: not applicable as we collected archived files of biopsied cases.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Author details
1 Oral Medicine, Diagnostic and Surgical Dental Science Department, College of Dentistry, Gulf Medical University, Ajman, UAE. 2 Oral and Maxillofacial Pathology, Oral Diagnosis Department, College of Dentistry, University of Sulaimani, Sulaimani, Kurdistan Region, Iraq.

Received: 18 December 2020   Accepted: 16 March 2021
Published online: 23 March 2021

References
1. Baykul T, Yilmaz HH, Aydin U, Aydin MA, Aksoy M, Yildirim D. Early diagnosis of oral cancer. J Int Med Res. 2010;38(3):737–49.
2. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008 GLOBOCAN 2008. Int J Cancer. 2010;127(12):2893–2907.
3. Ellington TD, Henley SJ, Senkomago V, O’Neil ME, Wilson RJ, Singh S, et al. Trends in incidence of cancers of the oral cavity and pharynx—United States 2007–2016. MMWR. 2020;69(15):533–8.
4. Gambhir RS, Veeresha KL, Sohi R, Kakkar H, Aggarwal A, Gupta D. The prevalence of oral mucosal lesions in the patients visiting a dental school in northern India in relation to sex, site, and distribution: a retrospective study. J Clin Exp Dent. 2010;3(1):e10–7.
5. Mota-Ramírez A, Silvestre FJ, Simó JM. Oral biopsy in dental practice. Med Oral Patol Oral Cir Bucal. 2007;12(7):E504–510.
6. Aljazeri S, Al Qudsi G, Jaber H, Al Elwi W, Haddad S, Echrish H. Biopsy records to the oral lesions in Basrah between 2012–2017. J Oral Med Oral Pathol Oral Radiol. 2020;6(2):74–80.
7. Al-Mahfoud M, AlSaimeary J, Al SA. Occurrence of oral and oropharyngeal squamous cell carcinoma among patients in Basrah city. Iraq J Biotechnol. 2017;16(3):255–61.
8. Ali AA, Suresh CS, Al-Tamimi D, Al-Nazr M, Atassi RA, Al-Rayes I, et al. A retrospective study. J Oral Maxillofac Surg Med Pathol. 2013;25:393–439.
9. Halboub ES, Al-Anazi YM, Al‑Mohaya MA. Characterization of Yemeni patients treated for oral and pharyngeal cancers in Saudi Arabia. Saudi Med J. 2011;32:1177–82.
10. Osman T, Satti A, Bee O, Yang Y, Ibrahim S, Suleiman A. Pattern of malignant tumors registered at a referral oral and maxillofacial hospital in Sudan during 2006 and 2007. J Cancer Res Ther. 2010;6(4):473–7.
11. Saleh SM, Idris AM, Vani NV, Tulabaghi FM, Alharbi FA, Sharwani AA, Mikhail NT, et al. Retrospective analysis of biopsied oral and maxillofacial lesions in South-Western Saudi Arabia. Saudi Med J. 2017;38(4):405–12.
12. Ali AA, Suresh CS, Al-Tamimi D, Al‑Nazr M, Atassi RA, Al-Rayes I, et al. A survey of oral and maxillofacial biopsies in the Eastern Province of Saudi Arabia: a 10 years’ retrospective study. J Oral Maxillofac Surg Med Pathol. 2013;25:393–439.
13. Al‑Hindi NA, Sindi AM, Binmadi NO, Elias WY. Retrospective study of oral and maxillofacial pathology lesions diagnosed at the Faculty of Dentistry, King Abdulaziz University. Clin Cosmet Investig Dent. 2019;11:45–52.
14. Telfah H, Hammouri E. Malignant tumors of the oral cavity among Jordanians. JRMS. 2014;21(3):6–13.
15. Alvarez-Amézaga J, Barberí-Herrero L, Pijoan-Zubizarreta JI, Martín-Rodríguez JC, Romo-Simón L, Genolla-Subirats J, et al. Diagnostic efficacy of sentinel node biopsy in oral squamous cell carcinoma. Cohort study and meta-analysis. Med Oral Patol Oral Cir Bucal. 2007;12(3):E235-243.
16. Museedi OS, Younis WH. Oral cancer trends in Iraq from 2000 to 2008. Saudi J Dent Res. 2014;5:41–7.
17. Al‑Rawi N, Talabani N. Squamous cell carcinoma of the oral cavity: a case series analysis of clinical presentation and histological grading of 1425 cases from Iraq. Clin Oral Invest. 2008;12(1):15–8.
18. Al‑Mahfoud M, AlSaimeary J, Al SA. Occurrence of oral and oropharyngeal squamous cell carcinoma among patients in Basrah city. Iraq J Biotechnol. 2017;16(3):255–61.
19. Khudier H. Malignant oral lesions in Sulaimania governorate/ a (5 years) retrospective study. Diyala J Med. 2012;2(1):13–20.
20. Al‑Niaimi AI. Oral malignant lesions in a sample of patients in the north of Iraq (Retrospective study). Al–Rafidain Dent J. 2006; 6(2): 176–180.
21. Hassawi BA, Ali E, Subhe N. Tumors and tumorlike lesions of the oral cavity: a study of 303 cases. Tikrit Med J. 2010;16(1):177–83.
22. Mohammed M. The retrospective survey of oral and maxillofacial malignant neoplasms. MDJ. 2014;11(1):129–35.
23. Aljazeri S, Al Qudsi G, Jaber H, Al Elwi W, Haddad S, Echrish H. Biopsy records to the oral lesions in Basrah between 2012–2017. J Oral Med Oral Surg Oral Pathol Oral Radiol. 2020;6(2):74–80.
24. Bashir S, Mohamed R, Al-Thomali Y, Al SA. The prevalence of oral cancer in Saudi Arabia—a systematic review. Ann Med Health Sci Res. 2019;9(2):S53–7.
25. International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) Version for 2010, chapter 2 neoplasm. https://icd.who.int/browse10/2010/en#/K70.0
26. Al‑Reyahi AB. Retrospective analysis of malignant oral lesions for 1534 patients in Iraq during the period (1991–2000). M.Sc thesis, College of Dentistry University of Baghdad, 2004.
27. Moridani S, Shaahsavi F, Adeli M. A 7-year retrospective study of biopsied oral lesions in 460 Iranian patients. RSBO. 2014;11(2):118–24.
28. Dhanuthai K, Rojanawatsirivej S, Thosaporn W, Kintarak S, Subarnbhesaj A, Darling M, et al. Oral cancer: a multicenter study. Med Oral Patol Oral Cir Bucal. 2018;23(1):e23–9.
29. Al‑Kawaz A. Oral squamous cell carcinoma in Iraq: a clinical analysis. MDJ. 2010;7(1):100–5.
30. Taha I, Younis W. Clinicopathological analysis of oral squamous cell carcinoma in Iraq during period (2001–2013). J Bagh Coll Dentistry. 2015;27(2):58–65.
31. Kamulegeya A, Kalyanyama B. Oral maxillofacial neoplasms in an East African population a 10 year retrospective study of 1863 cases using histopathological reports. BMC Oral Health. 2008;8:19.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.