

Knowledge and Attitude about Oral Cancer among Medical and Dental Students at Kuwait University: A Cross-sectional Study

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Objective: This study aims to assess the knowledge and attitude about oral cancer among undergraduate medical and dental students at Kuwait University Health Sciences Center.

Subjects and Methods: Using a structured questionnaire, a cross-sectional survey was conducted among 140 undergraduate Health Sciences Center students at Kuwait University, 70 were medical students and 70 were dental students. Students' knowledge and attitude about oral cancer and its risk factors, in addition, their diagnostic concepts and opinions were assessed. Moreover, the students' confidence in their ability to detect and refer clinically suspicious cases was evaluated and the responses were analyzed.

Results: Of the 140 undergraduate dental and medical students surveyed, 131 returned the completed questionnaire (93.5% response rate). There was a statistically significant difference detected in the students' knowledge about betel quid and smokeless tobacco as risk factors for oral cancer development. Also, there was a statistically significant difference in the students' knowledge about the high-risk age group associated with oral cancer, the viral association with oral cancer, oral premalignant lesions, high-risk areas associated with oral cancer, and the warning features that can raise the suspicion of oral cancer. In addition, there was a statistically significant difference in the students' confidence and ability to detect pre-malignant lesions and their opinion in their faculty curriculum development.

Conclusion: This study highlighted the importance of increasing awareness and attitude towards oral cancer detection by both undergraduate dental and medical students who are considered to be the future primary care providers.

Introduction

Oral cancer is one of the widely prevalent cancer types emerging as a growing problem in various regions of the world. Oral cancer is the sixth most common cancer in the world [1]. In Kuwait, the incidence rate is slightly higher among Kuwaiti women (1.8 per 100,000) than in men (1.1 per 100,000) [2]. Recognized risk factors are tobacco smoking and alcohol consumption. Betel quid and smokeless tobacco chewing are also important risk factors in some populations [3], and Human Papillomavirus (HPV) infection appears to be a risk factor for younger populations [4]. Additionally, a poor diet has been implicated as a risk factor for oral cancer [5]. Although the oral cavity is easily accessible for examination, up to 50% of oral cancers are not detected until the disease is well advanced [2]. Screening may assist with early detection and improve patients' outcomes as survival rates have not potentially improved in the last few decades. The 5-year survival rate exceeds 50% only due to early detection and modern advancement in the treatment [6]. Furthermore, early diagnosis of oral cancer greatly increases the probability of cure and encounter a better prognosis. It has been observed in multiple cases that oral cancer is preceded by a premalignant state, which can be easily visualized and assessed through clinical oral examination and precisely diagnosed utilizing biopsy and histopathologic examination. Early detection and appropriate management and follow-up of such potentially premalignant lesions provide a unique opportunity for successful secondary prevention of oral cancer [7]. A recent meta-analysis has indicated that the malignant transformation of potentially premalignant oral lesions is influenced by the clinical appearance, as

nonhomogeneous leukoplakia is more likely to transform to malignancy compared to homogeneous leukoplakia. In addition to the clinical appearance, location, as the lateral border of the tongue is considered to be a high-risk area for malignant transformation [8]. Based on the literature, studies were conducted among dental students or general dental practitioners who can easily examine and assess the oral cavity status. However, medical students and practitioners also need to be aware of oral cancer and potentially premalignant lesions and consider all the aspects of oral cancer for proper detection, diagnosis, and referral. Hence, this study aims to assess the knowledge and attitude of undergraduate medical students in comparison with dental students at Kuwait University Health Sciences Center concerning oral cancer. In addition, this study highlights the importance of awareness of oral cancer among future care providers and evaluates the learning process that both groups go through in their clinical training years.

Materials and Methods

In this cross-sectional study, oral cancer knowledge and attitude among undergraduate fifth, sixth, and seventh year medical and dental students at Kuwait University were assessed by means of a questionnaire distributed to 140 students. The sample was retrieved from students who were in their clinical training years. And due to the fact that the number of dental students was notably lower than the number of medical students at Kuwait University, a larger percentage of dental students (>90%) has been recruited compared to medical students. Seventy participants from each faculty were targeted; however, each medical student had an equal chance to participate in the study. The questionnaire was delivered to the students during routine lectures and clinical sessions. These students were selected as they have completed training in the human body and various diseases including malignancy. The questionnaire included twenty-four questions, evaluating the students' knowledge about oral cancer epidemiological status globally and specifically in Kuwait. As well as assessing the knowledge about the associated risk factors and the premalignant lesions associated with oral cancer. In addition, the questionnaire assessed the students' awareness about the importance of obtaining a detailed medical history and comprehensive extra-oral and intra-oral examination. The questionnaire highlighted the students' understanding of the value of screening and early detection and its impact on the survival rate. Knowledge and confidence in the students' ability to appreciate their role in oral cancer prevention, detection, and point of referral selection as future primary care providers were also evaluated. Furthermore, the students' satisfaction with the current curriculum of both the Faculty of Medicine and the Faculty of Dentistry; as well as their desire for further teaching and training were assessed. This study was conducted during the academic year 2017-2018 after obtaining the ethical clearance and approval on the 17th of December, 2017 by the Health Sciences Centre Student Research Committee. Informed consent has been obtained from each participant student anonymously, who was informed that the data collected would be used only for research purposes. Data were collected by the end of the academic year and entered on an Excel spreadsheet and statistical analysis was conducted using International Business Machine Statistical Package for the Social Sciences (IBM SPSS) software version 25. In addition to presentation and descriptive data, categorical data were compared using the Chi-square test. Statistical significance was determined on $P < 0.05$.

Results

Questionnaires were collected from 131 students, 65 and 66 medical and dental students respectively. The students' faculty and year of study are represented in Figure 1. Data regarding the students' knowledge about oral cancer status worldwide showed that 30.3% of dental students (N=20) and 30.8% (N=20) of medical students acknowledged that oral cancer is the sixth most common cancer in the world which has been reported as a fact in the literature. The majority, 89.4% (N=59) of dental students and 84.6% (N=55) of medical students believe that the incidence of oral cancer is higher in males compared to females in Kuwait; however, it is higher in females compared to males, which was the response of 1.5% (N=1) of dental students and 6.2% (N=4) of medical students. Furthermore, 47% (N=31) of dental students and 32.3% (N=21) of medical

students acknowledged that the five-year survival rate of oral cancer is 50%. Data concerned with the knowledge about the location-related prognosis resulted in 81.8% (N=54) of dental students and 78.5% (N=51) of medical students considering oral cancer to have a less favorable prognosis when compared to lip carcinoma. In addition, data related to the students' knowledge about the risk factors associated with oral cancer were analyzed, evaluating the students' understanding of the association between smoking and oral cancer. Also, their knowledge about the associated risk of betel quid and smokeless tobacco chewing, alcohol consumption, and poor diet with oral cancer has been assessed. Significantly more dental students 100% (N=66) agreed with the role of betel quid and smokeless tobacco in the development of oral cancer compared to 49.2% (N=32) of the medical students (Table 1).

	Dental Students			Medical Students			P-Value
	Agree N (%)	Partially agree N (%)	Disagree N (%)	Agree N (%)	Partially agree N (%)	Disagree N (%)	
Smoking	65 (98.5)	1 (1.5)	0	59 (90.8)	1 (1.5)	5 (7.7)	0.071
Betel quid and smokeless tobacco chewing	66 (100)	0	0	48 (73.8)	9 (13.8)	8 (12.3)	0.000*
Alcohol consumption	38 (57.6)	21 (31.8)	7 (10.6)	28 (43.1)	24 (36.9)	13 (20)	0.173
Poor diet	23 (34.8)	26 (39.4)	17 (25.8)	32 (49.2)	19 (29.2)	14 (21.5)	0.241

Table 1. Dental and Medical Students' knowledge Regarding the Risk Factors Associated with Oral Cancer.

* Statistical significance $P < 0.05$

Both dental and medical students regarded the age group of forty years old and above as a high-risk age group for the development of oral cancer with 90.9% (N=60) and 70.8% (N=46) respectively; the results were statistically significant. In addition, 51.5% (N=34) of dental students and 36.9% (N=24) of medical students linked HPV to the development of oral cancer; a statistically significant difference was observed. Fifty-three percent (N=35) of both dental students and medical students regarded the mode of transmission of this virus to be through sexual transmission. Data were collected regarding the critical information in the patient's medical history that could be relevant to oral cancer. Sixty five percent (65.2%, N=43) and 83.3% (N=55) of dental students and 47.7% (N=31) and 89.2% (N=58) of medical students reported the history of weight loss and smoking as essential information that could be pertinent to oral cancer. Also, students were evaluated with regard to their knowledge about premalignant lesions detected in the oral cavity during the examination. Significantly more dental students (98.5%, N=65) than medical students (70.8%, N=46) specified erythroleukoplakia to have a high premalignant potential. Students' appreciation of the high-risk anatomical areas associated with oral cancer was assessed and data revealed the majority with a percentage of 98.5% (N=65) of dental students and 35.4% (N=32) of medical students appreciated that the lateral border of the tongue is considered to be a high-risk anatomical location for oral cancer development; the results were statistically significant. The majority of dental students (98.5%, N=65) and medical students (83.1%, N=54) considered a non-healing ulcer for more than three weeks to be a warning feature of oral cancer; the results demonstrated a statistically significant difference. In addition, the students' knowledge about the most frequent site of metastasis of oral cancer was analyzed and resulted in 69.7% (N=46) of dental students, and 81.5% (N=53) of medical students determined the cervical lymph nodes to be the most frequent site of metastasis. The knowledge about the importance of early detection and the associated high survival rate was assessed among dental and medical students with 54.5% (N=36) and 41.5% (N=27) respectively, believing that early detection of oral cancer increases the patient's survival rate by 90%. Furthermore, data were collected assessing the students' perception of their role as primary care providers in the prevention of oral cancer. Eighty-nine percent (89.4%,

N=59) of dental students and 90.8% (N=59) of medical students appreciate their role in encouraging the patients to undergo smoking cessation and tobacco counseling. Also, 74.2% (N=49) of dental students and 63.1% (N=41) of medical students would discourage betel quid usage as a primary oral cancer preventative measure. Additionally, the majority of dental and medical students would refer high-risk, clinically suspicious lesions as soon as possible with 84.8% (N=56) and 70.8% (N=46) respectively (Figure 1).

Figure 1. The Number of Students who Participated in the Study and the Number of Students from each Faculty with the Year of Study.

In addition, the students’ appreciation of their responsibility for oral cancer screening and education among the community was assessed. Data were also collected regarding the students’ level of confidence in their ability to detect and refer premalignant lesions. The majority of medical students (52.3%, N=34) are not confident with their clinical ability to diagnose and refer clinically suspicious lesions. Students’ opinions regarding their faculty’s curriculum were analyzed; significantly more dental students, with a percentage of 68.2% (N=45) agreed with the fact that the faculty of dentistry curriculum provides sufficient knowledge about oral cancer that they can apply it during their practice (Table 2).

	Dental Students			Medical Students			
	Agree	Disagree	No opinion	Agree	Disagree	No opinion	P-Value
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Oral cancer screening and education is the responsibility of the dentist only	7 (10.6)	55 (83.3)	4(6.1)	10 (15.4)	54 (83.1)	1 (1.5)	0.312
Confidence in the ability to detect oral premalignant lesions by visual inspection and referral to a specialist	37 (56.1)	15 (22.7)	14 (21.2)	14 (21.5)	34 (52.3)	17 (26.2)	0.000*
The curriculum provides sufficient knowledge about oral cancer that can be applied in career	45 (68.2)	6 (9.1)	15 (22.7)	9 (13.8)	37 (56.9)	19 (29.2)	0.000*

Table 2. The Students’Appreciation of their Responsibility to Detect and Screen for Oral Cancer and the Contribution of both the Dental and Medical Teams. Moreover, it represents their satisfaction and confidence with their ability to detect oral premalignant lesions and referral, as well as their satisfaction with the faculty’s curriculum.

* Statistical significance P < 0.05

Discussion



The International Agency for Research on Cancer and World Health Organization reported that 43.8 million people are surviving with the disease, within 5 years of the diagnosis establishment, worldwide. In addition, over 18 million new cases of cancer and 9.5 million deaths due to cancer were reported in 2018 [9]. The results of such statistics provide an alarming situation to the health-service planning officials and health care providers. Oral cancer is considered one of the widely prevalent cancer types and is the sixth most common cancer worldwide [1]. In most countries worldwide, oral cancer is more common among males than females; this could be attributed to the heavy exposure to the different risk factors among males compared to females [1]. In Kuwait, the number of cases diagnosed with oral cancer is increasing and the incidence rate is slightly higher among females than males [2]. The risk of oral cancer development increases with age and a greater number of cases arise among people who are fifty years and older [1]. In our study, 90.9% of dental students and 70.8% of medical students identified forty years and above as a high-risk age group; in comparison to 68.7% of dental students in South Carolina according to Cannick et al. [10] and 65.3% of medical students in South Carolina in a study conducted by Reed et al. [11]. In general, squamous cell carcinoma is the most commonly occurring oral malignancy, constituting more than 90% of the malignant lesions in the oral cavity [9, 12, 13]. The usage of tobacco and consumption of alcohol are considered to be primary risk factors associated with oral squamous cell carcinoma [9, 12-18]. Betel quid and smokeless tobacco have been associated with an increased incidence of oral cancer in certain populations and it has been linked to social and economic status deprivation [19]. According to this study, the majority of dental students and medical students agreed that tobacco smoking has a significant effect on the development of oral cancer. Also, the results of the study done by Carter and Odgen in the United Kingdom [20] showed a significant difference between dental students (100%) and medical students (93%) appreciation of tobacco smoking as a risk factor. Regarding alcohol consumption, our data collection resulted in 57.6% of dental students and 43% of medical students in agreement with the presence of an association with oral cancer. However, significantly more dental students (94%) than medical students (33%) identified alcohol as a risk factor in the study presented by Carter and Odgen. On contrary to our study, 93.9% of dental students in South Carolina confirmed that alcohol consumption is associated with oral cancer; compared to 63.8% of medical students. Furthermore, the data in our study demonstrated that 100% of dental students and 73.8% of medical students identified betel quid and smokeless tobacco as risk factors implicated in oral cancer development. On the other hand, Carter and Odgen reported that more medical students compared to dental students identified betel quid as a risk factor with almost 20% of each group. Also, 98.8% of dental students identified the consumption of tobacco products to be strongly associated with the development of oral cancer in the study conducted by Cannick et al.; and 98.2% of medical students in the study conducted by Reed et al. Although the Human Papillomavirus (HPV) role in oral cancer is not clear, it was found to be associated with the increased incidence among young age groups. HPV is two to three times more likely to be identified in pre-cancerous oral mucosa and 4.7 times more frequently observed in oral squamous cell carcinoma [21]. HPV is associated with an increased risk of three to six times of oral squamous cell carcinoma, independent of alcohol consumption and tobacco exposure [22, 23, 24]. Oral cancer associated with HPV was found to be associated with specific genotypes, which are type-16 and type-18 [21]. This virus was found to be transmitted through sexual interaction [24]. In our study, 51.5% of dental students and 36.9% of medical students recognized HPV as a risk factor associated with oral cancer; in comparison to Cannick et al., 79.8% of dental students identified HPV as a risk factor. Additionally, Reed et al. reported that 61.4% of medical students identified the association between HPV and oral cancer. In addition, the favorable role of the Mediterranean diet on a variety of cancer types has been emphasized by Filomeno et al. [5]. This diet is characterized by frequent consumption of vegetables, fruits, cereals, seafood, and olive oil, with decreased consumption of meat and dairy products. This suggests that a diet that is deprived of antioxidants is another risk factor that could lead to the development of oral cancer [5, 19]. Additionally, studies have shown that heavy alcohol consumption is associated with nutritional deficiency and deprivation which enhanced oral carcinogenesis independently [19]. Our data revealed that 34.8% of dental students and 49.2% of medical students agreed to the presence of a possible association between poor diet and oral cancer. On the other hand, according to Carter and Odgen, almost 13% of dental students regarded poor diet as a risk factor compared to less than 5% of medical students.

Additionally, 52.8% of dental students in South Carolina identified poor diet as an oral cancer risk factor; compared to 38.6% of medical students. Equally important to the knowledge about the risk factors associated with oral cancer, the students, as future clinicians, must always thoroughly examine the oral mucosa with special attention to the high-risk anatomical sites, such as the lateral border of the tongue and the floor of the mouth. Furthermore, it is crucial to palpate the cervical lymph nodes to detect any mass that can represent metastasis [25, 26]. In our study, significantly more dental students (98.5%) were able to identify the lateral border of the tongue as a high-risk anatomical location for the development of oral cancer compared to 65% of dental students and 20% of medical students in South Carolina. Moreover, it is of great importance to establish an early diagnosis in oral cancer; therefore, it must be suspected in patients with a single oral lesion persisting for more than three weeks [26]. According to our study, 90.5% of dental students and 83.1% of medical students identified a non-healing ulcer for more than three weeks as a warning oral mucosal change that is highly suspicious of oral cancer compared to 53% of both dental and medical students in the study presented by Carter and Odgen. The clinical presentation of early malignant lesions in the oral cavity is often in the form of an erythroleukoplakic lesion [26, 27]. In this study, 98.5% of dental students and 70.8% of medical students determined that erythroleukoplakia has the highest premalignant potential in the oral cavity. Contrarily, according to Carter and Odgen, erythroleukoplakia was poorly recorded by less than 5% of dental students, and none of the medical students. In addition, in the study done by Cannick et al., 74.8% of dental students identified that the clinical appearance of premalignant oral cancer lesion is a small, painless, and red or white area; while, 17.8% of medical students considered leukoplakia and erythroplakia to be most likely associated with oral cancer. Early diagnosis of oral cancer is considered to be the most important factor in the improvement of the patient's survival rate as high as 80 - 90%, and it can reduce the extent of the treatment needed [26]. In our study, we highlighted the students' knowledge of the importance of early detection and diagnosis. This was not highlighted by the previously mentioned studies. A diagnosis of oral cancer and the associated impact of its management have a great implication on the patient's daily activities. Therefore, it is of great concern to emphasize the critical role of primary prevention of oral cancer. According to our study, almost 90% of both dental and medical students recognize their role in encouraging smoking cessation as future primary care providers. Furthermore, 74.2% and 63.1% of dental and medical students would discourage betel quid usage among their patients. In comparison, in the study presented by Carter and Odgen, significantly more dental students (93%) than medical students (67%) reported that they would advise their patients regarding oral cancer risk factors as a preventative measure after their graduation. Regarding the students' satisfaction and confidence with their ability to detect oral premalignant lesions and referral, notably more dental students than medical students had a positive response. According to Carter and Odgen, significantly more dental students felt that they had sufficient knowledge regarding the prevention and early detection of oral cancer. Lack of public awareness has been reported in the past to be the most significant factor in delaying referral and treatment of oral cancer. Some oral cancer lesions may be asymptomatic; and thus, ignorance of early signs of oral cancer may be the most important delaying factor [28]; also, the lack of general medical and dental practitioners' knowledge retards the process of early recognition and treatment of such disease [29]. Therefore, it is of great importance to provide sufficient educational material regarding oral cancer throughout the curriculum. For this purpose, data were collected regarding the students' opinion of the knowledge about oral cancer that is provided by each curriculum. Data analysis revealed a significant difference in the students' satisfaction level with each curriculum. In comparison, according to Carter and Odgen, approximately 90% of both medical and dental students requested further information on the prevention and early detection of oral cancer. Additionally, the findings in the study conducted by Cannick et al. suggests that educators need to strongly emphasize on oral cancer prevention and early detection in dental school. Similarly, the data collected by Reed et.al imply that medical students need more clinical training to examine patients for oral cancer. Regarding the study done by Cannick et al on dental students in South Carolina, which was based on a cross-sectional survey of dental students attending one dental school, the findings cannot be generalized to other dental schools. In addition, the nonresponse rate for senior dental students was as high as 59.2%; resulting in selection bias for the seniors. Furthermore, bias due to



confounding as a result of background experiences, including previous work as a dental hygienist or dental assistant, may have been pertinent to students' knowledge regarding oral cancer. In addition, Carter and Odgen did not include an equal sample size of dental and medical students; they included significantly more medical students. Furthermore, a comparison of risk factors knowledge amongst students at different years of training and different faculties was not done. Despite the small sample size of medical students included in our study in comparison to their large population, the study results can be generalized to all medical students. This is supported and empowered by previously conducted studies, clearly defined population, strict inclusion criteria, and random sampling.

Limitations

Regarding the sample size of medical students, there was not a sufficient number of students included in the study (almost 30%). The data collected were used only to compare dental and medical students. We did not compare the difference in knowledge among students in each clinical year within the same faculty and if any progress during the clinical years has improved the students' knowledge and attitude about oral cancer.

In conclusion, this study highlighted the importance of increasing the awareness and the attitude towards oral cancer detection by both undergraduate dental and medical students who are considered to be the future primary care providers. As the incidence of oral cancer is increasing in Kuwait, the role of both general medical and dental practitioners has a major impact on the prevention and detection of oral cancer. The data analyzed revealed a deficiency in the level of awareness regarding oral cancer, especially among medical students. Therefore, this highlights the need for improvement in the oral diseases' curriculum with special attention to oral cancer by providing different awareness lectures, interactive seminars, and clinical training on proper extra-oral and intra-oral examination methods.

Declarations Funding Sources

This research was supported by students' monthly allowance from Kuwait University.

Conflict of interest

The authors have no conflicts of interest to declare.

Ethical approval

This study was conducted after obtaining the ethical clearance and approval on the 17th of December, 2017 by the Health Sciences Centre Student Research Committee at Kuwait University.

Authors contribution

L.S. envisioned the research idea. L.S. and H.M. collected and interpreted the data, and helped to draft the manuscript. That was also discussed with B.J. who supervised the research project and helped with the questionnaire modification and development. All authors revised the manuscript critically and approved the final version to be published.

Highlights of the study

- Knowledge and attitude about oral cancer among undergraduate medical and dental students at

Kuwait University were assessed.

- A cross-sectional survey was conducted among 140 undergraduate Health Sciences Center students at Kuwait University.
- The analyzed data revealed a deficiency in the level of awareness regarding oral cancer, especially among medical students.

References

References

1. Warnakulasuriya Saman. Global epidemiology of oral and oropharyngeal cancer. *Oral Oncology*. 2009; 45(4-5)[DOI](#)
2. Joseph Bobby K., Sundaram Devipriya B., Sharma Prem. Oral Cancer Awareness among Dentists in Kuwait. *Medical Principles and Practice*. 2012; 21(2)[DOI](#)
3. de Camargo Cancela Marianna, Voti Lydia, Guerra-Yi Marta, Chapuis François, Mazuir Mathieu, Curado Maria Paula. Oral cavity cancer in developed and in developing countries: Population-based incidence. *Head & Neck*. 2009. [DOI](#)
4. Chaturvedi AK, Engels EA, Anderson WF, et al. Incidence trends for human papillomavirus-related and -unrelated oral squamous cell carcinomas in the United States. *J Clin Oncol*. 2008; 26:612-619.
5. Filomeno M, Bosetti C, Garavello W, Levi F, Galeone C, Negri E, La Vecchia C. The role of a Mediterranean diet on the risk of oral and pharyngeal cancer. *British Journal of Cancer*. 2014; 111(5)[DOI](#)
6. Johnson N.W., Warnakulasuriya S., Gupta P.C., Dimba E., Chindia M., Otoh E.C., Sankaranarayanan R., Califano J., Kowalski L.. Global Oral Health Inequalities in Incidence and Outcomes for Oral Cancer. *Advances in Dental Research*. 2011; 23(2)[DOI](#)
7. Nikitakis Nikolaos G.. Special focus issue on potentially premalignant oral epithelial lesions: introduction and perspective. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*. 2018; 125(6)[DOI](#)
8. Shilpashree S, Narayan TV. Meta-analysis on clinicopathologic risk factors of leukoplakias undergoing malignant transformation. *Journal of Oral and Maxillofacial Pathology*. 2016; 20(3)[DOI](#)
9. Güneri Pelin, Epstein Joel B.. Late stage diagnosis of oral cancer: Components and possible solutions. *Oral Oncology*. 2014; 50(12)[DOI](#)
10. CANNICK GABRIELLE F., HOROWITZ ALICE M., DRURY THOMAS F., REED SUSAN G., DAY TERRY A.. Assessing oral cancer knowledge among dental students in South Carolina. *The Journal of the American Dental Association*. 2005; 136(3)[DOI](#)
11. Reed Susan, Grijebovska Duffy Nadia, Walters K. Christian, Day Terry. Oral Cancer Knowledge and Experience: A Survey of South Carolina Medical Students in 2002. *Journal of Cancer Education*. 2005; 20(3)[DOI](#)
12. Lambert René, Sauvaget Catherine, de Camargo Cancela Marianna, Sankaranarayanan Rengaswamy. Epidemiology of cancer from the oral cavity and oropharynx. *European Journal of Gastroenterology & Hepatology*. 2011; 23(8)[DOI](#)
13. Messadi Diana V. Diagnostic aids for detection of oral precancerous conditions. *International Journal of Oral Science*. 2013; 5(2)[DOI](#)
14. Gupta Bhawna, Ariyawardana Anura, Johnson Newell W.. Oral cancer in India continues in epidemic proportions: evidence base and policy initiatives. *International Dental Journal*. 2013; 63(1)[DOI](#)
15. Epstein J.B., Silverman S., Epstein J.D., Lonky S.A., Bride M.A.. Analysis of oral lesion biopsies identified and evaluated by visual examination, chemiluminescence and toluidine blue. *Oral Oncology*. 2008; 44(6)[DOI](#)

16. Scully Crispian, Petti Stefano. Overview of cancer for the healthcare team: Aetiopathogenesis and early diagnosis. *Oral Oncology*. 2010; 46(6)[DOI](#)
17. Cleveland Jennifer L., Junger Michele L., Saraiya Mona, Markowitz Lauri E., Dunne Eileen F., Epstein Joel B.. The connection between human papillomavirus and oropharyngeal squamous cell carcinomas in the United States. *The Journal of the American Dental Association*. 2011; 142(8)[DOI](#)
18. Mighell A. J., Gallagher J. E.. Oral cancer - improving early detection and promoting prevention. Are you up to date?. *British Dental Journal*. 2012; 213(6)[DOI](#)
19. Petersen Poul Erik. Oral cancer prevention and control - The approach of the World Health Organization. *Oral Oncology*. 2009; 45(4-5)[DOI](#)
20. Carter Lachlan M, Ogden Graham R. Oral cancer awareness of undergraduate medical and dental students. *BMC Medical Education*. 2007; 7(1)[DOI](#)
21. Miller Craig S., Johnstone Bryan M.. Human papillomavirus as a risk factor for oral squamous cell carcinoma: A meta-analysis, 1982-1997. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2001; 91(6)[DOI](#)
22. Maden Christopher, Beckmann Anna Marie, Thomas David B., McKnight Barbara, Sherman Karen J., Ashley Rhoda L., Corey Lawrence, Daling Janet R.. Human Papillomaviruses, Herpes Simplex Viruses, and the Risk of Oral Cancer in Men. *American Journal of Epidemiology*. 1992; 135(10)[DOI](#)
23. Smith Elaine M., Hoffman Henry T., Summersgill Kurt S., Kirchner H. Lester, Turek Lubomir P., Haugen Thomas H.. Human papillomavirus and risk of oral cancer. *The Laryngoscope*. 1998; 108(7)[DOI](#)
24. Schwartz S. M., Daling J. R., Madeleine M. M., Doody D. R., Fitzgibbons E. D., Wipf G. C., Carter J. J., Mao E.-J., Huang S., Beckmann A. M., McDougall J. K., Galloway D. A.. Oral Cancer Risk in Relation to Sexual History and Evidence of Human Papillomavirus Infection. *JNCI Journal of the National Cancer Institute*. 1998; 90(21)[DOI](#)
25. Rethman Michael P., Carpenter William, Cohen Ezra E.W., Epstein Joel, Evans Caswell A., Flaitz Catherine M., Graham Frank J., Hujoel Philippe P., Kalmar John R., Koch Wayne M., Lambert Paul M., Lingen Mark W., Oettmeier Bert W., Patton Lauren L., Perkins David, Reid Britt C., Sciubba James J., Tomar Scott L., Wyatt Alfred D., Aravamudhan Krishna, Frantsve-Hawley Julie, Cleveland Jennifer L., Meyer Daniel M.. Evidence-Based Clinical Recommendations Regarding Screening for Oral Squamous Cell Carcinomas. *The Journal of the American Dental Association*. 2010; 141(5)[DOI](#)
26. Bagan Jose, Sarrion Gracia, Jimenez Yolanda. Oral cancer: Clinical features. *Oral Oncology*. 2010; 46(6)[DOI](#)
27. Mashberg Arthur, Merletti Franco, Boffetta Paolo, Gandolfo Sergio, Ozzello Franca, Fracchia Fabrizio, Terracini Benedetto. Appearance, site of occurrence, and physical and clinical characteristics of oral carcinoma in Torino, Italy. *Cancer*. 1989; 63(12)[DOI](#)
28. McGurk M., Chan C., Jones J., O'Regan E., Sherriff M.. Delay in diagnosis and its effect on outcome in head and neck cancer. *British Journal of Oral and Maxillofacial Surgery*. 2005; 43(4)[DOI](#)
29. Schnetler J.F.C.. Oral cancer diagnosis and delays in referral. *British Journal of Oral and Maxillofacial Surgery*. 1992; 30(4)[DOI](#)