Original Article

Awareness of oral cancer and precancer among final year medical and dental students of Universiti Sains Malaysia (USM), Malaysia

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Abstract   The objective of this survey was to evaluate the knowledge of final year dental and medical students of Universiti Sains Malaysia concerning epidemiology, aetiology, clinical aspects, prevention, early detection and treatment of oral cancer and oral potentially malignant disorders (OPMD). A pre-tested, self-administered questionnaire with 36 questions was used. Forty five dental students and 147 medical students participated in the study. Dental students were relatively better informed than their medical colleagues concerning most issues addressed in the questionnaire. Yet, in some areas of knowledge, the dental students did not differ significantly from their medical colleagues. Only a small proportion of both groups of students expressed confidence in their knowledge and skills in oral cancer prevention and detection. This study revealed areas of deficiency in the awareness of these students concerning oral cancer and OPMD. It points to a necessity to strengthen these aspects of medical and dental undergraduate curricula.

Keywords: Medical education, dental education, oral cancer, oral potentially malignant disorders, curriculum.

Introduction

Oral cancer is ranked as the sixth (Warnakulasooriya, 2009) or tenth (Ferlay *et al.*, 2010) most common cancer in the world among men based on slightly variable statistical information. Globally, oral cancer burden is high in the Asian continent with the South Asian nations of India, Pakistan, Bangladesh and Sri Lanka leading the League Table with up to 25% of all new cases of cancer (Warnakulasooriya, 2009). Malaysia has a moderately low incidence of oral cancer with an annual age standardised rate (ASR) of less than 6.8 per 100,000 of the population (Ferlay *et al.*, 2010). However, there is an increasing trend in its incidence and the ASR is relatively high in comparison to some of the neighbouring countries of South East Asia (Ferlay *et al.*, 2010). Oral cancer incidence in Malaysia varies between the different

ethnic communities due to different socio-cultural risk factors such as the betel chewing habit (Zain, 2001). Moreover, in contrast to the global trend, oral cancer in Malaysia appears to affect females more than males with the disease being the third most common malignancy among ethnic Indian females and sixth most common cancer among ethnic Indian males (Zainal Ariffin *et al.*, 2006).

More than 90% of oral cancers are squamous cell carcinoma (Warnakulasooriya, 2009) which in most instances is preceded by identifiable lesions or conditions that appear on the oral mucosa such as leukoplakia, erythroplakia, oral submucous fibrosis and, though not without controversy, oral lichen planus (Zain, 2001). These recognizable diseases that precede the appearance of oral cancer are collectively referred to as oral precancer or oral potentially malignant disorders (OPMD)

as recently suggested (Warnakulasooriya *et al.*, 2007). The main OPMD are usually associated with habits such as betel chewing, smoking, snuff dipping, areca nut chewing and excessive alcohol intake (Warnakulasooriya, 2009). Smoking and alcohol consumption have been shown to act synergistically with the combined risk considerably increased in comparison to when the individual factor is found alone. Smoking and alcohol consumption have been shown to act synergistically. The two factors mutually enhance each other's carcinogenic role increasing the risk considerably. This increased risk is higher than that posed by either factor acting alone (Blot *et al.*, 1988). In recent times, Human Papilloma Virus infection is increasingly suspected to play a role in the causation of oral cancer particularly in young patients (Herrero *et al.*, 2003). Globally, oral cancer affects predominantly the lower socio-economic strata of the population (Thames Cancer Registry, 2007). As most of the risk factors are related to life style of individuals, it is evident that most oral cancers are preventable.

Apart from lip cancers which are associated with more than 90% 5-year survival rates, most oral cancers have less than 50% 5-year survival rates even in developed countries (Warnakulasooriya, 2009). It is also a major national health problem in Malaysia with abysmal 5-year survival rates of less than 20% (Razak *et al.*, 2010). Floor of the mouth cancers have a particularly poor prognosis (Murthy *et al.*, 2010). Poor survival rates are mostly linked to diagnosis at late stages of the disease due to delay in seeking advice by the patients, as in the early stages, most oral cancers remain asymptomatic.

Most oral cancers are managed by surgery with adjuvant radiotherapy or chemoradiotherapy (Sher *et al.*, 2011). Presentation in advanced stages of oral cancer necessitates complex surgical management that often results in significant facial disfigurement and seriously compromised oral functions, not to mention psychological and nutritional consequences (Warnakulasooriya, 2009).

The objective of the present study was to assess the comprehensive awareness of final year medical and dental undergraduates of Universiti Sains Malaysia concerning oral cancer and oral potentially malignant disorders. A supplementary objective was to evaluate the need for reform in the medical and dental curricula.

Materials and methods

Final year dental (n=45) and medical students (n=147) of Universiti Sains Malaysia Health Campus were surveyed with the aid of a self administered questionnaire. The latter was pretested on the fourth year dental students for clarity of questions and appropriate changes were made. The questionnaire forms were delivered at the end of lectures and their completion required less than 15 minutes and all the students who were present in the lecture hall returned the completed questionnaire. The questionnaire consisted of a total of 36 statements inviting an agree/disagree/ neither agree nor disagree response with 9 statements each on epidemiology, aetiology and clinical aspects, 2 statements on treatment of oral cancer, 5 statements on prognosis, 1 question on early detection and a final question on self evaluation of awareness. The latter question had been framed as a statement of confidence offering 3 responses including yes, no and unsure. The Research Committee of the School of Dental Sciences, Universiti Sains Malaysia had agreed that there were no ethical issues involved in this study (dated 25th January 2011). The results were analysed using the statistical software PASW Statistics 18 (IBM Corporation, Route 100 Somers, NY 10589, USA), employing the Chi-square test and Fisher's exact test where appropriate. A *p*-value less than 0.05 was deemed to be significant.

Results

Out of 200 registered final year medical students, 147 individuals participated in this study with a participation rate of 73.5%. Among the dental students, 45 out of a registered number of 50 took part in the survey with a participation rate of 90%.

Epidemiological questions

The majority of the dental (97.8%) and medical (70.7%) students correctly identified oral cancer as a leading cancer on a global level. These differences were statistically significant (χ^2=14.249, df=1, p<0.001). Significantly more dental students (54.5%) than medical students (34.0%) appeared to be aware that oral cancer burden is higher in the Asian continent than in Europe (χ^2=5.848, df=1, p<0.05). The well-known global oral cancer epidemiological information that South Asian countries (India, Pakistan, Sri Lanka) rank highest in oral cancer incidence in the world was known to 91.1% of dental students. In comparison, less than half (44.9%) of the medical students showed awareness of this fact (χ^2=29.824, df=1, p<0.001).

Only a minority of both groups of students (medical -25.2%, dental -15.6%) were aware that Malaysia had a relatively high incidence of oral cancer among the member countries of Association of South East Asian Nations (ASEAN). This difference was not statistically significant. More dental students (73.3%) than medical students (55.8%) agreed that all ethnic communities in Malaysia were not equally affected by oral cancer, which showed statistically significant difference (χ^2=4.418, df=1, p<0.05). The existence of gender imbalance (F>M) among Malaysian oral cancer patients was known to 60% of dental students whereas, just under half (49.7%) of medical students were aware of this fact, which showed no statistical significant difference. No significant difference was found between the two groups of students in the awareness of the fact that oral cancer predominantly affects the lower socio-economic groups among the population (medical 55.8%, dental 60%). While 100% of dental students demonstrated awareness that squamous cell carcinoma constitutes the commonest type of oral cancer, only 70.7% of medical students appeared to be aware of this fact (χ^2=16.962, df=1, p<0.001). Surprisingly, fewer dental students (55.6%) than medical students (66.7%) believed that oral cancer is a largely preventable disease; however, there was no statistically significant difference.

Aetiological questions

Betel quid with its various ingredients was identified as a risk factor for oral cancer by 97.8% of dental students and 85.7% of medical students (χ^2=4.942, df=1, p<0.05) while smoking was recognised as a risk factor by 97.8% of dental students and 83.7 % of medical students (χ^2=6.052, df=1, p<0.05). Significantly more dental students (88.9%) than medical students (61.9%) considered smokeless tobacco (chewed or in snuff) to play a role in the causation of oral cancer (χ^2=11.573, df=1, p<0.01). The awareness of medical students (62.6%) with regard to excessive consumption of alcohol as a risk factor for oral cancer was significantly lower than that of their dental counterparts (95.6%), (χ^2=17.942, df=1, p<0.001). Combination of smoking habit and alcohol consumption in the same person was more harmful than when either habit is present alone was a fact known to less medical students (71.4%) than dental students (88.9%) and this difference was also significant (χ^2=5.682, df= 1, p<0.05).

A majority in both groups of students (medical-63.3%, dental-75.6%) conceded that oral cancer can occur even in the absence of the risk factors of betel chewing, smoking and alcohol consumption. Almost a similar proportion of students (medical-64.6%, dental-75.6%) also agreed that good oral hygiene alone cannot protect a person from oral cancer. Both these findings did not show any statistically significant differences. The purported role of Human Papilloma Virus in the aetiology of oral cancer was known to 59.6% of medical students and 75.6% of the dental students and this difference was also not statistically significant. Figure 1 illustrates the salient findings in the awareness of the students concerning the important risk factors.

Questions on clinical aspects

The fact that oral cancer is mostly preceded by potentially malignant disorders that appear as white or red patches was known significantly to more dental students (91.1%) than medical students (75.5%) (χ^2=5.084, df=1, p<0.05). Among medical students, 62.6% would consider oral leukoplakia as a potentially malignant disorder while 84.4% of the dental students would do so which showed a significant difference (χ^2=7.530, df=1, p<0.01). However, only 42.2% of dental students and 12.2% medical students appeared to have the correct understanding of the definition of leukoplakia and this difference was highly significant. (χ^2=19.901, df=1, p<0.001).

Significantly more dental students (71.1%) than medical students (33.6%) recognized oral erythroplakia as a potentially malignant disorder (χ^2=19.858, df=1, p<0.001). Nevertheless, only 24.4% of dental students and 6.8% medical students appeared to have the correct understanding of the definition of erythroplakia and this difference too was significant (Fisher's Exact Test, p<0.01).

The fact that oral sub mucous fibrosis is a well identified potentially malignant disorder appeared to be known to 70.1% of medical students and 84.4% of dental students with no statistically significant difference. Sixty per cent of dental students and a low 36.1% of medical students were aware that oral lichen planus is considered a potentially malignant disorder with a statistically significant difference (χ^2=8.128, df=1, p<0.01). Only a very small and almost equal percentage of both groups of students (medical 6.8%, dental 6.7%) knew that hairy leukoplakia found in HIV infected patients was not a potentially malignant disorder.

A majority of medical (89.7%) and dental (88.9%) students displayed a misconception that a potentially malignant disorder would always progress to malignancy in the absence of treatment, with obviously no significant difference between the two groups. Significantly, a larger proportion of dental students (71.1%) than medical (45.2%) students disagreed with the statement that oral cancer always presented as a painful ulcer (χ^2= 9.240, df=1, p<0.01). Figure 2 summarizes the findings in the awareness of the students regarding OPMD.

Questions on treatment aspects

The use of surgery and/or radiotherapy for the treatment of oral cancer was known to 70.1% of medical students and 95.6% of dental students and this difference was statistically significant (χ^2=12.285, df=2, p<0.001). Although the difference was not statistically significant, only 24.4% of dental students and 17.0% of medical students were aware of the limitation of surgery in restoring satisfactory oral function and good quality of life in advanced oral cancer.

Questions on prognosis and early detection

In response to a statement that overall 5-year survival rate of oral cancer is more than 60%, only 10.9% of medical students and 22.2% of dental students rejected the statement and this did not constitute a statistically significant difference. Only 25.2% of medical and 33.3% of dental students appeared to be aware that lip cancer had a better prognosis in comparison to cancer in other oral sites, and this difference too was not statistically significant. With regard to the fact that cancer of the floor of the mouth has a poor prognosis, only a minority of medical students (36.7%) and a slight majority of dental students (53.3%) displayed awareness and the difference is mildly significant (χ^2=3.935, df=1, p<0.05) . Sixty per cent of dental students believed that late detection of oral cancer can significantly affect 5-year survival rates even if promptly treated whereas 36.1% of medical students considered this to be true with the difference being significant (χ^2=8.128,

df=1, *p*<0.01). Significantly more dental students (77.8%) than medical students (49.0%) were aware that surgical treatment of advanced oral cancer can lead to disfigurement of orofacial region (χ^2=11.581, df=1, *p*<0.01). There appeared to be a misconception among the majority of both medical (86.4%) and dental (75.6%) students that late stage presentation of most cases of oral cancer is due to its early detection being difficult. The difference was not statistically significant.

Self confidence of students in knowledge of oral cancer

Just over half of the medical students (52.4%) and just under a quarter of dental students (24.4%) did not believe that they had sufficient knowledge of oral cancer including its prevention and detection. A majority of dental students (57.8%) were unsure in this regard giving a neutral response while one-third of (33.3%) of medical students were in this category. These differences were statistically significant (χ^2=11.415, df=2, *p*<0.05). Figure 3 highlights the differences between the student groups in this regard. Table 1 summarizes the analysis of the responses to those questions that elicited correct answers from more than 50% of the students while Table 2 shows the breakdown of the responses to the questions that elicited correct answers from less than 50% of students.
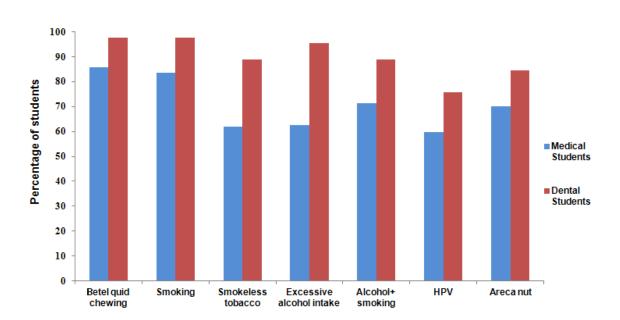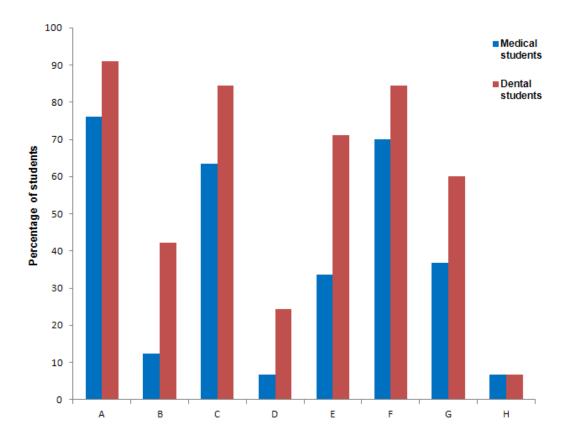

Fig. 1 Awareness of risk factors.

Fig. 2 Awareness of oral potentially malignant disorders (OPMDs). **A:** Concept of OPMD; **B:** Defining leukoplakia correctly; **C:** Leukoplakia as an OPMD; **D:** Defining erythroplakia correctly; **E:** Erythroplakia as an OPMD; **F:** Oral submucous fibrosis as an OPMD; **G:** Oral lichen planus as an OPMD; **H**: Hairy leukoplakia as a non-OPMD
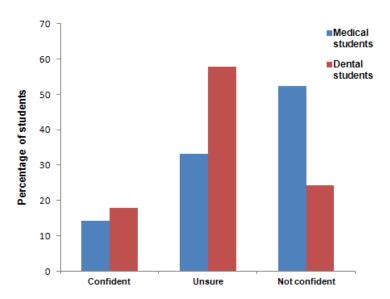

Fig. 3 Student responses of self evaluation of knowledge on oral cancer.

Table 1 Question topics that elicited correct answers from more than 50% of students of either group

Topic	% of medical students	% of dental students	p value
Statistically significant differences			
Oral cancer (OC) is within 15 most common cancers of the world	70.7	97.8	*p*=0.000
All ethnic communities in Malaysia are not equally affected by OC[a]	55.8	73.3	*p*=0.036
Squamous cell carcinoma constitutes the commonest type of OC	70.7	100.0	*p*=0.000
Chewing betel quid with its various ingredients is a cause of OC	85.7	97.8	*p*=0.026
Smoking plays a role in the causation of OC[b]	83.7	97.8	*p*=0.014
Smokeless tobacco (chewed/snuff) is a causative factor for OC	61.9	88.9	*p*=0.001
Excessive consumption of alcohol can lead to OC	62.6	95.6	*p*=0.000
Combination of smoking and alcohol consumption in same person is more harmful than when a habit is present alone	71.4	88.9	*p*=0.017
OC is mostly preceded by white or red patches on the oral mucosa	75.5	91.1	*p*=0.024
Oral leukoplakia ia an OPMD	62.6	84..4	*p*=0.006
Surgery and/or radiotherapy are used for the treatment of OC	70.1	95.6	*p*=0.000
Statistically non- significant differences			
OC predominantly affects the lower lower socio-economic groups	55.8	60.0	*p*=0.617
OC is largely a preventable disease	66.7	55.6	*p*=0.174
OC can occur even in people without betel chewing, smoking and drinking habits[b]	63.3	75.6	*p*=0.127
A person with good oral hygiene can develop OC[b]	64.6	75.6	*p*=0.172
Human Papilloma virus is known to be a causative factor for OC	59.6	75..6	*p*=0.052
Areca nut induced oral submucous fibrosis is an OPMD	70.1	84.4	*p*=0.056

a- Presented as a positive statement; b- Presented as a negative statement; Rest presented as here.

Table 2 Question topics that elicited correct answers from less than 50% of students of either group

Topic	% of medical students	% of dental students	*p* value
Statistically significant differences			
Oral cancer (OC) burden is higher in Asia than Europe*	34	(54.5)	*p*=0.016
South Asian countries (India, Pakistan, Sri Lanka) rank highest in OC incidence in the world	44.9	(91.1)	*p*=0.000
Any white lesion on the oral mucosa is not a leukoplakia*	12.2	42.2	*p*=0.000
Any red lesion on the oral mucosa is not a erythroplakia*	6.8	24.4	*p*=0.002
Erythroplakia is an oral potentially malignant disorder(OPMD)	33.6	(71.1)	*p*=0.000
Oral lichen planus is an OPMD	36.1	(60)	*p*=0.004
OC does not always present as a painful ulcer*	45.2	(71.1)	*p*=0.002
Cancer of the floor of the mouth has comparatively poor prognosis	36.7	(53.3)	*p*=0.047
Late detection of oral cancer can significantly affect 5-year survival rates even if promptly treated*	36.1	(60)	*p*=0.004
Surgical treatment of advanced oral cancer can lead to disfigurement of orofacial region	49	(77.8)	*p*=0.001
Statistically non- significant differences			
Malaysia has a relatively high incidence of oral cancer among the member countries of South East Asia	25.2	15.6	*p*=0.179
OC affects more females than males in Malaysia*	49.7	(60)	*p*=0.224
Hairy leukoplakia is not an OPMD*	6.8	6.7	*p*=0.975
Every OPMD would not progress to malignancy if untreated*	10.3	11.1	*p*=0.873
Surgery for advanced oral cancer cannot (always) achieve satisfactory oral function and good quality of life†	17	24.4	*p*=0.263
Overall 5-year survival rate of oral cancer is much less than 70%*	10.9	22.2	*p*=0.052
Lip cancer has good prognosis compared to cancer of other sites*	25.2	33.3	*p*=0.281
Most patients with oral cancer present in advanced stages not because early detection is difficult†	13.6	24.4	*p*=0.084

†- Presented as a positive statement;   *- Presented as a negative statement; Rest presented as here. Figures in parentheses included for comparison

Discussion

A survey of literature reveals that studies of oral cancer awareness of dental students had been undertaken in Spain (Jaber *et al.*, 1997, Seoane *et al.*, 1997a, 1997b), Nigeria (Uti and Fashina, 2006), Iran (Ogden and Mahboobi, 2011) and the United Kingdom (Carter and Ogden, 2007). The latter study had included medical students as well. The only other studies on oral cancer knowledge of medical students have been reported by Al Dubai *et al.* (2012) and Reed *et al.* (2005) among medical students in Malaysia and South Carolina respectively. The study in Malaysia referred to, conducted among medical and nursing students, had addressed only somewhat superficial knowledge of gross clinical features of oral cancer and had not dealt with OPMD. The present study however targeted dental as well as medical students testing their in-depth knowledge on oral cancer and OPMD in addition to comparing the findings. Carter and Ogden (2007) have similarly compared dental and medical students. Arguably therefore, the present study is the first of its kind to emanate from Asia to evaluate in-depth awareness of dental and medical students concerning oral cancer and OPMD.

Unlike the studies referred to above, the questionnaire used in the present study was designed to evaluate a comprehensive level of oral cancer awareness by incorporating questions on epidemiologic, prognostic and treatment aspects in addition to the commonly included aetiological and clinical questions. It can be argued that students with awareness of the wider dimensions of the global oral cancer burden and its less than satisfactory prognosis and treatment outcomes are more likely to play a more committed role in oral cancer prevention and early detection as future practitioners. Hence, the questionnaire of this study contained comparatively more questions than claimed in the former studies and, by necessity, closed-ended questions. Almost half the questions were constructed as positive statements while the rest were designed in the negative sense in order to dissuade the respondents from adopting a pattern in selecting responses.

A general feature seen in the present study is that the dental students were relatively better informed than the medical students with regard to most issues addressed in the questionnaire. This is consistent with the findings of Carter and Ogden (2007). Yet, there were some areas of knowledge in which the dental students did not differ significantly from their medical counterparts (Tables 1 and 2).

With regard to epidemiological information concerning oral cancer, the dental students appeared to have significantly better awareness than the medical students on global epidemiological facts. However, with regard to domestic (Malaysian) epidemiological information, there was no significant difference between the two groups although dental students were marginally more aware of the facts.

As seen in Figures 1 and 2, dental students were relatively better informed than the medical students concerning risk factors in the causation of oral cancer and OPMD. Significantly, almost 37% of medical students were uninformed of excessive alcohol consumption as a risk factor for oral cancer in comparison to the less than 5% of dental students who were ignorant of the same. However, this appears to be considerably better than the findings of Carter and Ogden (2007) who reported that 67% of medical students and 6% of dental students in Dundee failed to identify alcohol as a risk factor. It is also noteworthy that nearly 38% of medical students and about 11% of dental students failed to recognize smokeless tobacco as a risk factor and this too was found to be significantly different. Surprisingly, although only 62.6% of medical students identified alcohol alone as a risk factor, 71.4% of them considered the combination of alcohol usage and smoking in an individual as a greater risk factor. This apparent inconsistency may be due to the influence of the higher percentage (83.7%) of medical students who recognized smoking as a major risk factor.

There was a dearth of awareness among majority of both medical (87.8%)

and dental (57.8%) students as to what a leukoplakia is, although a majority of both groups knew that the lesion is an OPMD. In addition, a majority of medical students (66.4%) were ignorant that erythroplakia is an OPMD in comparison to their dental counterparts (28.9%) while as much as 75.6% of dental students and 93.2% medical students considered any red lesion on the oral mucosa as an erythroplakia. Although the prevalence of erythroplakia is less than that of leukoplakia, erythroplakia is recognised as a lesion with a high degree of malignant potential in comparison with the latter (Reichart and Philipsen, 2005). Hence, its importance in oral cancer education cannot be overemphasized. Nearly 55% of medical students believed that oral cancer always presented as a painful ulcer which is a misconception that may result in wrong information being conveyed to patients, which in turn may lead to late presentation.

As Table 2 shows, the level of awareness on prognostic and treatment aspects of the both groups of students had been found to be considerably low, although the dental students were observed to be better informed in few instances. As illustrated by Figure 3 a majority of medical students (52.4%) expressed a lack of confidence in their awareness concerning oral cancer, its prevention and detection while, it is interesting to note that the majority of dental students (57.8%) were unsure of their confidence. One third of the medical students (33.3%) were similarly neutral in this regard. Only 14.3% of medical students and 17.8% of dental students stated that they were confident of themselves in the domain of oral cancer including its prevention and detection.

Oral cavity is a part of the body that can be easily examined without the need for any sophisticated equipment. Primary and secondary prevention of oral cancer is thus a relatively easily attainable objective if healthcare providers such as dentists and doctors have adequate knowledge of risk factors and skills in the recognition of OPMD, and are able to educate their patients to abstain from the known risk factors in addition to examining the mouths of their patients, whenever opportunity arises, to rule out OPMD.

Furthermore, such routine examination of the mouth would facilitate the detection of oral cancer in its early stages, which would in turn lead to prompt referral of the patient for relatively less complicated and less mutilating treatment. It is evident therefore that dental and medical students should receive education and training to enable them, as future dental and medical practitioners play effective roles in the primary and secondary prevention of oral cancer.

It is imperative that dental students should be imparted with adequate knowledge and skills with regard to oral cancer and OPMD on account of their close involvement with oral health. Generally speaking, the dental undergraduate curriculum in most dental schools aims to educate dental students on various aspects of oral cancer, comparatively, to a greater depth. In the case of medical students, the demands of the medical curriculum may reduce the relative importance of this aspect of their education. Nevertheless, it is equally important that medical students acquire similar levels of knowledge and skills concerning oral cancer and OPMD because it has been shown that patients often seek advice from their general medical practitioners (GMP) regarding oral conditions and that patients with higher risk of oral malignancy very often present to their GMP (Langdon, 1995; Yellowitz and Goodman, 1995; Goodman *et al.*, 1995).

In addition, university students are to some extent expected to achieve many aspects of knowledge and skills through self learning and extracurricular means (Shokar *et al.*, 2002). Furthermore, lower levels of confidence among GMPs about oral cancer knowledge have been linked to a lack of training at medical school (Macpherson, 2003). Evaluation of their awareness on oral cancer and OPMD in order to gauge the effectiveness of their learning would contribute to advances in medical and dental education.

Conclusion

This study reveals areas of deficiency in the awareness of medical and to some extent dental undergraduates in the field of oral cancer and particularly OPMD. It is of utmost importance that these aspects of medical and dental undergraduate curricula are strengthened in order to produce medical doctors and dentists of tomorrow who would play committed and confident roles in prevention and early detection of oral cancer and OPMD.

Acknowledgements

References

Al Dubai SAR, Ganasegaran K, Alabsi AM, Alshagga MA, Ali RS (2012). Awareness and Knowledge of Oral Cancer among University Students in Malaysia. *Asian Pacific J Cancer Prev*, **13**(1): 165-168.

Blot WJ, McLaughlin JK, Winn DM, Austin DF, Greenberg RS, Preston-Martin S *et al.* (1988). Smoking and drinking in relation to oral and pharyngeal cancer. *Cancer Res*, **48**(11): 3282–3287.

Carter LM, Ogden GR (2007). Oral cancer awareness of undergraduate medical and dental students. *BMC Med Educ*, **7**: 44.

Ferlay J, Shin HR, Bray F, Forman D, Mathers CD, Parkin D (2010). GLOBOCAN 2008, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 10. [Internet]. Lyon, France: International Agency for Research on Cancer. Available from: http://globocan.iarc.fr. Accessed on 24/10/2013.

Goodman HS, Yellowitz JA, Horowitz AM (1995). Oral cancer prevention. The role of family practitioners. *Arch Fam Med*, **4**(7): 628-636.

Herrero R, Castellsagué X, Pawlita M, Lissowska J, Kee F, Balaram P *et al.* (2003). Human papillomavirus and oral cancer: the International Agency for Research on Cancer multicenter study. *J Natl Cancer Inst*, **95**(23): 1772–1783.

Jaber MA, Diz Dios P, Vázquez García E, Cutando Soriano A, Porter SR (1997). Spanish dental students knowledge of oral malignancy and premalignancy. *Eur J Dent Educ*, **1**(4): 167-171.

Langdon JD (1995). Oral cancer: raising the level of awareness. *Dent Update*, **22**(7): 269-270.

Macpherson LMD, McCann MF, Gibson J, Binnie VI, Stephen KW (2003). The role of primary health care professionals in oral cancer prevention and detection. *Br Dent J*, **195**(5): 277-281.

Murthy V, Agarwal JP, Laskar SG, Gupta T, Budrukkar A, Pai P *et al.* (2010). Analysis of prognostic factors in 1180 patients with oral cavity primary cancer treated with definitive or adjuvant radiotherapy. *J Cancer Res Ther*, **6**(3): 282-289.

Ogden GR, Mahboobi N (2011). Oral cancer awareness among undergraduate dental students in Iran. *J Cancer Educ*, **26**(2): 380-385.

Razak AA, Saddki N, Naing NN, Abdullah N (2010) Oral cancer survival among Malay patients in Hospital Universiti Sains Malaysia, Kelantan. *Asian Pacific J Cancer Prev*, **11**(1): 187-191.

Reed SG, Duffy NG, Walters KC, Day TA (2005). Oral cancer knowledge and experience: a survey of South Carolina medical students in 2002. *J Cancer Educ*, **20**(3): 136-142.

Reichart PA, Philipsen HP (2005). Oral erythroplakia- a review. *Oral Oncol*, **41**(6): 551-561.

Seoane J, Gonzalez-Reforma N, Aguado A, Romero MA, Varela-Centelles PI (1997a). Assessment of dental students' diagnostic accuracy for oral cancer screening. *J Dent Educ*, **61**(5): 437-439.

Seoane J, Varela-Centelles PI, González-Reforma N, Aguado A, Esparza G (1997b). Assessment of dental students' ability to recognise precancerous lesions and conditions. *Eur J Dent Educ*, **1**(4): 172-175.

Sher DJ, Thotakura V, Balboni TA, Norris CM Jr, Haddad RI, Posner MR *et al.* (2011). Treatment of oral cavity squamous cell carcinoma with adjuvant or definitive intensity-modulated radiation therapy. *Int J Radiat Oncol Biol Phys*, **81**(4): e215-e222.

Shokar GS, Shokar NK, Romero CM, Bulik RJ (2002). Self-directed learning: looking at outcomes with medical students. *Fam Med*, **34**(3): 197-200.

Thames Cancer Registry (2007). Cancer inequalities in London 2000–2004. [Internet] London: Thames Cancer Registry. Available

from: http://www.ncin.org.uk/view?rid=227 Accessed on 01 June 2014.

Uti OG, Fashina AA (2006). Oral cancer education in dental schools: knowledge and experience of Nigerian undergraduate students. *J Dent Educ*, **70**(6): 676-680.

Warnakulasuriya S (2009). Global epidemiology of oral and oropharyngeal cancer. *Oral Oncol*, **45**(4-5): 309–316.

Warnakulasuriya S, Newell W. Johnson, van der Waal I (2007). Nomenclature and classification of potentially malignant disorders of the oral mucosa. *J Oral Pathol Med*, **36**(10): 575-580.

Yellowitz JA, Goodman HS (1995). Assessing physicians' and dentists' oral cancer knowledge, opinions, and practices. *J Am Dent Assoc*, **126**(1): 53-60.

Zain RB (2001). Cultural and dietary risk factors of oral cancer and precancer - a brief overview. *Oral Oncol*, **37**(3): 205-210.

Zainal Ariffin O, Zainudin MA, Nor Saleha IT (eds.) (2006). *Malaysian Cancer Statistics-Data and Figure, Peninsular Malaysia 2006*. Kuala Lumpur: National Cancer Registry, Ministry of Health, Malaysia.