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SUBSCRIPTIONS

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Verruca-papillary lesions (VPLs) of the oral cavity described in the literature involve a spectrum of conditions including squamous papilloma, verruca vulgaris, focal epithelial hyperplasia, condyloma, proliferative verrucous leukoplasia and verruca carcinoma. The majority of the VPLs are slow growing, benign in nature and have a viral aetiology (1). Mucosal HPV types (HPV 6, 11, 13, 30, 32, 45, 52, 55, 59, 69, 72 and 73) have been implicated as possible etiological causes for these benign lesions (2) while virus associated benign mucosal outgrowths are not too difficult to diagnose either clinically or by microscopy. Apart from virus-associated lesions, VPLs harboring malignant potential such as verrucous carcinoma, proliferative verrucous leukoplasia and oral verruca hyperplasia (OVH) need to be further clarified for better understanding of their predictable biologic behavior and appropriate treatment. In particular, the condition referred to as oral verruca hyperplasia (OVH) poses a major diagnostic challenge. OVH represents a histopathological entity whose clinical features are not well recognised and is usually clinically indistinguishable from a verrucous carcinoma (3).

In 1980, Shear and Pindborg classified OVHs into two clinical variants, a sharp variety comprising of long, narrow, heavily keratinized verrucous processes which appears white as a result of heavy keratinization and a second variant referred to as the blunt variety consisting of verrucous processes that are broader, flatter and not heavily keratinized (3). A new pathological entity distinct from what Shear and Pindborg earlier described has been found in recent years among betel-quid chewers mainly from Taiwan. In 2005, Chung et al., in a field survey of 1075 adults noted 9 verrucous lesions which they described as exophytic outgrowths, which the authors hinted had hitherto not been reported in the scientific literature (4). Their Figure: 1 illustrated this newly described “verrucous lesion”. Subsequently in 2009 Wang et al described a case series of 60 cases from Taipei and classified these lesions as plaque-type and mass-type lesions primarily based on their histopathological features. It was also documented that the mass-type verruca hyperplasia may manifest as single or multiple verrucose whitish pink lesions clinically while the plaque-type lesions may appear as whitish verrucous plaques. They also concluded that the terminology OVH should be reserved to denote only the mass-type lesions both clinically and histologically and suggested that the plaque-type lesions should be clinically classified as oral verruciform leukoplasia and histologically as verruciform hyperplasia (5).

In an effort to bring uniformity in reporting these lesions both clinically and histopathologically a consensus meeting was held in Kuala Lumpur, Malaysia during December 15-18, 2013. A working committee that included specialists working on oral malignant and potentially malignant disorders attempted to formulate the clinical and histopathological criteria of OVH based on the discussion among the participants in the meeting. The meeting was attended by 46 participants from 7 countries
and included specialists and trainees in the disciplines of Oral Medicine and Oral and Maxillofacial Pathology. Consensus guidelines arising from this meeting is as follows.

**CLINICAL CRITERIA FOR VERRUCOUS HYPERPLASIA OF THE ORAL CA VITY:**

The working committee proposed the term “Exophytic Verrucous Hyperplasia” to denote the clinical entity that represents the microscopic diagnosis of OVH. The following criteria for the clinical diagnosis of OVH was proposed:

a. These lesions clinically present in two forms: 1) as an exophytic, fleshy verruco-papillary outgrowth with a white and/or pink surface color and 2) as a white, plaque-like exophytic verrucous lesion. The latter may mimic verrucous leukoplakia. In both instances the clinical term ‘exophytic verrucous hyperplasia’ should be used.

b. Exophytic verrucous hyperplasia may occur in any anatomical site in the oral cavity and in general would be more than 1 cm in size.

c. Unlike proliferative verrucous leukoplakia (PVL) exophytic verrucous hyperplasia is a discrete and solitary lesion.

d. Exophytic verrucous hyperplasia may co-exist in a patient presenting with oral submucous fibrosis.

e. The clinical presentation of exophytic verrucous hyperplasia could masquerade as a squamous cell carcinoma or verrucous carcinoma. Absence of induration is a cardinal feature of exophytic verrucous hyperplasia.

**HISTOLOGICAL CRITERIA FOR VERRUCOUS HYPERPLASIA OF THE ORAL CA VITY**

The working committee proposed the following criteria for the histological diagnosis of oral verrucous hyperplasia:

a. Keratinized exophytic verruco-papillary processes seen. Keratin plugging may be present.

b. Epithelium is hyperplastic with both basal cell hyperplasia and acanthosis.

c. Absence of downward growth of the hyperplastic epithelium into the lamina propria when compared with the level of the basement membrane of the adjacent normal epithelium.

d. Epithelial dysplasia may or may not be present.

e. Subepithelial lymphocytic infiltration as a host response may or may not be present.

f. Verrucous hyperplasia should be clearly differentiated from verrucous carcinoma which exhibits frank downward growth of the epithelial processes below the level of the basement membrane of the adjacent normal epithelium.

g. Verrucous hyperplasia should be differentiated from squamous cell papilloma by its size and by the presence of a prominent fibrovascular core in the latter.

h. In a small biopsy without adjacent normal mucosal epithelium particular attention should be paid to exclude other pathologies such as squamous cell papilloma and verrucous carcinoma.

It was proposed by the working committee that of above, criteria (a), (b) and (c) must be present to make a histopathological diagnosis of OVH. Further it was recommended that the pathology report should include a statement describing the degree of dysplasia if present and a cautionary note to say that OVH may recur following excision and may progress to verrucous carcinoma and squamous cell carcinoma. Therefore careful surveillance is mandatory.

**CONCLUSIONS**

The terminology and the criteria proposed by the working committee at this consensus meeting will strengthen the understanding of what is already known and will serve to minimize the use of conflicting terminologies that designate OVH. The malignant potential of OVH has been shown in a number of publications (5, 6, 7, 8). Future studies in South Asia should examine the natural history of this novel disorder and we propose that it should be considered as one of the oral potentially malignant disorders at the next WHO revision of classification and nomenclature of Oral Potentially Malignant disorders (9). We may not succeed in completely eliminating the use of these varied terminologies but a consensus for a universal proposed guidelines and terminologies can be further validated in future case series.

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THE EFFECT OF ORAL HEALTH EDUCATION SEMINAR ON ORAL HEALTH KNOWLEDGE, PRACTICE AND PERCEPTION OF ROLE OF THE PRESCHOOL TEACHERS


ABSTRACT

Background: In Malaysia, preschool teachers have long been utilised as oral health educators. However their level of oral health knowledge and effectiveness of the training they received are seldom investigated. This study aims to evaluate the oral health education seminar (OHE) held for public preschool teachers (KEMAS) in terms of the improvement of their knowledge, practices and attitudes

Methods: This was a one arm interventional study (before and after survey following OHE seminar intervention). All KEMAS preschool teachers (n=107) in Hulu Terengganu were invited to attend OHE seminar which consisted of 1 hour lecture and 40 minutes OHE demonstration. Pre-test questionnaire was collected before the seminar started and post-test questionnaire was collected two weeks later. A self-administered questionnaire used in this study was adapted from “preschool teachers’ knowledge, practices and attitudes towards oral health”, National Oral Health Survey of Preschool Children, 2005. Data were analysed using descriptive and McNemar test, SPSS version 15.0.

Results: Of 107 subjects, only 61 teachers responded yielding to 57% response rate. All subjects were female with mean age of 46 years (SD: 6.03). Overall, there was an improvement of teachers’ oral health knowledge, practices and attitudes after the seminar. Several items seem to have be improved significantly after the seminar, for example knowledge item on factors causing periodontal disease (p=0.03). In terms of practice, all teachers reported they brushed teeth at least twice daily using fluoridated toothpaste and use of dental floss was increased significantly after the seminar (p<0.001).

Majority of teachers have positive perceptions on their roles in oral health education. Conclusion: Oral health education seminar appeared to be effective at influencing certain aspects of teachers’ oral health knowledge, practices and attitudes.

Keywords: attitudes, knowledge, oral health promotion, practice, preschool teachers.

INTRODUCTION

A multi-disciplinary approach is needed for effective dental education for children. Teachers are identified as key alternative personnel to be involved in combating preventable diseases such as oral disease (1, 2). There is a vast body of evidence acknowledging the advantages of utilising the services of teachers in school health education and health promotion. Teachers are able to influence a huge number of children, parents and members of the community (1-5). Due to the fact that teachers spend a great deal of time with their students daily, they can ensure that oral health message is delivered to children continuously. They will also be able to incorporate oral health message into the school’s general health curriculum (2, 3, 6).

Apart from the potential advantages of utilising teachers in oral health education, the main weakness reported was teachers’ lack of training in delivering health messages (2, 6, 7). Other barriers reported were lack of materials (4), insufficient time and failure to incorporate oral health into the curriculum (3). These barriers may prevent teachers from effectively participating in oral health promotional activities.

A structured preschool oral health programme has been implemented in Malaysia since 1984 focusing on preventive and promotional activities in oral health (8) which includes yearly clinical visits to kindergartens by dental nurses. Preschool teachers have long been utilised as oral health educators for this programme. In spite of having had a comprehensive preschool oral health programme for nearly three decades, dental caries among preschool children remains a significant dental public health problem in Malaysia, particularly in rural
METHODS

This study was a one arm intervention study (before and after survey following oral health education seminar intervention). A pre and post seminar survey was conducted using a self-administered questionnaire involving all public preschool teachers (n=107) in “Jabatan Kemajuan Masyarakat” (KEMAS), Ministry of Rural and Regional Development, in the district of Hulu Terengganu. KEMAS preschool teachers were chosen because dental services to these kindergartens are fully covered by the Terengganu State Dental Division.

A questionnaire was adapted from the National Oral Health Survey of Preschool Children, 2005 (10). The questionnaire consisted of four sections. Section A was to gain demographic information which includes age, gender and education level. Section B comprised of six questions on oral health knowledge including knowledge on plaque, factors causing caries, signs of periodontal disease, factors causing periodontal disease, prevention of caries and prevention of periodontal disease. Section C comprised of four questions on perceived oral health care practices including tooth brushing habits, usage of fluoridated toothpaste and flossing habits. Section D comprised of five questions on the perceived roles of teachers towards oral health education. For section B and C, response formats was multiple choice answers in which subjects choose one or more correct answer from the provided list of answer options. For section D, respondents were asked to indicate the extent of their agreement or disagreement on perceptions of roles of teachers in oral health education. A five point Likert scales ranging from strongly agree to strongly disagree was used (10).

The questionnaire was face validated by two dental public health specialists in Oral Health Division, Ministry of Health, Malaysia. They were asked to provide feedback independently on the overall content and structure of the questionnaire. The feedback received from the experts only involved minor structural adjustments. The questionnaire was pre-tested among five KEMAS preschool teachers in other districts. Following the pre-test, the questionnaire was found to be clear and relevant with no changes required.

All participants were invited to attend oral health education seminar which consisted of 1 hour lecture and 40 minutes of oral health education demonstration. The lecture-demonstration method of oral health education used was almost similar to those used in other studies (12, 13). Pre-test questionnaires were distributed just before the seminar and collected on the same day. The module of the oral health education seminar was based on “Guidelines of Oral Healthcare for Preschool Children” (8). The lecture was given by a dental public health specialist and oral health education demonstration was done by two calibrated dental officers. Oral health education demonstration was divided into two stations. Each interactive 20-minutes station utilized audio-visual aids (models, pictures, posters and flip charts). The first station focused on common oral disease (which includes normal structure and functions of teeth, type of dentitions and their significance, aetiology of dental caries and periodontal disease, clinical manifestations and treatment modalities). The second station focused on basic oral health care (which includes prevention of dental caries, periodontal disease, effective tooth brushing technique, flossing, importance of regular dental visits, the importance of having a balanced diet and influence of oral health on general health). Teachers were divided into small groups (consisting of 15 people maximum) for rotational demo station. For post-test the same structured questionnaires were distributed to all teachers and collected two weeks after the pre-test. The reason of having the two weeks intervals of pre-test and post-test were meant to provide adequate period of knowledge/behavioural change after the intervention and at the same time minimize the contamination effects from other influences or factors that can contribute to the observed changes (9). For statistical analysis purposes, both pre and post-tests questionnaires were anonymous and identification code numbers were used to match mentioned questionnaires.

Ethical approval to conduct this study was obtained from Medical Ethics Committee, University of Malaya. Permission to conduct this study was obtained from the Terengganu State Dental Division and “Jabatan Kemajuan Masyarakat” (KEMAS), Ministry of Rural and Regional Development. Following approval, a letter was sent to invite all KEMAS preschool teachers in Hulu Terengganu to participate in this study. Participants were assured of confidentiality.
Data management and analysis

Data were analysed using SPSS version 15.0 and significant value was set at 0.05. For oral health knowledge section, the answers were grouped as “true” and “false” answer and for oral hygiene practice section, the answers were grouped as “yes” and “no” answer. In terms of the perception scores, the answers were grouped into “agree” and “disagree” to indicate level of acceptance of roles of preschool teachers towards oral health education. Descriptive and McNemar test was used to analyse the percentage improvement between before and after intervention.

RESULTS

All public preschool teachers of KEMAS Hulu Terengganu (n=107) were invited to participate in this study. Sixty one teachers responded, giving a response rate of 57%. Of the 61 participants, two participants were absent during post-test and data was excluded from analysis. All participants were female with mean age of 46 years (SD: 6.03). In terms of education level, majority (80.0%) completed secondary school level education, followed by 13.3% having completed tertiary education and 6.7% having completed primary school education.

Oral health knowledge

Table 1 indicates some improvement of oral health knowledge percentage after oral health education seminar intervention. Almost all teachers understand what dental plaque is before and after the intervention. Apart from having knowledge of plaque, overall findings reflect poor oral health knowledge among preschool teachers in Hulu Terengganu. Although the percentage of improvement is less than 20%, there was a significant improvement of knowledge on factors causing periodontal disease (p=0.03) after the seminar. However, there was no significant difference in relation to knowledge of signs of periodontal disease, prevention of periodontal disease, prevention of caries and factors causing caries (p>0.05).

Oral hygiene practices

Table 2 shows distribution of oral hygiene practices among preschool teachers in Hulu Terengganu. All respondents (n=59) reported that they brushed at least twice daily using fluoridated toothpaste. The use of dental floss among the respondents improved significantly after the intervention (p<0.001).

Perceptions of roles of teachers

Generally, it was found that preschool teachers have positive perceptions on their roles in oral health education during pre-test ranging from 86.4% to 89.8%. Of this, their role in recognizing tooth decay and gum problems in preschool children, supervising of daily tooth brushing during school hours, controlling of foods served, setting examples to children by having good oral health and the insertion of dental messages into lessons as often as possible (Table 3). There was no statistical significant difference found before and after the seminar for all items (p>0.05). However, after the seminar there was increased agreement percentage (over 90%) to all questions on teachers’ roles in oral health education in preschool setting.

| Table 1: Distribution of percentage oral health knowledge before and after oral health education seminar among preschool teachers in Hulu Terengganu (n=59) |
|---|---|---|---|
| | Correct answer | Pre-test | Post-test | p-value* |
| B1. Knowledge on plaque | 58 (98.3) | 58 (98.3) | 1.00 |
| B2. Factors causing caries | 22 (37.3) | 23 (39.0) | 1.00 |
| B3. Signs of periodontal disease | 12 (20.3) | 14 (23.7) | 0.75 |
| B4. Factors causing periodontal disease | 10 (16.9) | 18 (30.5) | 0.03* |
| B5. Prevention of caries | 23 (39.0) | 29 (49.2) | 0.21 |
| B6. Prevention of periodontal disease | 12 (20.3) | 13 (22.0) | 1.00 |

*McNemar test, significant at p<0.05

| Table 2: Distribution of percentage oral hygiene practices before and after oral health education seminar among preschool teachers in Hulu Terengganu (n=59) |
|---|---|---|---|
| | Who answer Yes | Pre-test | Post-test | p-value* |
| C1. Tooth brushing (once) | 59 (100) | 59 (100) | 0.18 |
| C2. Use of fluoridated toothpaste | 59 (100) | 59 (100) | 1.00 |
| C3. Use of dental floss | 15 (25.4) | 35 (59.3) | <0.001* |

*McNemar test, significant at p<0.05
Table 3: Distribution of percentage roles of teachers before and after oral health education seminar in a sample of preschool teachers in Hulu Terengganu (n=59)

<table>
<thead>
<tr>
<th>Pre-test n (%)</th>
<th>Post-test n (%)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1. Able to recognize tooth decay and gum problems in children</td>
<td>52 (88.1)</td>
<td>54 (91.5)</td>
</tr>
<tr>
<td>D2. Supervise daily tooth brushing of children during school hours</td>
<td>51 (86.4)</td>
<td>55 (93.2)</td>
</tr>
<tr>
<td>D3. Control of foods served to preschool children</td>
<td>53 (89.8)</td>
<td>56 (94.9)</td>
</tr>
<tr>
<td>D4. Set an example to children by having good oral health</td>
<td>52 (88.1)</td>
<td>55 (93.2)</td>
</tr>
<tr>
<td>D5. Include dental message into lessons as often as possible</td>
<td>53 (89.8)</td>
<td>55 (93.2)</td>
</tr>
</tbody>
</table>

*p-McNemar test, significant at p<0.05

DISCUSSION

Findings from this study indicated that there was increased level of knowledge among preschool teachers after attending the oral health education intervention seminar. However, it is worth noticing that, the percentage improvement is relatively very small (less than 20%). The result of this study was consistent with another local study conducted among KEMAS preschool teachers in Kelantan (9). Despite of the percentage of improvement was no greater than 20%, the overall outcome suggests that the oral health education seminar appeared to be effective at influencing certain aspects of teachers’ oral health knowledge, practices and attitudes, hence empowering them as agents of change.

Although there was an improvement in oral health knowledge, overall findings reflect poor oral health knowledge among preschool teachers in Hulu Terengganu. Similar results were reported by other studies (1, 6), which suggest that teachers’ knowledge about oral health and current methods of prevention are incomplete and inaccurate. The teachers’ lack of oral health knowledge may affect what they convey to their pupils, as it is generally believed that an individual cannot give what he or she does not have (6). Providing in-service programmes for teachers such as oral health education seminars is one approach to raise oral health awareness (1). Teachers should be reminded of the reasons and benefits of such programmes. Findings from this study suggest the need to increase training on oral health education among preschool teachers to ensure accurate information delivery to their pupils. In addition, repeated reinforcement will help to increase knowledge and develop positive habits (6).

All preschool teachers in the present study were reported to have good oral hygiene practices before and after exposure to oral health education by brushing their teeth more than once daily using fluoridated toothpaste. This basic information might be influenced by annual preschool visits by dental nurses and sophisticated mass media in promoting oral health education (9). On a positive note, there was significant improvement (p<0.001) reported in terms of flossing habits among respondents after the intervention from 25.4% (pre-test) to 59.3% (post-test). This post-test percentage was higher than the national average of flossing habits reported among Malaysian preschool teachers (39.9%) (10).

There was conflicting findings in terms of teachers’ perceptions of their roles in oral health education activities. Results from the present study indicated that teachers have positive perceptions towards their roles in oral health education which require their direct involvement and supervision during school time. This finding was supported by other studies in Trinidad (3) and India (14). In contrast, some teachers, though quite knowledgeable with respect to oral health, had poor levels of motivation and commitment related to oral health activities (7). Thus, the positive attitudes of teachers in the present study should be encouraged. The main challenge however, will be how to ensure proper implementation of the existing guidelines and to evaluate effectiveness of the oral health education of the children.

The response rate (57%) for this study was relatively low compared to other studies among school teachers. This could be explained that the seminar was conducted during school holidays whereby many teachers were involved with continuous education programme to upgrade their qualification from certificate to diploma level (15). Therefore, it is important for oral health personnel to include teachers during oral health programme planning stage to ensure maximum coverage of teachers receiving oral health education training. In addition, due to geographic distance, lack of public transportation and challenging roads in Hulu Terengganu, some teachers faced difficulty in accessing the seminar centre. Thus, multicentre training is recommended in the future.

Findings from this study should be interpreted in the light of some limitations. Firstly, due to nature of self-reporting survey there could have been reporting bias. Secondly, the results can only provide an insight about preschool teachers surveyed in Hulu Terengganu and should not be generalised to all preschool teachers in Malaysia. Thirdly, we were unable to determine whether the seminar had an impact on actual behaviour. It is recommended that future research is done to evaluate whether the knowledge, attitude and practices of preschool
children could improve with the upgrading of preschool teachers’ knowledge on oral health. In addition to that, a long term follow-up to assess the improvement of teachers’ oral health knowledge, attitudes and practices should also be conducted.

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ABSTRACT

Aim: In response to the introduction of an integrated dental education program at University of Malaya (UM) in 2011, a study was conducted to develop a caries risk assessment model (CRA) for use in non-surgical caries management for Year 3 and 4 students of the new integrated program.

Methods: The CRA model was based on risk indicators used by dental students in the Preventive Dental Clinic (PDC). Patients aged 15 years and above who attended the PDC for the first time in year 2009 and 2010 were used as study sample. Four hundred and fourteen patient names were identified from the student PDC logbook. Of the 414, 359 dental records had complete data and included in the analysis. Data were analysed using SPSS version 17.0. Chi-square test was used for group comparison and associated factors for coronal caries were analysed using Multiple Logistic Regression (MLR).

Results: The final model showed that adults, brushing teeth once daily, and not having dental prosthesis/appliance were 3.31 (CI=1.64-6.69), 2.53 (CI=1.19-5.40), and 2.25 (CI=1.25-4.10) more likely to develop coronal caries, respectively, than adolescents, brushing teeth at least twice a day, and having dental prosthesis/appliance.

Conclusions: The results indicate that age group, toothbrushing frequency and dental prosthesis status are significant indicators for coronal caries among patients. Outcomes of the study contributed towards bridging the gap between cariology and preventive modules in the new integrated dental program.

Key words: Dental caries, Malaysia, risk assessment.

INTRODUCTION

Dental caries management involves both surgical and non-surgical intervention (1-3). For non-surgical intervention, patient risk-based analysis has been considered as a practical approach for oral disease early prevention strategy (2, 4, 5). Evidence from literature suggests that caries risk assessment as a form of risk-based analysis is useful to formulate the right treatment plan, review visits and types of preventive care (2-6). It also helps clinicians to promote successful treatment outcome and identify high risk patients for early prevention (6). For patients, risk assessment of oral disease by dentist promotes patient compliance. It also reduces the need for complex clinical intervention, cost, and promotes patient satisfaction in dental treatment (7, 8).

According to Burt (2005) (9), risk is the probability for an outcome to take place following an exposure to a factor. The outcome usually refers to health outcome, disease occurrence or even mortality. As health gain or disease occurrence involves a time frame, the term ‘risk’ refers to the probability that a certain event will occur within a given period of time following an exposure to a causative factor (10).

Globally, greater attention has been given to the identification of oral disease risk indicators in dental practice for a positive dental health outcome (4, 16, 17). However, little is known about caries risk assessment in the Malaysian setting. The University of Malaya (UM) dental educators argued that it was crucial to implement caries risk assessment approach in dental caries management in the undergraduate curriculum. Utilising a caries risk assessment model to treat caries would also facilitate the integration of surgical and non-surgical caries
management in the new integrated dental program which took effect in 2011. Thus, the study aimed to develop a caries risk assessment model for those aged 15 years and above for use by the dental students. The model was based on potential caries risk indicators currently used in the Preventive Dental Clinic (PDC). Findings from this study would help towards closer integration between cariology and preventive dentistry modules in the new integrated curriculum.

METHODOLOGY

This study was a cross-sectional study based on patient records as a source of secondary data. Dental records of adult patients who attended the PDC for the first time in year 2009 and 2010 were included in the study. The inclusion criteria were patients aged 15 and above who were treated by dental students. The exclusion criteria were missing dental records, patients with full dentures and patients aged less than 15 years.

The sample size calculation was based on Malaysian adult caries prevalence in 2000 (18). Based on a 5% error, the minimum sample size was 138. There were 414 patients who attended the PDC in 2009 and 2010. In order to overcome the problem of incomplete data, it was decided that all the 414 patients were included in the study as long as the final sample above 138. The dental records were identified. Of the 414 dental records, only 359 had complete data. Patient’s information on caries experience and caries risk indicators was extracted from the oral health Risk Assessment Form (RAF) in the dental record. The information was transferred into a standard form to facilitate data entry. The RAF was a clinical pathway framework designed by the UM dental faculty to help students in patient management. It consists of a range of dental caries indicators that students can specify for each patient. The form is easy to complete and suitable to use by the students. The RAF is also used in patient oral health education and as a means to evaluate changes in patient’s caries risk and oral health status.

In UM, Year 3 and 4 dental students are encouraged to bring their new patients to the PDC for oral health education. Each patient will be assessed by the student based on the RAF caries risk indicators which included socio-demographic factors (age, gender, ethnicity), oral health behaviours (tooth brushing frequency, sugar intake, smoking status), oral health status (DMFT score), oral hygiene status, and presence of prosthesis. Laboratory-based microbial investigation and salivary test were not included as these were not available for undergraduate students during routine patient caries risk assessment.

For analysis, age was categorised into adolescent (15-20 years old), adult (21-59 years old) and elderly (60 years old and above). For ethnicity, patients were categorised into Malay, Chinese and other, i.e. Indians, Aborigines and non-Malaysians. Tooth brushing frequency was categorised into brushing once per day and two or more times per day. Intake of sugary diet was categorised into low-sugar diet (≤3 times of sugary food consumption per day including main meals) and high-sugar diet (≥ 4 times per day including main meals) groups. Smoking status was categorised into smoker (habitual smoker) and non-smoker. Occasional or past smokers were considered as non-smokers.

For oral hygiene status, percentage plaque score was recorded using the Plaque Control Record by O’ Leary et al., 1972 (19). Oral hygiene levels were categorised into excellent (plaque level = 0-20%) and fair to poor (plaque level ≥21%). Patients with dental prosthesis or appliances, i.e. partial dentures or removable/fixed orthodontic appliances were grouped into ‘yes’ (having dental prosthesis/appliance) and ‘no’ (no dental prosthesis/appliance). For caries experience (DMFT), only the decay (DT) component of coronal caries was used as the outcome variable. Coronal caries was recorded at the D3 level (cavitation into dentine) on occlusal pits or fissures, and smooth surfaces of the tooth. In the study, a tooth with a temporary filling or sealant with decayed margins was recorded as having coronal caries. In cases where the crown had damaged due to caries with roots remaining, it was assumed the caries had originated from the crown and thus recorded as coronal caries (20). As Malaysia piped water supply is fluoridated, it was assumed that almost all patients were exposed to fluoridated drinking waters at 0.5 ± 0.1 ppm.

DATA ANALYSIS

The Statistical Package for Social Sciences (SPSS) for Window version 17 was used for data analysis. In the analysis, the decay component of coronal caries was used as the dependent variable. Age, gender, ethnicity, oral hygiene status, intake of sugary diet, tooth brushing frequency, presence of dental prosthesis and smoking status were used as the independent variables. Univariate analysis of coronal caries prevalence between categories of the independent variables was assessed using chi-square test. Variables with significant association at univariate analysis were further analysed using multiple logistic regression (MLR) to develop a model for coronal caries. In the multivariate analysis, model exploration was conducted using backward and forward methods. The final model was based on the enter method using significant variables obtained from the exploration process. Approval to conduct the study was obtained from the Medical Ethics Committee of UM Dental Faculty. The significant level was set at p<0.05.

RESULTS
Of the 414 patient records, only 359 fulfilled the study criteria, with 86.7% response rate. The sample comprised more female (54.3%) than male patients (45.7%). The majority were adults (60.7%), followed by elderly (23.7%) and adolescents (15.6%). In terms of patient ethnicity, there were more Malay (43.2%) than Chinese patients (40.9%), followed by other (15.9%). More than half of the patients had low sugar diet (51.3%) and the rest had high sugar diet (48.7%). Almost two-thirds of the patients had poor-to-fair oral hygiene levels (64.9%) and the rest had good-to-excellent oral hygiene levels (35.1%). A large majority brushed teeth twice or more a day (84.7%). About one-quarter (25.6%) of the patients wore dental prosthesis or appliance. One out of ten patients was smoker (10.6%).

Table 1 shows univariate analysis of the caries risk indicators to determine the independent role of each factor on coronal caries. Three caries risk indicators were significantly associated with coronal caries, i.e. ethnicity, age group, and wearing prosthesis or appliance. Tooth brushing frequency had a near significant association with DT. Malays had the highest proportion of coronal caries (82.9 %), followed by Chinese (66.7 %) and other ethnic groups (64.9%). The difference was statistically significant (p=0.003). Adults had the highest proportion of coronal caries (83.9%), followed by adolescents (62.5%) and elderly (54.1%). The difference was statistically significant (p<0.001). Similarly, patients without prosthesis or appliance had higher proportion of coronal caries (77.2%) than patients with prosthesis or appliance (62.0%) (p<0.001). Patients who brushed once a day (59.0%) had higher proportion of DT compared

<table>
<thead>
<tr>
<th>Risk Indicator</th>
<th>Total n (%)</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>164 (45.7%)</td>
<td>119 (72.6%)</td>
<td>45 (27.4%)</td>
<td>0.700</td>
</tr>
<tr>
<td>Female</td>
<td>195 (54.3%)</td>
<td>145 (74.4%)</td>
<td>50 (25.6%)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malay</td>
<td>155 (43.2%)</td>
<td>128 (82.9%)</td>
<td>27 (17.4%)</td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>147 (40.9%)</td>
<td>98 (66.7%)</td>
<td>49 (33.3%)</td>
<td>0.003*</td>
</tr>
<tr>
<td>Other</td>
<td>57 (15.9%)</td>
<td>37 (64.9%)</td>
<td>20 (35.1%)</td>
<td></td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adolescent</td>
<td>56 (15.6%)</td>
<td>35 (62.5%)</td>
<td>21 (37.5%)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Adult</td>
<td>218 (60.7%)</td>
<td>183 (83.9%)</td>
<td>35 (16.1%)</td>
<td></td>
</tr>
<tr>
<td>Elderly</td>
<td>85 (23.7%)</td>
<td>46 (54.1%)</td>
<td>39 (45.9%)</td>
<td></td>
</tr>
<tr>
<td>Oral Hygiene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good to Excellent</td>
<td>126 (35.1%)</td>
<td>90 (71.4%)</td>
<td>36 (28.6%)</td>
<td>0.505</td>
</tr>
<tr>
<td>Fair to Poor</td>
<td>233 (64.9%)</td>
<td>174 (74.7%)</td>
<td>59 (25.3%)</td>
<td></td>
</tr>
<tr>
<td>Sugar Diet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>184 (51.3%)</td>
<td>129 (70.1%)</td>
<td>55 (29.9%)</td>
<td>0.131</td>
</tr>
<tr>
<td>High</td>
<td>175 (48.7%)</td>
<td>135 (77.1%)</td>
<td>40 (22.9%)</td>
<td></td>
</tr>
<tr>
<td>Brushing frequency&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>39 (10.9%)</td>
<td>23 (59.0%)</td>
<td>16 (41.0%)</td>
<td>0.058</td>
</tr>
<tr>
<td>Twice and more</td>
<td>304 (84.7%)</td>
<td>230 (75.7%)</td>
<td>74 (24.3%)</td>
<td></td>
</tr>
<tr>
<td>Presence of prosthesis &amp; appliances</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>92 (25.6%)</td>
<td>57 (62.0%)</td>
<td>35 (38.0%)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>No</td>
<td>267 (74.4%)</td>
<td>206 (77.2%)</td>
<td>61 (22.8%)</td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>38 (10.6%)</td>
<td>29 (76.3%)</td>
<td>9 (23.7%)</td>
<td>0.681</td>
</tr>
<tr>
<td>Non smoker</td>
<td>321 (89.4%)</td>
<td>235 (73.2%)</td>
<td>86 (26.8%)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> Other consists of Indian (n=50), Aborigines (n=5) and non-Malaysians (n=2)
<sup>2</sup> Sample do not equal to N=359 due to missing data
* Non-parametric statistics: Chi-square test
* The level of statistical significant was set at p=0.05
with patients who brushed two times or more (75.7%) (p=0.058).

Table 2 shows the results of MLR for a model associated with coronal caries after adjusting for age, presence of dental prosthesis, and brushing frequency. According to the model, adults were 3.31 more likely to develop coronal caries compared to adolescents. Patients without dental prosthesis or appliance were 2.25 more likely to develop coronal caries than patients who wore prosthesis or appliances. Patients who brushed once a day were 2.53 more likely to develop coronal caries than patients who brushed twice or more a day. The Hosmer & Lemeshow test was not significant indicating a good model fit with good overall predictive accuracy (classification table=76.7%). The area under the ROC curve was 0.7 indicating a fair model discrimination test.

**Table 2:** Multiple Logistic Regression analysis (MLR) to determine the significant predictors for coronal caries

<table>
<thead>
<tr>
<th>p-value</th>
<th>B (SE)</th>
<th>Lower (95% CI)</th>
<th>Odds Ratio</th>
<th>Upper (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.789</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Adults</td>
<td>0.001</td>
<td>1.197</td>
<td>1.64</td>
<td>3.31</td>
</tr>
<tr>
<td>Not wearing prosthesis &amp; appliances</td>
<td>0.007</td>
<td>-0.817</td>
<td>1.25</td>
<td>2.25</td>
</tr>
<tr>
<td>Brushing once</td>
<td>0.016</td>
<td>-0.930</td>
<td>1.19</td>
<td>2.53</td>
</tr>
</tbody>
</table>

Possible two-way interaction terms were not significant
Hosmer & Lemeshow test p-value= 0.27
Classification table: overall predictive accuracy ~ 76.7%
ROC value= 0.70

**DISCUSSION**

Despite the rich literature on risk assessment approaches for dental caries management, little is known about this approach on global adult populations, and there was no previous evidence on the suitable model involving Malaysian population.

In this study, a multi-factorial analysis of potential caries risk indicators had shown that age, tooth brushing frequency and dental prosthesis status were significant risk indicators for coronal caries.

Findings regarding tooth brushing frequency were similar to other studies whereby tooth brushing frequency was cited as one of the risk indicators for caries. Tooth brushing also correlates with lower prevalence and incidence of caries (21-23). Tooth brushing twice daily with fluoride toothpaste provides enamel protection against caries, reverses early caries lesions, neutralises saliva pH, removes plaque, and helps control oral malodour. These benefits can only be achieved with correct tooth brushing technique. According to Sutcliffe (24), an increase in the frequency of tooth brushing may not necessarily result in effective elimination of plaque if the brushing is ineffective. In the UM preventive dental clinic, patients are asked about plaque control and perception about oral health on the first visit. Then, they are taught the correct tooth brushing technique, usage of floss, benefits of fluoride toothpaste, and also given diet advice. At subsequent visits, dental plaque is re-assessed using a disposing tablet. Where necessary, methods for plaque control and oral health instructions are reinforced. Patients will be considered as being competent in plaque control when they are able to reduce plaque levels after 3 subsequent visits.

In this study, it was found that patients without dental prosthesis or appliance were significantly more likely to develop coronal caries than patients with dental prosthesis or appliances after controlling for other factors. This finding is unexpected and initially appears to contradict findings from other studies on similar topics where partial dentures (25, 26) and orthodontic appliances wearers (27) had higher risk for caries than those without prosthesis. However, findings from several recent studies on coronal and root caries have indirectly provided evidence to support our finding. Several researchers (25, 28, 29) had reported that significant associations between denture wearers and caries were only observed with root caries and not coronal caries. Studies that do not distinguish between coronal and root caries would not be able to provide such evidence. In fact, Yeung et al. (2000) (29) had conducted a 6-year follow up on a group of partial denture wearers and found significant association between contact point of partial dentures and root caries but not coronal caries. However, they do not compare the partial denture wearers with group not wearing partial dentures. Thus, as far as this study is concerned, our finding may be considered justified as we included data on coronal caries only and compare those wearing dental prosthesis and those not wearing dental prosthesis.

The effect of removable prosthesis on mouth caries is still debatable (28). There were studies that reported root caries among partial denture wearers as the result of poor oral hygiene and thus recommended topical fluoride to fight against caries (25, 28, 29). In this study, we assumed all patients had exposure to fluoride from toothpaste and fluoride in the water supply. Additional use of topical fluoride by patients could not be verified. However, there were possibilities that patients with dentures or orthodontic appliance had regular topical fluoride application as part of pre-prosthetic or orthodontics treatment. Thus, it could be argued that the low caries risk of patients with dentures and orthodontics appliance in the study was due to the
caries reducing effect of professionally applied topical fluoride which they received as part of the treatment plan.

There are several existing conceptual models that have been widely used to predict caries risks. There are the Caries-risk Assessment Tool by American Academy of Pediatric Dentistry (30), Caries Management by Risk Assessment by California Dental Association (12) and computerised program i.e. Cariogram for caries risk program among Swedish schoolchildren (31). However, there are variations in terms of which model is best to predict caries and the existing models mainly focus on children. The model in the present study used a combination of a simple and low cost screening tool to predict caries risk for adults. It is quite similar to a screening model developed in Singapore where a group of researchers had successfully developed and validated caries risk assessment models for use in the community and clinical settings for early detection of high-caries groups. These models are divided into a screening and an extensive model (11). The screening model includes risk factors but without laboratory tests while the extensive model involves laboratory tests, i.e. microbial analysis, salivary test and plaque pH. The risk assessment model developed in our study seems practical for routine use by undergraduate students, in the community setting and private clinic. It may also be used as a screening tool to identify high-risk patients for caries for further assessment using laboratory tests.

Individual summary of caries risk assessment is often associated with preventive advice such as counselling, modified personal oral health behaviours, professional preventive procedures, and dental treatment (2, 32). The evidence from this study indicates the need for dental students to develop competence in prevention strategy by practicing risk assessment in patient’s management. Furthermore, dental caries shares common risk factors with major chronic diseases such as obesity and diabetes which make risk assessment even more important (33, 34). By undertaking prevention therapy such as oral health education, it would benefit patient’s oral health and also general health. Some researchers suggest that students’ experience in delivering oral health education to patients during undergraduate training could help them expand the prevention concept into holistic patient management. They would also be more likely to become interested in the overall well-being of their patients (35).

Guiding students to undertake caries risk assessment in the PDC and to provide oral health education and prevention is not without difficulties. Past interviews with students, and through lecturers’ observations, suggest that students remain doubtful over the benefit and effectiveness of patient oral health education. In general, students feel spending time in the PDC is less worthy and less compelling than treating patients. To overcome this, dental educators in UM have integrated caries risk assessment and clinical management of caries into theory and clinical curriculum for Year 3 and 4 of the new dental programme.

Several dental schools which have started the integration have reported positive outcomes (2, 13). As such, the preventive framework for the new integrated curriculum for Year 3 and 4 would be directed at bridging the gap between surgical and non-surgical caries management taking into account the findings of this study.

UM dental faculty has incorporated caries risk assessment and oral health education as a competence requirement in the preventive dentistry module. Students must be competent in three key areas of plaque control advice, diet advice and smoking cessation as part of a holistic approach towards total patient care. For example, for every new patient, a student is expected to carry out caries risk assessment, formulate a diagnosis, conduct a relevant oral health education program and do follow-ups. Each case is verified by a lecturer using an evaluation sheet. Apart from treating sufficient number of cases in the clinic, the student is required to achieve a satisfactory grade in a required number of patients in the preventive module before they are allowed to sit for the final professional examination. In the examination, the preventive and cariology module questions are integrated with the aim to evaluate student’s understanding on the theory and practical aspects of both modules.

This study has several limitations. Only information from the oral health RAF and caries charting from the dental records were available for assessment. These were completed by students and might contain some errors in the data recording and diagnosis. However, the students were required to verify their findings with a lecturer in charge throughout the session. Thus, any errors that might occur would have been kept to a minimum.

One may query the validity of the RAF used in the study and its limited information. The RAF was designed for use in the Malaysian setting based on literature review and through expert group discussions by dental public health lecturers in UM dental faculty. The risk indicators used in the RAF were comparable with other studies elsewhere (6, 13, 14). As such, it was deemed valid, relevant and suitable to be used as a data collection method in the faculty.

Further studies are recommended to evaluate the effectiveness, cost-benefit and health outcome of the model. Although indicators of risk are proven to be useful in caries management, more studies are required to establish the evidence of its effectiveness in long term management of high risk individuals (36). Future research should also focus on the acceptability of the caries risk assessment model by different stakeholders namely patients, students and lecturers.

CONCLUSION

The study indicates that patient’s age, toothbrushing frequency and prosthesis status are the risk indicators
in the caries risk assessment model for adults to predict coronal caries.

REFERENCES


ORAL HEALTH RELATED QUALITY OF LIFE AND PERIODONTAL STATUS OF A SELECTED MALAYSIAN ADULT POPULATION: A PILOT STUDY

N.S. Abdullah, N.F.M. Radzali, R. Saub, R.D. Vaithilingam.
Annal Dent UniV Malaya 2013 (2): 16-23

ABSTRACT

Aim: To assess the oral health related quality of life (OHQoL) of a selected population of Malaysian adults and to compare the OHQoL by periodontal status. Material & Methods: This cross-sectional study comprises a convenient sampling of fifty subjects from the Primary Care Unit, Faculty of Dentistry, University of Malaya. OHQoL was assessed using the Malaysian version of Oral Health Impact Profile-14 (OHIP-14). Basic periodontal examination (BPE) was performed on all subjects to determine their periodontal status. Descriptive statistics and bivariate analysis were performed. Results: Psychological discomfort, physical pain and psychological disability domains were the most affected dimensions in this population. Subjects with income levels >RM2,500 had higher impacts on their OHQoL as compared to those from other income levels (p<0.05). 78% of the subjects had some form of periodontitis (BPE scores 3 or 4) with the other 22% recording healthy/gingivitis status (BPE 0, 1 or 2). Subjects with periodontitis experienced higher impacts on OHQoL as compared to those with healthy/gingivitis in nearly all domains (p>0.05). Conclusion: Subjects with high income levels had high impacts on their OHQoL. Those with periodontitis experienced higher impacts on their OHQoL as compared to those who had a healthy periodontium or gingivitis and affected a wide range of domains of quality of life.

Keywords: Oral health related quality of life, chronic periodontitis, basic periodontal examination, oral health impact profile, gingivitis.

INTRODUCTION

Oral health related quality of life (OHQoL) has been defined as a multidimensional construct that reflects people’s comfort when eating, sleeping and during interaction; their self-esteem; and their satisfaction with respect to their oral health (1). Several researchers (2, 3) identified the shift in the perception of health from merely the absence of disease and infirmity to complete physical, mental and social wellbeing as the key issue in the conceptions of health related quality of life (HRQoL) and, subsequently OHQoL. OHQoL is therefore an individual’s assessment of how the following affect his/her well-being: functional factors, psychological factors, social factors, and experience of pain/discomfort in relation to orofacial concerns (3). Various tools have been used to measure OHQoL such as the OHQoL-UK, Geriatric (General) Oral Health Assessment Index (GOHAI) and Oral Health Impact Profile (OHIP).

Chronic periodontitis, the most common type of periodontal disease, is characterised by loss of clinical attachment due to the destruction of the adjacent periodontal supporting structures. National clinical oral epidemiological studies from developed countries have repeatedly estimated that over 90% of the general population has some form of periodontal disease (4, 5). In addition, studies have reported that between 10% and 20% of the population in most countries have severe forms of periodontal disease (6, 7). In a recent national oral health survey conducted in Malaysia, 94% of Malaysian adults were reported to present with periodontal conditions and 18.2% of these subjects have advanced periodontal disease (8).

A wide range of clinical signs and symptoms are produced in chronic periodontitis such as gum bleeding or recession and tooth mobility. Some of these signs and symptoms may have a considerable impact on the patients’ day to day life or life quality (9). Traditionally, when assessing periodontal status, dental researchers have focused on clinically-driven outcome measures such as probing pocket depths and probing attachment levels. This has been done at the expense of more subjective patient-
driven measures such as that perceived by functional status and psychological wellbeing (10-13) These clinically-driven measures have been used particularly in the fields of cariology, oral rehabilitation, to some extent in oral surgery and oral medicine as well as periodontology. Over the last 15 years, there has been increasing interest in how periodontal disease and its treatment affect the well being of patients (14).

Measurements of the impact of periodontal conditions on OHQoL should be a part of the evaluation of oral health needs because clinical indicators alone cannot describe the satisfaction or symptoms dental patients’ experience or their ability to perform daily activities. Studies have shown that patients with chronic periodontitis have reported negative impacts upon physical comfort, functional limitation, psychologic function or other domains of everyday life (12, 13, 15). Thus far, no known study has reported the OHQoL impacts on periodontitis in Malaysians. The present study was carried out to assess the OHQoL of a selected population of Malaysian adults and to compare the OHQoL by periodontal status.

MATERIALS AND METHOD

Study population
This cross-sectional pilot study enrolled patients using a convenient sampling method from the Primary Care Unit, Faculty of Dentistry, University of Malaya. Subjects who fulfilled the inclusion/exclusion criteria were selected. The inclusion criteria were individuals aged 30 years and older, had at least 12 teeth present (excluding third molars) and subjects were free from systemic diseases. Subjects who had received periodontal treatment or antibiotics within the past 4 months or who were pregnant were excluded from the study. The nature of the study was explained to the subjects. A written informed consent was obtained from all subjects who wished to participate in the study. The examination period was between June to August 2011 and a total of 50 subjects enrolled in this study. Ethical approval was obtained from the Ethics Committee, Faculty of Dentistry, University of Malaya (DF PE1103/0037(L)).

Questionnaire
The questionnaire gathered information on socio-demographics of subjects including age, gender, ethnicity, level of education and income level. Subjects were also enquired on oral health related habits like smoking habits, alcohol consumption and dental visits, as well as oral health practices such as brushing frequency, interdental cleaning and mouth rinsing.

The OHQoL was assessed using the Malaysian version of the Oral Health Impact Profile (OHIP)-14 which contains 14 items that was derived and validated by Saub et al (2005). The Malaysian OHIP-14 is specifically tailored to the Malaysian population and is available in English or Malay translation (16, 17). Subjects were asked to rate the impact of their oral health on 14 key areas of OHQoL which were grouped under 7 different domains, which are Functional Limitation, Physical Pain, Psychological Discomfort, Physical disability, Psychological disability, Social disability and Handicap. The questionnaire was conducted as a face-to-face interview.

Basic periodontal examination
Four examiners, comprising a periodontist and three dentists (who have been trained to use Basic periodontal examination [BPE]) attached to the Primary Care Unit carried out the oral examination. BPE was used to screen all subjects to determine the periodontal status of these subjects. The WHO probe which is a tapered, rod-like instrument and calibrated in millimetres with blunt rounded tip was used for the BPE. BPE divides the full dentition into six sextants. These six sextants consists of i) four groups of teeth each comprising molars (excluding third molars) and premolars of one side of one jaw and ii) two groups of teeth each comprising canines and incisors of one jaw. All teeth in the sextants were examined. The probe was inserted into the sulci/pockets around the teeth in each sextant and the highest score for each sextant was recorded. BPE scores were given as 0= Healthy, 1= Bleeding on probing, 2= Presence of calculus or plaque retention factors, 3= Probing depth between 3.5 mm and 5.5 mm and 4= Probing depth more than 5.5 mm.

Before the study commenced, intra and inter-examiner reproducibility was conducted on 7 subjects and all examiners showed good reproducibility (All kappa scores were more than 80%). The highest score recorded for each subject was determined as the subject score. Patients were then divided into two categories: healthy/gingivitis when their BPE score was 0, 1 or 2 and periodontitis if their BPE scores were 3 or 4.

Data Analysis
For each item in the OHIP questionnaire, subjects were given a Likert scale chart to choose answers from a six point scale: 1=very often, 2=quite often, 3=sometimes, 4=seldom, 5=never and 6=don’t know (18). Missing value and “don’t know” responses were imputed by the mean for the question. Two parameters for OHIP were computed (19): prevalence of impact (the percentage of subjects reporting impacts “very often/ quite often”, “sometimes” or “seldom/ never”) and severity (the sum of response codes of the 14 items). For the prevalence of impact, subjects reporting categories “very often/ quite often” are considered to have high impact”, ‘sometimes” as moderate impact and “seldom/ never” as having low impact. Given the response codes, OHIP scores can range
from 14 to 70; lower values indicating more frequent impact (9).

Since the data was not normally distributed and sample size was small, non-parametric tests, Mann-Whitney U test and Kruskall Wallis was used to analyse the difference between total OHIP-14 score with sample characteristics, oral hygiene practices/ habits and oral health status. The level of significance was set at 0.05 for all tests. Statistical analysis was done using the SPSS 12.0 statistical package.

RESULTS

Sociodemographic characteristics and mean OHIP scores of all subjects

A total of 50 subjects with age ranging from 30-74 years comprising of 23 males (46%) and 26 females (52%) were examined in this study (Table 1). The majority of subjects (94%) had completed their education up to secondary school level. No significant differences were detected between age, ethnicity, gender and educational levels and OHIP scores. However, income level had a significant impact on OHQoL. Subjects earning RM1,500- RM2,500 (middle income group) had the lowest impact on their OHQoL while those earning >RM2,500 had the highest impact on their OHQoL (p=0.04).

Habits / oral health practices and mean OHIP scores of all subjects

Oral health practices/habits of subjects were assessed as shown in Table 2. Seventy percent of the subjects never smoked and 72% of them never consumed alcohol. Majority of the subjects brush their teeth twice daily (82%) and were irregular dental attendees (68%). Sixty six percent of the subjects performed interdental cleaning while 64% use mouth rinse. There were no significant differences between practices/ habits like smoking, consuming alcohol, dental visits, interdental cleaning, and mouth-rinsing with mean OHIP scores.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>OHIP scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>30-44 years</td>
<td>27 (54)</td>
</tr>
<tr>
<td>45-59 years</td>
<td>16 (32)</td>
</tr>
<tr>
<td>60-74 years</td>
<td>7 (14)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>Malay</td>
<td>22 (44)</td>
</tr>
<tr>
<td>Chinese</td>
<td>24 (48)</td>
</tr>
<tr>
<td>Indian</td>
<td>4 (8)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23 (46)</td>
</tr>
<tr>
<td>Female</td>
<td>26 (52)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>3 (6)</td>
</tr>
<tr>
<td>Secondary</td>
<td>27 (54)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>20 (40)</td>
</tr>
<tr>
<td><strong>Income level</strong></td>
<td></td>
</tr>
<tr>
<td>&lt; RM 1,500</td>
<td>15 (30)</td>
</tr>
<tr>
<td>RM 1,500-RM</td>
<td>20 (40)</td>
</tr>
<tr>
<td>&gt; RM 2,500</td>
<td>15 (30)</td>
</tr>
</tbody>
</table>

* Refers to Mann-Whitney test for gender and Kruskal-Wallis test for age, ethnicity, education level, and income level.

Table 2: Habits/ Oral health practices and mean OHIP scores of all subjects

<table>
<thead>
<tr>
<th>Habits/Practices</th>
<th>OHIP scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>12 (24)</td>
</tr>
<tr>
<td>Former</td>
<td>3 (6)</td>
</tr>
<tr>
<td>Never</td>
<td>35 (70)</td>
</tr>
<tr>
<td><strong>Alcohol</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10 (20)</td>
</tr>
<tr>
<td>Former</td>
<td>4 (8)</td>
</tr>
<tr>
<td>Never</td>
<td>36 (72)</td>
</tr>
<tr>
<td><strong>Brushing</strong></td>
<td></td>
</tr>
<tr>
<td>1x/day</td>
<td>3 (6)</td>
</tr>
<tr>
<td>2x/day</td>
<td>41 (82)</td>
</tr>
<tr>
<td>&gt;2x/day</td>
<td>6 (12)</td>
</tr>
<tr>
<td><strong>Dental visit</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;2x/year</td>
<td>4 (8)</td>
</tr>
<tr>
<td>&gt;2x/year</td>
<td>12 (24)</td>
</tr>
<tr>
<td>Irregular</td>
<td>34 (68)</td>
</tr>
<tr>
<td><strong>Interdental cleaning</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>33 (66)</td>
</tr>
<tr>
<td>No</td>
<td>17 (34)</td>
</tr>
<tr>
<td><strong>Rinsing</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>32 (64)</td>
</tr>
<tr>
<td>No</td>
<td>18 (36)</td>
</tr>
</tbody>
</table>

* Refers to Mann-Whitney test for interdental cleaning and rinsing and Kruskal-Wallis test for smoking status, alcohol consumption, brushing frequency and dental visits.

Oral health status and mean OHIP scores of all subjects

Oral health status of the sample population was assessed as shown in Table 3. Majority of the subjects had less than 5 missing teeth (80%). 78% of the subjects had some form of periodontitis (BPE scores 3 or 4) but only 22% of...
them had a periodontium that was either healthy or with gingivitis (BPE scores 0, 1 or 2).

Mean OHIP scores and oral health status of all subjects were assessed as shown in Table 3. There was no significant difference between number of missing teeth and with mean OHIP scores. The mean OHIP scores for healthy/gingivitis was 60.64(±5.4) while the mean OHIP scores for periodontitis subjects was 58.18(±7.1). This demonstrates that the periodontitis subjects have a higher impact on their OHQoL. However this difference was not significant.

<table>
<thead>
<tr>
<th>Table 3: Oral Health status and mean OHIP scores of all subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral health status</td>
</tr>
<tr>
<td>No of missing teeth</td>
</tr>
<tr>
<td>&lt; 5 teeth</td>
</tr>
<tr>
<td>≥5 teeth</td>
</tr>
<tr>
<td>Periodontal status</td>
</tr>
<tr>
<td>Healthy</td>
</tr>
<tr>
<td>Gingivitis (BPE 0&amp;1&amp;2)</td>
</tr>
<tr>
<td>Periodontitis,</td>
</tr>
<tr>
<td>(BPE 3&amp;4&amp;*)</td>
</tr>
</tbody>
</table>

* Refers to Mann-Whitney test for number of missing teeth/periodontal status

Prevalence of impact for individual items response for all subjects.

The prevalence of OHQoL impact of all 50 subjects was assessed as shown in Table 4. The most affected domains of quality of life were psychological discomfort, physical pain and psychological disability domains.

Under the psychological discomfort domain, majority of subjects reported that food impaction (28%) and feeling shy because of problems with their oral condition (8%) would affect their OHQoL. For the physical pain domain, 12% of the subjects reported that they often felt discomfort while eating and another 6% often experienced oral ulcers. Under the functional limitation domain, only 6% of subjects reported that difficulty in chewing food and having bad breath affects them at a frequent rate. For the handicap domain, 6% of subjects reported spending money & feeling less confident of their oral condition. Under the physical disability domain, 6% of subjects reported that they avoided eating certain food.

<table>
<thead>
<tr>
<th>Table 4: Prevalence of impact for individual items response for total population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>Functional limitations</td>
</tr>
<tr>
<td>Difficulty in chewing</td>
</tr>
<tr>
<td>Bad breath</td>
</tr>
<tr>
<td>Physical pain</td>
</tr>
<tr>
<td>Eating discomfort</td>
</tr>
<tr>
<td>Oral ulcer</td>
</tr>
<tr>
<td>Psychological discomfort</td>
</tr>
<tr>
<td>Food lodged</td>
</tr>
<tr>
<td>Shy</td>
</tr>
<tr>
<td>Physical disability</td>
</tr>
<tr>
<td>Avoid eating</td>
</tr>
<tr>
<td>Avoid smiling</td>
</tr>
<tr>
<td>Psychological disability</td>
</tr>
<tr>
<td>Sleep disturbance</td>
</tr>
<tr>
<td>Concentration disturbance</td>
</tr>
<tr>
<td>Social disability</td>
</tr>
<tr>
<td>Avoid going out</td>
</tr>
<tr>
<td>Daily activities disturbed</td>
</tr>
<tr>
<td>Handicap</td>
</tr>
<tr>
<td>Spending money</td>
</tr>
<tr>
<td>Less confident</td>
</tr>
</tbody>
</table>

The prevalence of impact for individual items response by periodontal status

The prevalence of impact for individual items response by periodontal status (healthy/gingivitis and periodontitis subjects) are as shown in Table 5. The percentage for individual items response for periodontitis subjects were higher than that reported for the healthy/gingivitis group in all domains except for ‘feeling shy’ (psychological discomfort domain), ‘to avoid eating’ (physical disability domain) and ‘sleep disturbance’ (psychological disability domain). Food getting lodged between teeth (psychological discomfort domain) had the highest impact in the periodontitis group as compared to the healthy/gingivitis group.
The present study investigates the OHQoL as well as periodontal status and its impact on the quality of life of adult subjects who attended the Primary Care Unit, Faculty of Dentistry, University of Malaya. The findings in this study demonstrated high impacts on their OHQoL in the psychological discomfort, physical pain and psychological disability domains. This is in agreement with McGrath & Bedi (2002) who concluded that effect of oral health on quality of life for the British population was considerable, with many individuals experiencing negative impacts across a broad range of physical, social and psychological aspects of life quality (20). An understanding and knowledge of the relationship between clinical and subjective indicators will enable the dental practitioner to make rational decisions about what oral conditions require treatment and the type of treatment that is needed for a given condition with the available resources (21).

Income level was the only sociodemographic factor found to be significant with the OHQoL. Those who have income levels >RM2,500 had higher impacts on their OHQoL than those subjects with other income levels. This finding is in agreement with Araújo et al. (2010) (15) who detected that OHQoL impacts were significantly associated with income level. The reason for the higher income group having higher impacts on their OHQoL may be due to their higher expectations of oral health as compared to the lower income categories (20).

No significant difference was found between gender and OHQoL in this study. This finding is in agreement with Fernandes et al. (2006) (22). In contrast, Mason et al (2006) found a positive relationship between gender and OHQoL (23). They concluded that life course influences on oral-health-related quality of life appear different for men and women, which may have implications for the effectiveness of public health interventions and health promotion. In the current study we have failed to show this difference and this may be due to the small sample size in this pilot study. A future study with an adequately powered sample size may be able to capture this difference.

In this study there was no significant difference between age and OHQoL. These findings are not in agreement with findings from previous studies (15, 20, 24). McGrath and Bedi (2002) demonstrated that OHQoL tended to decrease with age (20). In contrast, Araújo et al. (2010) and Steele et al (2004) showed an increase in OHQoL with increasing age (14, 24). Araújo et al. (2010) concluded that these differences may indicate distinct differences in the way oral health is perceived upon quality of life at different ages or stages in life (15). Bryla et al. (2013) demonstrated that age on its own was

### DISCUSSION

Table 5: The prevalence of impact for individual items response by periodontal status

<table>
<thead>
<tr>
<th></th>
<th>Healthy/ Gingivitis</th>
<th>Periodontitis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very/ quite often n (%)</td>
<td>Sometimes/ seldom n (%)</td>
</tr>
<tr>
<td><strong>Functional limitations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Difficulty in chewing</td>
<td>0(0)</td>
<td>4(36.4)</td>
</tr>
<tr>
<td>• Bad breath</td>
<td>0(0)</td>
<td>6(54.6)</td>
</tr>
<tr>
<td><strong>Physical pain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Eating discomfort</td>
<td>1(9.1)</td>
<td>4(36.4)</td>
</tr>
<tr>
<td>• Oral ulcer</td>
<td>0(0)</td>
<td>8(72.8)</td>
</tr>
<tr>
<td><strong>Psychological discomfort</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Food lodged</td>
<td>2(18.2)</td>
<td>7(63.7)</td>
</tr>
<tr>
<td>• Shy</td>
<td>2(18.2)</td>
<td>0(0)</td>
</tr>
<tr>
<td><strong>Physical disability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Avoid eating</td>
<td>1(9.1)</td>
<td>2(18.2)</td>
</tr>
<tr>
<td>• Avoid smiling</td>
<td>0(0)</td>
<td>4(36.4)</td>
</tr>
<tr>
<td><strong>Psychological disability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sleep disturbance</td>
<td>1(9.1)</td>
<td>3(27.3)</td>
</tr>
<tr>
<td>• Concentration disturbance</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Social disability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Avoid going out</td>
<td>0(0)</td>
<td>0(0)</td>
</tr>
<tr>
<td>• Daily activities disturbed</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Handicap</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Spending money</td>
<td>0(0)</td>
<td>7(63.6)</td>
</tr>
<tr>
<td>• Less confident</td>
<td>0(0)</td>
<td>3(27.3)</td>
</tr>
</tbody>
</table>
not a determining factor but when combined with other variables such as diseases as well as mental and physical disabilities it could significantly decrease quality of life. In the current study, all subjects were systemically healthy with no mental or physical disabilities and this may explain the lack of an association between age and OHQoL (25).

Fernandes et al. (2006) found the impacts on OHQoL of patients who were smokers to be higher than non-smokers (22). In the present study, current smokers showed a higher trend for having impacts on their OHQoL compared to former smokers and never smokers; however this difference was not significant. The negative effect of smoking on OHQoL is probably due to the harmful effects of smoking on oral tissues (26).

In this study, 22% of the sample population was diagnosed as being periodontally healthy/gingivitis while 78% of the sample population was diagnosed as having periodontitis. Periodontitis subjects demonstrated higher impacts on their OHQoL as compared to healthy/gingivitis subjects but the difference was however not significant. The findings in the present study corroborate with the study by Araújo et al. (2010) who demonstrated that highest impact on OHQoL were those of patients with a diagnosis of chronic or aggressive periodontitis (15). Needleman et al. (2004) detected that OHQoL-UK scores were correlated with the number of teeth with pocket depths of 5 mm or more (12). In the present study, the reason for there not being a significant difference could have been the small sample size (50 subjects) as compared to the study by Needleman et al. (2004) and Araújo et al. where the numbers were 205 and 401 subjects respectively (12, 15).

The finding that with decreasing number of teeth, the perceived OHQoL tended to decrease has been observed in previous studies (24, 27, 28). In the present study, there was no significant difference between numbers of missing teeth with OHQoL and again this may have been due to the small sample size in the current study.

In this study, individual items response for OHIP-14 in periodontitis subjects were higher than that reported for the healthy/gingivitis group in nearly all domains. Food getting lodged between teeth (psychological discomfort domain) had the highest impact in the periodontitis group as compared to the healthy/gingivitis group. This is in agreement with Saito et al. (2010) who detected that pain, eating and chewing, and psychologic function were identified as compromised OHQoL domains (29).

The negative impacts faced across this broad range of domains demonstrate that the effect of periodontitis on quality of life of this selected Malaysian population was considerable. This finding may change the perception of chronic periodontitis being categorised as a silent disease.

The current study was designed to eliminate all probable confounding factors such as systemic diseases and pregnancy. Self-perceived health is thought to be the end result of the effects of systemic diseases, disabilities, and limitations of daily activities (30). Wee et al. (2005) demonstrated that subjects with diabetes and multiple co-existing chronic medical conditions have reported poorer HRQoL than those without these conditions (31). They found that the co-existence of other chronic medical conditions in diabetic subjects led to further lowering of HRQoL in an additive, rather than synergistic or subtractive fashion. In this study, we excluded patients who had systemic diseases such as Type 1 or Type 2 diabetes as well as pregnant subjects in order to eliminate the effect it may have on their quality of life.

This study has used basic periodontal examination (BPE) to assess the periodontal status. BPE assessments have the marked advantage of being quick with minimal subject discomfort. However, BPE has the potential to underestimate the prevalence of periodontal breakdown in populations with less susceptibility or overestimate the prevalence when based on the measurements of lifetime cumulative attachment loss (32, 33, 34). In contrast, full mouth charting assessments as performed in a number of epidemiological studies will provide optimal examination of periodontal conditions (35). Although it is desirable to record as many sites as possible to increase the probability of detecting disease prevalence, one of the main drawbacks of full mouth assessments is that it can be time consuming. BPE is currently being used as a screening tool for all periodontal patients in the Primary Care Unit of the Faculty of Dentistry, University of Malaya. In this study, since the patients were obtained from this unit, it was decided that BPE would be used as the examination method to determine the periodontal status of the subjects in this study.

Various methods have been used to develop oral specific health status measures. Since its development, the OHIP-14 has been preferred to the OHIP-49 by a number of researchers due to its practicability (22). In this study the OHIP-14 questionnaire was done as a two way interview whereby the evaluator asks the questions and the subjects are given a flash card with the range of answers from which they can choose. This two-way interaction method between subject’s and evaluators reduces error, dishonesty and inaccuracy when compared to one way interaction method while answering the OHIP-14 questionnaire.

CONCLUSION

In this study, the selected population had high impacts on their OHQoL in the psychological discomfort, physical pain and psychological disability domains. Those with income levels >RM2,500 had higher impacts on their OHQoL than those subjects from other income levels. Subjects with periodontitis demonstrated higher impacts on their OHQoL as compared to those who have healthy periodontium/gingivitis, affecting a wide range of OHQoL domains. The findings from this pilot study will
form the basis for implementing a future study with a larger sample size which will increase the validity of this study. It is also recommended that future studies should include assessments of full mouth periodontal charting as compared to BPE as this will increase the probability of detecting disease prevalence.

ACKNOWLEDGEMENTS

The authors would like to thank Dr Leilawati Sulaiman, Dr Anand Ramanathan and Dr Fadya Abdul fattah Mustafa as well as the staff of the Primary Care Unit, Faculty of Dentistry, University of Malaya for their assistance in carrying out this research. This study was supported by a research grant received from the Ministry of Higher Education (UM.C/HIR/MOHE/DENT/04).

REFERENCES


TISSUE RESPONSE OF TYPE 2 DIABETICS TOWARDS NON-SURGICAL PERIODONTAL THERAPY: A RETROSPECTIVE, COMPARATIVE STUDY WITH NON-DIABETICS - A PRELIMINARY INVESTIGATION

D. Swaminathan, Y.C. Goh, S.L. Lau, A. Ramanathan.
Annal Dent Univ’ Malaya 2013; 20(2): 24-28

ABSTRACT

The purpose of this study was to assess the tissue response of Type 2 diabetic subjects towards non surgical periodontal therapy as compared with matched, non-diabetic subjects. This was a retrospective, comparative study using periodontal case notes of 40 subjects attending undergraduates’ periodontal clinics (20 diabetics, 20 non-diabetics), who were selected based on the inclusion and exclusion criteria. Response towards non surgical periodontal therapy was assessed through three clinical periodontal parameters, namely plaque score, gingivitis score and number of periodontal pocket ≥5mm at the baseline and after initial non surgical periodontal therapy. Data obtained was then analyzed by SPSS Version 12. Both diabetic and non-diabetic subjects showed significant improvements (p-value = 0.021; 0.000; 0.010; 0.014; 0.001) in all three parameters after the therapy. However, when comparison was made between the two groups, there was no significant difference (p-value = 0.913; 0.892 and 0.903) in any of the parameters. Periodontal conditions improved clinically in both diabetic and non-diabetic subjects after non-surgical periodontal therapy. Therefore, both groups responded similarly towards the therapy and thus it can be postulated that well-controlled diabetic status does not have a significant effect on the outcome of periodontal therapy.

Keywords: Type 2 Diabetes, periodontal disease, non surgical periodontal therapy

INTRODUCTION

Diabetes mellitus is one of the most common non-communicable diseases globally. It is now a major public health concern with the increasing prevalence globally (1). Diabetes mellitus has been listed as the 8th cause of death in the 10 principal causes of death in Malaysia in 2008. Statistics showed 1.7% of medically certified death in Malaysia in 2008 was due to diabetes mellitus (2).

There are two main classes of diabetes, insulin-dependent Type 1 diabetes and non-insulin dependent Type 2 diabetes (3). Type 1 diabetes mellitus is a chronic childhood disease characterized by absolute insulin deficiency with destruction of the pancreatic beta cells being the most common cause (4). Type 2 diabetes mellitus is characterized by decreased response of target tissue to the normal levels of circulating insulin due to the insulin resistance (4).

Periodontal disease is one of the most common dental conditions. Presently, periodontal disease is a group of inflammatory diseases that affect the supporting tissues of the teeth (5,6). Gingivitis is gingival inflammation associated with plaque and calculus accumulation (7). It is characterized by the presence of clinical signs of inflammation that are confined to the gingival and shows no attachment loss of the associated tooth (8). Untreated long standing gingivitis can progress to the more advanced form of periodontal disease known as periodontitis (9). Periodontitis is an inflammatory condition of the supporting structures of teeth resulting from plaque biofilm attached to tooth surface and resulting in progressive destruction of periodontal tissues (5, 7).

Relationship between diabetes mellitus and periodontal disease has been extensively studied. A number of oral diseases and disorders have been associated with diabetes mellitus. Periodontal disease has been identified as the sixth complication of diabetes mellitus and those with diabetes mellitus are said to have twice the risk of periodontal infection (10). Many studies have showed diabetes mellitus as the risk factor for periodontal disease and levels of glycemic control appears to be an important determinant in the relationship between diabetes mellitus and periodontal disease.
The aim of this retrospective study was to assess the response of Type-2 diabetic subjects towards non-surgical periodontal therapy.

MATERIALS AND METHODS

Subject Selection
Case notes of 2463 were obtained from undergraduates of Faculty of Dentistry, University of Malaya. Twenty subjects’ case notes that were treated in the periodontal clinic were selected in each group (control group and diabetic group) which fulfilled the inclusion and exclusion criteria using purposive sampling.

Inclusion Criteria
(a) Cases
Subjects with Type 2 diabetes mellitus whose diagnosis had been established (WHO diagnostic criteria) and were on regular follow-up in the Diabetes Clinic, University Malaya Medical Center for a minimum of 2 years and have been diagnosed with periodontal condition (chronic periodontitis) were selected.

(b) Control
Subjects who are non-diabetic were included in this study. Subjects with their age ranged ± 5 years compared with their diabetic counterparts who were then matched according to their diagnosed periodontal condition were selected.

For both cases and controls, only patients’ folders which had the complete medical history on their diabetic status and had a history of being well controlled diabetics were chosen for this study. All subjects included should have at least 12 teeth present. According to the case reports, each chosen subjects had undergone through examination, received and completed initial non-surgical periodontal therapy and had been reviewed by undergraduates of the Faculty of Dentistry. All the subjects included had their case notes duly checked and signed by the specialist on duty during the session.

Exclusion Criteria
Subjects with a history of poorly controlled diabetics were excluded. Those pregnant, smokers, immune-compromised, on steroid therapy or radiation therapy and on other systemic modulating factors were also excluded. Subjects who did not complete the initial non-surgical periodontal therapy or those who received periodontal treatment elsewhere within past 3 months or received periodontal therapy during the interval between examination and review after the initial non-surgical periodontal therapy were also excluded. Those subjects with incomplete case notes or with case notes that was not duly checked by specialist on duty were also excluded.

Periodontal Parameters
In this study, periodontal parameters taken into consideration included plaque score, gingivitis score and the number of periodontal pocket ≥5mm. These parameters were measured at 6 sites per tooth (mesiobuccal, mid buccal, distobuccal, distolingual, mid lingual, and mesiolingual). Both plaque and gingivitis score was assessed by using Visible Plaque Index and Bleeding on Probing Index (11) respectively and were then tabulated into percentage.

Statistical Analysis
Data entry and analysis was done using Statistical Program for Social Science (SPSS) Version 12.0. In order to evaluate the response towards non-surgical periodontal therapy in test and control group respectively, paired-samples T test was applied for plaque score parameter while Wilcoxon Signed Ranks test was used for gingivitis score as well as number of periodontal pocket ≥5mm. In order to determine if there was any difference in the response towards non-surgical periodontal therapy between test and control group, Independent T test was employed for plaque score while Mann-Whitney Test for the other two parameters.

RESULTS
Out of the three parameters examined among test subjects, only plaque score demonstrated a normal distribution while gingivitis score and number of periodontal pocket ≥5mm both displayed positively skewed distribution. As such, plaque score readings were analyzed by using paired-samples T-test. A decrease of 15.71 value of plaque score was observed after the therapy (p-value <0.05) in case subjects.

Wilcoxon Signed Ranks test was carried out to determine and compare median values for both gingivitis score and number of periodontal pocket ≥5mm. The non-parametric test showed a decrease of 9.91 for gingivitis score and 5.50 for number of periodontal pocket in median values and both p-values were significant with values of 0.000 and 0.001 respectively, as shown in Table 1.

Control subjects displayed normal distribution for both plaque score and number of periodontal pocket while the gingivitis score was positively skewed. A decrease of 16.65 value of plaque score was observed after the therapy and p-value (0.010) attained from paired-samples T-test was statistically significant. The same parametric test was employed for number of periodontal pocket and the findings included a decline (5.55 mm) and a significant p-value (0.001).
Table 1: Clinical parameters among cases and control subjects before and after non-surgical periodontal therapy

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>p-value</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(SD)</td>
<td>(IQR)</td>
<td>(SD)</td>
<td>(IQR)</td>
<td></td>
<td>(SD)</td>
<td>(IQR)</td>
<td>(SD)</td>
<td>(IQR)</td>
<td></td>
</tr>
<tr>
<td>Plaque score</td>
<td>46.50</td>
<td>30.79</td>
<td>-</td>
<td>-</td>
<td>0.021a</td>
<td>52.00</td>
<td>35.35</td>
<td>-</td>
<td>-</td>
<td>0.010a</td>
</tr>
<tr>
<td>Gingivitis score</td>
<td>-</td>
<td>-</td>
<td>27.17</td>
<td>17.26</td>
<td>0.000*</td>
<td>-</td>
<td>-</td>
<td>41.86</td>
<td>19.19</td>
<td>0.014*</td>
</tr>
<tr>
<td>(44.40)</td>
<td>(16.76)</td>
<td>(24.62)</td>
<td>(30.97)</td>
<td>(24.62)</td>
<td></td>
<td>(8.57)</td>
<td>(9.53)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of pocket ≥5mm</td>
<td>-</td>
<td>-</td>
<td>9.00</td>
<td>3.50</td>
<td>0.001*</td>
<td>11.75</td>
<td>6.20</td>
<td>-</td>
<td>-</td>
<td>0.010a</td>
</tr>
<tr>
<td>(8.00)</td>
<td>(6.00)</td>
<td>(8.57)</td>
<td>(9.53)</td>
<td></td>
<td></td>
<td>(8.00)</td>
<td>(10.25)</td>
<td>(7.00)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a represents p-value determined by paired-samples T-test
*b represents p-value determined by Wilcoxon Signed Ranks test
p-value <0.05 was set to be statistically significant

Table 2: Clinical parameters between cases and control subjects

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Case (n=20)</th>
<th>p-value</th>
<th>Control (n=20)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Median (IQR)</td>
<td>Mean (SD)</td>
<td>Median (IQR)</td>
</tr>
<tr>
<td>Plaque score</td>
<td>15.71</td>
<td>16.65</td>
<td>0.913a</td>
<td></td>
</tr>
<tr>
<td>(28.02)</td>
<td>(25.92)</td>
<td>(25.92)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gingivitis score</td>
<td>-</td>
<td>14.85</td>
<td>0.892*</td>
<td></td>
</tr>
<tr>
<td>(22.20)</td>
<td>(22.20)</td>
<td>(43.76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of pocket ≥5mm</td>
<td>-</td>
<td>5.00</td>
<td>0.903*</td>
<td></td>
</tr>
<tr>
<td>(10.25)</td>
<td>(7.00)</td>
<td>(7.00)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a represents p-value determined by Independent T test
*b represents p-value determined by Mann-Whitney test
p-value <0.05 was set to be statistically significant

Wilcoxon Signed Ranks test, which was utilized in gingivitis score, resulted in a pre therapy reading of 41.86 and post therapy reading of 19.19. The non-parametric test also established a significant p-value of 0.014 (Table 1).

As both test and control subjects displayed normal distribution for plaque score, this parameter was analyzed by using Independent-T test. The parametric test exploited the mean values for both groups of subjects and obtained a statistically insignificant p-value of 0.913.

A difference of 5.73 was observed from the median values between cases and control subjects after the data was evaluated using Mann-Whitney test. This reported difference, however, did not suggest any significance as the non-parametric test concluded a value of p-value>0.05. The same value of 5.00 was obtained for both test and control groups in the term of number of periodontal pocket ≥5mm after the data from both groups were explored using Mann-Whitney test. P-value (0.903) acquired from the test did not propose any significance like both the other two parameters (Table 2).

It is apparent that a large number of subjects displayed positive response towards the therapy given (Figure 1). No less than 75% improved after the therapy in all three parameters form both groups (Figure 1).

DISCUSSION

A previous study was carried out to assess the severity of periodontal disease in subjects with type 2 diabetes mellitus when compared to matched, healthy subjects using the information from the selected patients’ case notes. Although no conclusive results were obtained from this retrospective study, there were clinical differences in the...
severity of the disease in both the groups which indicated that the periodontal status of non diabetic subjects was marginally but not statistically better (unpublished work). This study, also using case notes, compared the tissue response of non surgical periodontal treatment in subjects with type 2 diabetes mellitus and healthy subjects. It has to be emphasized again that the results of these studies were not conclusive as the diabetic status of the subjects selected could not be determined as the fasting blood glucose levels and HbA1C levels before and/or after non-surgical periodontal therapy of the subjects in the test group were not obtained from the patients’ case notes which is the limitation of this study.

Both groups showed similar response in short term periodontal healing after the therapy and the presence of diabetes does not appear to have a major affect on the success of periodontal therapy. However, the results of this retrospective study and as concluded from another study, indicated that there was no significant difference between response of diabetic and non diabetic subjects towards non surgical periodontal therapy (12).

It has been suggested that the diabetic status must not be a deterrent that restrict diabetic patients from certain procedures and research carried out so far were focused more on well-controlled diabetic patients. Thus the same cannot be said for uncontrolled diabetic patients. Joint effort between oral health and medical practitioners should be emphasized in treating diabetics, especially poorly controlled diabetics so as the patients may experience full benefits of the therapy they received and respond well to it.

Oral health professionals should also be able to recognize the signs and symptoms of diabetes in their patients, especially for type 2 diabetes mellitus, as the disease can remain undiagnosed for years because hyperglycemia appears gradually and often without symptoms (13). Oral health professionals may be the first line of health care providers to alert the patients of their condition as the disease itself may have oral manifestations.

**CONCLUSION**

Periodontal conditions improved clinically in both diabetic and non-diabetic subjects after non-surgical periodontal therapy. Therefore, both groups responded similarly towards the therapy and thus it can be postulated that well-controlled diabetic status does not have a significant effect on the outcome of periodontal therapy. However, limitation of this study was that, fasting blood glucose levels and HbA1C levels could not be determined before and/or after non-surgical periodontal therapy. Therefore, presently a clinical trial is being carried out to compare the response of diabetic subjects and healthy subjects to non surgical periodontal treatment. This clinical trial involves the participation of medical colleagues who are monitoring.
the blood glucose levels (HbA1C) of the subjects before and after non surgical periodontal treatment and we hope to get more conclusive results of the periodontal tissue status and the status of glucose levels before and after non surgical periodontal treatment in the diabetic and non diabetic subjects.

REFERENCES


Conventional oral squamous cell carcinomas are readily recognized histopathologically but the presence of additional atypical features may be challenging from a diagnostic point of view. We present a case of a well-differentiated oral squamous cell carcinoma with pseudo-glandular differentiation and discuss the possible differential diagnoses on a histopathological basis. Accurate diagnosis is imperative for timely and appropriate intervention and denotes distinctive prognostic implications. The presence of perivascular and perineural infiltrations as observed in this case would indicate the need for further post-operative therapeutic decision-making aimed at controlling local spread as well as distant metastases.

**Keywords:** Oral squamous cell carcinoma, pseudo-glandular, adenoid, gland-like, histopathology, diagnosis

**INTRODUCTION**

Squamous cell carcinoma (SCC) is the most common form of oral malignancy and majority present as well-differentiated or conventional keratinizing squamous cancers. However, additional characteristic histological features and clinical behavior distinguish the rare variants or subtypes of SCC from the conventional SCC. These constitute in aggregate, approximately 10-15% of all SCCs in the upper aerodigestive tract (1). Histologic subtypes of oral SCC include spindle cell carcinoma (sarcomatoid), basaloid squamous cell carcinoma, adenosquamous carcinoma, adenoid squamous or acantholytic carcinoma, papillary or exophytic squamous cell carcinoma, verrucous carcinoma and carcinoma cuniculatum (1, 2, 3). Besides academic interest, recognition of these subtypes is vital as each exhibits unique histomorphological appearance which raises several differential diagnostic considerations, and distinctive prognostic implications (1).

**CASE REPORT**

A 69 year old Chinese man presented to the Department of Oral and Maxillofacial Surgery (OMFS), Faculty of Dentistry, University Malaya on the 23rd of March 2011 with a complaint of a painless, progressively growing ulcer at the right lower jaw for the past 4 months. The patient was a non-smoker but suffered a myriad of medical problems including hypertension, benign prostatic hyperplasia, unrepaired right inguinal hernia, chronic constipation, chronic hyponatremia, major depression complicated by obsessive-compulsive disorder-like symptoms, suspected early dementia, treated glaucoma and cataract. He also had a history of repeated falls and sustained fractured fingers and clavicle.

Extraoral examination showed that the right submandibular lymph node was palpable, mobile, non-tender and measured about 1 cm in diameter. A dental panoramic radiograph and a lower occlusal radiograph did not show any underlying bony involvement. Upon intraoral examination, there was an ulcerated swelling at the buccal sulcus in the region of teeth 45, 46 and 47. It measured approximately 5 cm x 5 cm and extended upwards towards the upper dentition and lower edentulous area. Tooth 47 was displaced lingually and had grade II mobility. The base of the swelling was indurated but the surface was friable. An incisional biopsy was taken from the ulcerated swelling and was submitted for histopathological examination. Subsequent microscopic evaluation revealed a well-differentiated SCC arising from the overlying dysplastic epithelium and randomly invading the underlying connective tissue. The tumour epithelium exhibited well-differentiated squamous cells, keratin pearl formation and distinct intercellular bridges. Mitoses were less than 2 per 10 HPF (high power field). The invasive front was blunt, presenting in a Type 1 pattern.A mild chronic inflammatory cell infiltrate was present. Adjacent to the tumour was normal epithelium. Lymphovascular permeation was not evident.

CT (computed tomography) scan found a 2.5 x 2.3 x 2.3 cm mass eroding the right mandible which was...
consistent with a carcinoma but there was no evidence of metastasis. A wide excision of the tumour with marginal mandibulectomy was done on the 11th of April 2012 with post-operative radiotherapy to follow.

Histopathological examination of the surgical specimen returned a diagnosis consistent with the biopsy report. Sections of the main tumour showed a solid malignant epithelial neoplasm with an exophytic fungating component and an endophytic component that extended deep into the submucosal tissues. The neoplastic epithelium showed an admixture of squamous and pseudoglandular differentiation (Figure 1).

Keratin production was moderate to marked. Mitotic count was 3 per 10 HPF. Lymphovascular invasion was not evident. The tumour advancing front consisted of large tumour islands and smaller clusters randomly invading the submucosa. Tumour extended to involve the surgical margins. A diffuse chronic inflammatory cell infiltrate was present in the intervening stroma. Special stains did not show the presence of mucous-secreting cells within the tumour epithelium. There were tumour nests juxtaposed to the blood vessel wall and epineurium in some areas from the specimen labeled inferior alveolar nerve (Figure 2). Tumour involvement of the bone was evident with positive marrow spread but submandibular lymph nodes were free of tumour.

Patient was last seen in OMFS clinic two weeks post operatively.

**Perivascular invasion**

**Figure 1:** (A) Pseudoglandular appearance of neoplastic epithelium due to comedo necrosis. Pseudoglandular structures (arrows) stain negative for Mucicarmine (B) and PAS (C).

**Figure 2:** H&E stains demonstrate prominent perivascular invasion by neoplastic epithelium [A] (Mag x 10).
DISCUSSION

In the present case, the neoplastic epithelium showed an admixture of squamous and adenoid (gland-like) features prompting several differential diagnoses. Adenoid features could be present in several types of carcinoma, complicating the interpretation of tissue sections which may lead to misdiagnosis. Differentiation among these neoplasms is essential to ensure that appropriate clinical management is administered (4). Malignancies in consideration are the conventional SCC with or without ductal involvement, adenosquamous carcinoma, acantholytic SCC and basaloid SCC. Minor salivary gland neoplasms such as adenoid cystic carcinoma, mucoepidermoid carcinoma and adenocarcinoma with squamous metaplasia should be ruled out as well (2, 4, 5).

Adenosquamous, basaloid and acantholytic variants of SCC are biphasic, with squamous-type carcinoma being a consistent feature, lending the appearance of conventional SCC in the superficial part (1, 2). Adenosquamous carcinoma of the head and neck was first defined by Gerughty et al. in 1968 but its existence as a distinct entity remained controversial for many years as some investigators regarded it a high grade mucoepidermoid carcinoma (6). However, separation between the two entities is merited in view of the highly malignant and aggressive nature of adenosquamous carcinoma with markedly worse prognosis compared to mucoepidermoid carcinoma, as well as distinct morphologic and clinical differences (7). The precise origin of this tumour is also subject to debate with opinions divided between a mucosal origin versus a salivary gland duct origin. Regardless, there is little doubt that an origin in surface mucosa, involving squamous and ductal epithelium is paramount to the diagnosis (8). The predominant squamous cell carcinoma component which may range from well to poorly differentiated, can present as invasive carcinoma or a carcinoma in situ (1). In the deeper parts, there is an intimate mixture of squamous and adenocarcinoma components which may exist as separate, exclusive zones (9). Adenocarcinomatous component can be tubular, alveolar and/or glandular. The glandular morphology should classically consist of “punched out” spaces with smooth, rather than ragged, edges. Mucin production is typically present but is not a prerequisite for diagnosis in the presence of true gland formation (7).

Acantholytic SCC is an extremely rare variant which is more commonly found on sun-damaged skin of the head and neck and occasionally on the lower lip. Synonyms include adenoic SCC, pseudo-glandular SCC, SCC with gland-like features, angiosarcoma-like SCC and pseudovascular adenoid SCC (10). It was first described by Lever in 1947 as adenocanthoma of eccrine origin until later studies recognized it as SCC of non-eccrine origin. Muller et al. suggested the term “adenoid squamous cell carcinoma” in 1964 to avoid confusion (11). This tumour is characterized by acantholytic or dyscohesive changes in tumour nests at the invasive front, creating a gland-like or adenoid appearance (9). Many of the pseudo-glandular spaces contain acantholytic and dyskeratotic epithelial cells. Mucin stains are always negative in this lesion and evidence of glandular differentiation is absent. In contrast, the duct-like structures in adenosquamous SCC contain intraepithelial or intraluminal sialomucins and the lining cells show ductal differentiation (11).
Basaloid SCC is a high grade variant with poor prognosis first described by Wain et al. in 1986. Later in 1991, it was included in the WHO’s revised classification of tumours of head and neck as a distinct entity (12). The basaloid component is composed of small, hyperchromatic cells with scanty cytoplasm and peripheral palisading arranged into lobular, cord-like, cribriform, tubular and glandular or nest patterns (1). Comedonecrosis is often seen in the central areas of lobules (3, 9). Islands of basaloid cells may be surrounded by and contain droplets of PAS-positive hyaline material in a pattern reminiscent of adenoid cystic carcinoma. The hyaline material represents entrapped stroma or excessive basement membrane material (2, 12).

The presence of adenoid features necessitates careful exclusion of salivary gland neoplasms. Identifying dysplastic overlying epithelium will help distinguish primary salivary gland neoplasms such as mucoepidermoid carcinoma from SCC and its variants (4, 8). In instances where secondary fusion of salivary carcinoma with oral epithelium can simulate a surface origin, the presence of epithelial dysplasia elsewhere in the oral cavity or oropharynx provides circumstantial evidence of a genuine surface origin (2).

On occasions, conventional SCC has been found to extend along salivary ducts where the cancer cells have been found to replace normal ductal cells. Normal ductal luminal cells positively stained with CK7+/CK20- would demonstrate the transition from salivary ducts to SCC whereas squamous cells lining pseudo ducts would stain negative (10, 11). Conventional SCC entrapping seromucinous glands of the upper respiratory tract may lead to a misdiagnosis of adenocarcinoma. However, the entrapped glands do not show atypical cytological features (6). The present case exhibits notable distance between the neoplastic epithelium and the underlying minor salivary glands which does not favour a primary salivary gland origin (13).

Mucoepidermoid carcinoma is defined by WHO as a malignant glandular epithelial neoplasm characterized by mucous, intermediate and epidermoid cells, with columnar, clear cell and oncocytoid features (14). It frequently affects major salivary glands, most commonly the parotid glands (15). When it occurs in the minor salivary glands, it usually grows beneath the surface epithelium without breaching it or only infiltrating it subsequently (6). Several histological characteristics helpful in distinguishing mucoepidermoid carcinoma from adenocarcinoma SCC are absence of dysplastic overlying epithelium, lobular arrangement and presence of intermediate cells (1, 6, 9, 10, 16). In addition, mucus cells and intraepithelial and ductal sialomucins are readily recognized in mucoepidermoid carcinoma which is not the case here (10).

Adenoid cystic carcinoma (ACC) is a basaloid tumour consisting of epithelial and myoepithelial cells in variable morphologic configurations, including tubular, cribriform and solid patterns. It has a relentless clinical course and usually a fatal outcome (14). Solid variant may resemble basaloid SCC but it should be distinguishable by its characteristic pattern of infiltration, encircling stroma and its preferential perineural spread. There should also be demonstrable ductal structures with a mucin-positive cast in the lumen (2). In solid ACC, comedo necrosis and squamous differentiation is not common while dysplastic surface epithelium is generally absent in ACC (9). Unlike oral SCC, it usually does not have prominent pleomorphism, mitoses or necrosis and tends to metastasize to distant sites rather than cervical lymph nodes (1).

Basal cell adenocarcinoma and salivary duct carcinoma (SDC) merit a mention by virtue of their resemblance to basaloid SCC. Basal cell adenocarcinoma may show squamous differentiation with keratin formation and may merge with or ulcerate the mucosa, raising comparisons with basaloid SCC (2). On the other hand, presence of comedo necrosis in solid areas of SDC may resemble basaloid SCC. The lack of an SCC component and dysplasia in surface epithelium, the associated growth patterns found in SDC and presence of tumour cells with a prominent eosinophilic cytoplasm will help to exclude SDC (9).

In the present case, negative mucin stains with Periodic Acid Schiff and Mucicarmine, coupled with a dysplastic overlying epithelium essentially excluded the possibility of a salivary gland origin or involvement. Absence of true duct formation supports this observation as well as negating adenocarcinoma as a diagnostic possibility. Extensive comedo necrosis noted throughout the lesion resulted in areas with pseudo-glandular appearance mimicking that in a basaloid SCC and an anaplastic SCC. However, a lack of basaloid proliferation and convincing anaplastic component in the deeper tumoral tissue components preclude these diagnoses.

It is generally known that in reporting oral malignancy, the absence or presence of vascular, nerve and bone invasions form part of the minimum core dataset. Vascular invasion is a relatively poor predictor of nodal metastasis whereas neural invasion predicts a more aggressive disease. The presence of bone involvement by tumour is important for staging of oral malignancies. In the current case, positive involvement of all three above-mentioned structures constitutes important pathological findings which when taken together with the clinical data can be utilized by the surgeon for further post-operative therapeutic assessment and prognostication.

CONCLUSION

This is a case of well-differentiated squamous cell carcinoma of the right buccal mucosa presenting with
pseudo-glandular differentiation. It is important to rule out other carcinomas with adenoid features because of the prognostic implications and for appropriate therapeutic decisions.

REFERENCES

SALIVARY PROTEIN PROFILING FOR TYPE 2 DIABETES MELLITUS PATIENTS WITH AND WITHOUT PERIODONTITIS

Chan Hang Haw
Department of Oral Biology and Biomedical Sciences

Introduction: Type 2 diabetes mellitus (T2DM) is a metabolic disorder in which the blood glucose level is higher than normal as a result of the body not producing enough insulin or the body cells not responding to the insulin produced. The number of people diagnosed with T2DM is increasing at an alarming rate. It has been reported in several studies that T2DM will increase the risk of having periodontitis. Objectives: The first objective of the study was to screen for potential proteins in saliva as biomarkers associated with periodontitis and T2DM. The second objective was to identify the potential biomarkers and its relativeness to the diseases. Methods: Volunteers for the study were patients from the Diabetic Unit, University of Malaya Medical Centre, whose periodontal status was determined. The diabetic volunteers were divided into two groups, i.e., patients with periodontitis and those who were periodontally healthy. Saliva samples were collected and treated with 10% TCA/acetone/20 mM DTT to precipitate the proteins, which were then separated using two-dimensional polyacrylamide gel electrophoresis. Gel images were scanned using the GS-800TM Calibrated Densitometer. The protein spots were analyzed and expressed in percentage volumes. The percentage volume of each protein spot was subjected to Mann-Whitney statistical analysis using SPSS software and false discovery rate correction. Results: When the expression of the salivary proteins was compared between the T2DM patients with periodontitis with those who were periodontally healthy, seven proteins, including polymeric immunoglobulin receptor, plastin-2, actin related protein 3, leukocyte elastase inhibitor, carbonic anhydrases 6, immunoglobulin J and interleukin-1 receptor antagonist, were found to be differentially expressed ($p < 0.01304$). This implies that the proteins may have the potential to be used as biomarkers for the prediction of T2DM patients who may be prone to periodontitis. Comparison between the T2DM patients who were periodontally healthy and non-T2DM volunteers who were periodontally healthy, two proteins, including zinc-alpha-2-glycoprotein and complement C3 were found to be differentially expressed ($p < 0.01304$). The proteins may have the potential to be used as biomarkers for prediction of T2DM disease itself. Three proteins namely polymeric immunoglobulin receptor, interleukin-1 receptor antagonist and complement C3 were validated using western blotting method with specific antibodies. Conclusion: The proteins that are differentially expressed may have the potential to be used as biomarkers to detect patients who are likely to suffer from T2DM and also T2DM patients who are prone to periodontitis.

THE EFFECT OF SURFACE TREATMENT AND LUTING CEMENT ON THE MICROTENSILE BOND STRENGTH OF CEREC CAD/CAM ALL CERAMIC CROWNS TO DENTINE

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Department of Restorative Dentistry

Objectives: To evaluate the microtensile bond strength ($\mu$TBS) and failure mode of Cerec CAD/CAM all ceramic crowns bonded to dentine using different surface treatments and luting cements. Methods: Fifty four human premolars were prepared for all-ceramic crowns. Occlusal dentine was cut flat and polished using 600 grit carbide paper. Fifty four all ceramic crowns were fabricated using Cerec ceramic blocs and CAD/CAM system (Sirona GmbH, Germany). The fitting surfaces were treated with either (1) 9% hydrofluoric acid etchant (N=18), (2) 9% hydrofluoric acid followed by silane coupling agent (N=18) or (3) no treatment (N=18). Each group was subdivided into a group of six for cementation with three different cement (i) Calibra, (Dentsply/Caulk, USA) (ii) RelyX U200 (3M/ESPE, USA) (iii) Fuji Plus (GC, Japan) respectively. After 24h of water storage at 37°C, all specimens were thermocycled 500 times in a bath of distilled water at 5 to 55°C. Each crown was then sectioned to produce two 1 mm2 microbars. The microbars were subjected to a microtensile load testing using a universal testing machine (Shimadzu, Japan) at crosshead speed 1mm/min. Debonded specimens were examined under stereomicroscope and SEM to determine the mode of failure. The Kruskal-Wallis test was used to detect the overall significance, followed by Mann-Whitney U tests for multiple pairwise comparisons ($P=0.05$). Result: Significant difference in $\mu$TBS was found within HF acid groups ($P=0.04$). Mann-
Aim: The aim of this study was to evaluate the fracture resistance and the failure mode of endodontically treated molars teeth restored with different intra-radicular techniques. **Methodology:** Seventy five human mandibular molars were randomly divided into five equal groups (N=15). One group of sound teeth was used as control and received no intraradicular restoration. Remaining teeth were decoronated 2 mm above CEJ, root-canal treated and received the following intraradicular restoration according to the assigned group: 1. amalgam core only; 2. prefabricated titanium post in the distal canal with amalgam core; 3. composite core only; 4. fibre post in the distal canal with composite core. Non-precious metal crowns were fabricated and cemented on the prepared specimens with Rely X U200 resin cement. All specimens were subjected to compressive load at crosshead speed 0.5 mm/min, 25° to the long axis of the tooth. Mode of failure was also recorded. Statistical analysis was performed using One-way ANOVA and the level of significance was set at p = 0.05. **Results:** Post hoc’s multiple pairwise comparisons revealed that there were no significant difference in the mean failure load among the four different intra-radicular techniques (p >0.05). The groups with composite core and amalgam core showed significantly lower fracture resistance than the control group (p=0.025, p=0.041 respectively). The composite core with fibre post and amalgam core with titanium posts showed the highest percentage of favourable failures (67%) and unfavourable failures (87%) respectively. **Conclusions:** Different intra-radicular techniques did not have significant influence on the fracture resistance when 2mm of ferrule and full coverage crown were provided. Fibre post with composite core as the intra-radicular restorations revealed the highest favourable failure mode and the titanium post with amalgam core revealed the highest unfavourable failure mode. All four intraradicular techniques tested may be used for restoring endodontically treated molars. However; titanium post with amalgam core must be used with caution due to high risk of unfavourable failure.

**FRAC TURE R ESISTANCE OF ENDODONTICALLY TREATED MOLARS RESTORED WITH DIFFERENT INTRA RADICULAR TECHNIQUES**

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Department of Conservative Dentistry

**Introduction:** The nut of *Areca catechu* (areca nut) and gambir (*Uncaria gambier*) are wrapped in *Piper betle* leaf making the ingredients of what the Malaysian called “sireh” or betel quid. Sometimes slaked lime is added to it. It has been reported that the respective ingredients of betel quid except slaked lime have wide spectrum of therapeutic and antioxidant properties. However the bioactivity of betel quid has not been clearly reported. **Aim:** The aim of this study was to investigate the antioxidant and cytoprotective activities of betel quid containing ingredients in the proportions usually consumed by the locals in Malaysia. **Methodology:** The correlation between cytoprotective and antioxidant activities with phenolic content was also determined. Five samples (betel leaf, areca nut, gambir, betel quid and betel quid containing slaked lime) were extracted in deionised distilled water for 12 hours at 37 oC. Antioxidant activities were evaluated for radical scavenging activity using DPPH assay, reducing power using FRAP assay and lipid peroxidation inhibition activity using FTC assay. Total phenolic content (TPC) was determined using Folin-Ciocalteu procedure. Phenolic composition was analysed using LCMS/MS. Cytoprotective activity of the extracts using human gingival fibroblast cells was examined by MTT assay. **Results:** The results showed that gambir had the highest DPPH (IC50 = 6.397 ± 0.79 μg/ml), FRAP (5717.8 ± 537.6 μmol Fe(II)/mg), TPC (1142.46 ± 106.79 μg TAE/mg) and cytoprotective activity (100.08± 4.62%) than areca nut and betel leaf. Betel quid when compared with betel quid containing slaked lime had higher DPPH (IC50 = 59.345 ± 4.38 μg/ml), FRAP (1022.2 ± 235.7 μmol Fe(II)/mg), TPC (139.98 ± 22.30 μg TAE/mg) and cytoprotective activity (113.49 ± 15.91%). However, all of the five extracts showed good lipid peroxidation inhibition...
compared to vitamin E. LCMS/MS analysis revealed the presence of quinic acid as the major compound of gambir and betel quid. A positive correlation was observed between TPC and radical scavenging ($r = 0.972$), reducing power ($r = 0.981$) and cytoprotective activity ($r = 0.682$).

**Conclusions:** The study concluded that betel quid without the slaked lime (prepared according to the proportion that is consumed by Malaysian) exhibited positive antioxidant and cytoprotective activities and this may be attributed to its phenolic content.

**HIGH THROUGHPUT MUTATIONAL PROFILING OF SIGNALING MOLECULES IN ORAL SQUAMOUS CELL CARCINOMA**

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**Introduction:** Comprehensive characterization of mutations in cancer provides us with important clues on the genes that are involved in driving carcinogenesis, and affords the opportunity for these genes to be used for diagnostic and therapeutic purposes. In particular, specific mutations in cancer-associated genes (often referred to as “actionable mutations”) have been demonstrated to be useful for matching patients with the treatment that would most benefit clinically. Although these genetic aberrations are well characterized in cancers such as breast and colorectal cancers, information on the mutational profile of these “actionable mutations” remains limited for oral squamous cell carcinoma (OSCC). **Objectives:** This study aims to comprehensively characterize mutations in genes within oncogenic signaling pathways to identify cancer pathways that are frequently deregulated in OSCC. **Methodology:** In this study, comprehensive characterization of 238 ‘actionable mutations’ across 19 oncogenes in 133 OSCC samples was performed using matrix-assisted-laser desorption time-of-flight (MALDI-TOF) Sequenom® MassARRAY®; OncoCarta™ panel v1.0 assay and Sanger sequencing. In addition, PTEN protein expression was analyzed by IHC. **Results:** Oncogenic mutations were detected in 10/133 (7.5%) OSCC patients. Out of the 19 genes that were analyzed, mutations were found in two genes, with mutation frequencies of 3% and 6% in *HRAS* and *PIK3CA* respectively. Oncogenic mutations were found more frequently in patients without metastasis ($p = 0.032$). The negative regulator of PI3K was also analyzed in this study where 18/40 (45%) OSCC tissues were detected with the loss of PTEN expression, suggesting that PI3K pathway is activated in these patients. **Conclusion:** The results from this study further enhances the understanding and insights of the molecular basis of oral carcinogenesis and more importantly, the lack of actionable hotspot mutations that are commonly seen in other solid tumors argue strongly for the need of a more comprehensive characterization of genetic alterations associated with OSCC for the development of new diagnostic and therapeutic tools.

**CLAUDIN EXPRESSION PATTERNS IN THE KERATOCYSTIC ODONTOGENIC TUMOUR**

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Department of Oral Pathology, Oral Medicine and Periodontology

**Introduction:** Keratocystic odontogenic tumour (KCOT) formerly known as odontogenic keratocyst (OKC) having high recurrence rate and aggressive invasive behaviour as unique characteristics of KCOT. **Aims and Objectives:** The present study was aimed at determination of claudin (CLDN) expression patterns in KCOT, in comparison with radicular and dentigerous cysts. Its role in the invasiveness and tumorigenesis of KCOT were explored. **Materials and Methods:** Samples of 23 KCOT, 10 radicular cysts and 9 dentigerous cysts were provided by the archives of the Department of Oral Pathology, Oral Medicine and Periodontology. The paraffin-embedded sections were immunohistochemically stained (Envision™ Detection System) using CLDN-1,-3,-4,-5 and -7 antibodies (Abcam Inc., Cambridge, MA, USA). Distribution patterns of all CLDN antibodies were analysed and their immunoreactivity was semiquantitatively scored in both epithelium and connective tissues in each case. **Results:** The samples showed variable immunoreactivity to CLDNs. CLDN-4 was strongly expressed in KCOT as compared to dentigerous and radicular cysts; however a significant downregulation of CLDN-3 and CLDN-5 was found in the basal layer of KCOT. CLDN-1 and -7 had mild to moderate expression patterns in all cases. In most of the cases, radicular cyst showed mild to moderate immunoreactivity for all CLDN proteins except for strong expression of CLDN-1. A mild to moderate immunoreactivity for all CLDN proteins was found in majority of dentigerous cyst cases. A significant difference was found between immunopositivity of epithelial lining and connective tissue staining. Fibroblast and endothelial cells were expressed mostly very weak or negative. Suprabasal epithelial cells showed strong immunoreactivity to all CLDN proteins in comparison with basal cells in most cases. An overexpression of CLDN-4 and underepression of CLDN-3 and CLDN-5 in KCOT suggested different pathways in tumour development and its invasive behaviour respectively. **Conclusion:** Altered expressions of CLDN-3,-4 and -5 indicate promising targets for tumour detection in KCOT.
SEROEPIDEMIOLOGY OF HPV 16 E6 AND E7 ONCOPROTEINS IN PATIENTS WITH ORAL SQUAMOUS CELL CARCINOMA

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Introduction: Oral squamous cell carcinoma (OSCC) is a serious global health problem. Cigarette smoking, alcohol consumption and betel quid chewing are established risk habits of OSCC. Human papillomaviruses (HPV) have been suggested to be an important etiological agent of oral cancer. However, the evidences on the association of HPV and OSCC are inconclusive because a wide range in the prevalence of HPV has been reported in numerous studies. Thus, there is a need to establish a standard HPV detection method to investigate the prevalence of HPV and hence to investigate the true association between HPV infection and OSCC. Objectives: The objectives of this study are to detect the presence of antibody against the HPV 16 oncoproteins E6 and E7 in serum of OSCC patients and healthy normal controls, to determine the prevalence of HPV 16 seropositivity among Malaysian OSCC patients and to determine the association of HPV 16 infection with OSCC risk in the Malaysia population. Methodology: In the methodology, HPV 16 E6 and E7 antigens were constructed in recombinant plasmids as glutathione-s-transferase (GST) fusion proteins. A GST-capture ELISA has been established using these constructed antigens and optimized. Fifty (50) healthy control serum samples and 50 serum samples from OSCC patients were tested in this HPV ELISA. Prevalence of HPV 16 seropositivity was determined and statistical analysis was performed to determine the association of HPV 16 seropositivity and risk of oral cancer. Results: HPV 16 E6 and E7 recombinant antigens were successfully constructed and expressed in Escherichia coli BL 21 cell lysate. Expressed recombinant antigens were validated using SDS-PAGE and western blot. The calculated cutoff values for HPV 16 E6 and HPV 16 E7 ELISA were 0.008 and 0.009 respectively. HPV blocking assay was used to validate this established ELISA using selected positive and negative control sera from serum pool. Thirty percenta (30%) of cases and 16.0% of controls were found to be HPV 16 E6 positive, and E7 was positive in 18% of cases and 14% of controls. The variation of HPV 16 serology prevalence in male and female subjects was revealed. The adjusted risk of OSCC was elevated among those male subjects positive for HPV 16 E6 (OR=21.739, 95% CI=1.302-333.333) and HPV 16 E6 and E7 (OR=21.739, 95% CI=1.302-333.333). Furthermore, suggested significant increased risk of OSCC was also observed in HPV 16 E6 and E7 double positivity among those non-betel quid chewers when variation of HPV 16 serology in different habit group was examined (OR=12.987, 95% CI=0.927-166.667). No significant association was found between HPV 16 seropositivity and site of tumour and survival rate. Conclusion: In summary, a simple and convenient HPV 16 E6 and E7 ELISA assay has been established in this study. A significant association of HPV 16 E6 and E7 seropositivity with increased risk of OSCC in male subjects was revealed. Interestingly, HPV 16 E6 and E7 seropositivity also showed potential association with increased risk for developing OSCC in non-betel quid chewers. In concordance with some previous studies, this study presents additional evidence of HPV infection in OSCC patients in Malaysia. These preliminary findings warrant future investigation using a larger sample size.
Conferences, Seminars, Lectures and Workshops organized by the Faculty of Dentistry, University of Malaya

1. Seminar: “Dare to Dream: My Exciting Research Journey” by Dr. Tan Aik Choon (Assistant Professor, University of Colorado Denver), Faculty of Science, UM 11/7/2013.

2. Seminar: “Systems biology in oncology drug development” by Dr. Tan Aik Choon (Assistant Professor, University of Colorado Denver), Seminar Room, Level 1, High Impact Research (HIR) Building, 16/7/2013.

3. Seminar: “Precision oncology: the past, present and future of cancer treatment” by Dr. Tan Aik Choon (Assistant Professor, University of Colorado Denver), Faculty of Medicine, UM, 17/7/2013.


7. Conference: “Faculty Research Day – Expanding Research Horizon” by Dr. Sia Chong Huat and Postgraduate Students at Auditorium, Level 11, Postgraduate and Research Tower, Faculty of Dentistry, UM, 24/9/2013.

8. Lecture: “Hospital Dentistry” by Dr. Graeme Ting (Visiting Consultant- Special Care Dentistry) at Lecture Hall, Level 9, Postgraduate and Research Tower, Faculty of Dentistry, UM, 9/10/2013.

9. Lecture: “Dental Aids for Hospital Based Patients” by Mrs. Helen Tan (Representative from Glaxosmithkline SDN BHD) at Lecture Hall, Level 9, Postgraduate and Research Tower, Faculty of Dentistry, UM, 10/10/2013.


11. “Seminar on the Latest Technology of a Compact Scanning Probe Microscopy” by Mr. KY Tay (Technical Manager, Hi-Tech Instrument) at Lecture Hall, Level 9, Postgraduate and Research Tower, Faculty of Dentistry, UM, 18/11/2013.

12. Seminar: “Sandwich One2Two Session” by Prof. Dr. Cheong Sok Ching (Predicting pharmacologic response based on genetic aberrations in Asian oral cancer cell lines) and Prof. Madya Dr. Siti Adibah Othman (Defining classification of patients with cleft lip and palate using three-dimensional data) at Lecture Hall, Level 9, Postgraduate and Research Tower, Faculty of Dentistry, UM, 27/11/2013.

13. Consensus Meeting: “1st Asian Regional Consensus Meeting on Terminology and Criteria of Oral Verrucous Papillary Lesions of the Oral Cavity”, Organized by The University of Malaya’s Oral Cancer Research & Coordinating Centre (UM-OCRCC) by (i)Prof. Saman Warnakulasuriya (King’s College London) (ii)Prof. WM Tilakaratne (University of Peradeniya) (iii)Prof. Takashi Takata (Hirosima University) (iv)Prof Rosnah Zain (University Malaya) (v)Prof. Jin Kim (University of Yonsei) at Armada Hotel dan Faculty of Dentistry on 15/12/2013-18/12/2013.

15. Lecture: “Sandwich One-2-Two” by Prof Ian Paterson (Deregulated S1P signaling contributes to a more aggressive phenotype in oral squamous cell carcinoma cells) and Dr. Yap Lee Fah (Aberrant phospholipid signaling in EBV-associated nasopharyngeal carcinoma) at Lecture Hall, Postgraduate and Research Tower, Faculty of Dentistry, UM, 19/12/2013.
NEW INSTRUCTION FOR AUTHORS

The Annals of Dentistry University of Malaya (ADUM) is published annually as the official publication of the Faculty of Dentistry, University of Malaya, Kuala Lumpur, Malaysia. Since its first publication in 1994, this peer-reviewed journal strives to promote the advancement of clinical practice, dental education and scientific research in Malaysia as well as elevating the quality of patient care. An emphasis is now given to publishing and disseminating research works undertaken by dental trainees, i.e. undergraduate and postgraduate dental students, locally and globally. In line with current trend, the ADUM will be publishing forthcoming articles online before they are scheduled to appear in print.

Original research articles, and critical reviews pertaining to dentistry and its allied fields will be considered for publication at the discretion of the Editor-in-chief. If in doubt, all potential authors are encouraged to write to the Editor-in-chief prior to submission. All articles will be refereed independently by at least 2 referees. Authors of all types of articles should be aware of the following guidelines when submitting to ADUM.

I. SUBMISSION

All manuscripts must be written in English (Concise Oxford Dictionary at http://oxforddictionaries.com). They must include a title page (see detailed requirement below) and be accompanied by a cover letter, a list of suggested reviewers and the Copyright Transfer Agreement. Title pages should include the title of the manuscript, the surname(s) and initial(s) of the author(s), affiliations, address, corresponding author, abstract, total word count, total number of tables/figures and the number of references.

Cover letters should certify that the research is original, not under publication consideration elsewhere, and free of conflict of interest. It should contain the name, address and contacts (fax, telephone number and e-mail) of the author responsible for correspondence and for proofreading purpose and information whether the authors are willing to meet the cost of reproducing illustrations in colour prints (if any).

Authors are encouraged to submit the names, address, and email addresses of four preferred reviewers to facilitate the speedy review of their manuscript. Preferred reviewers cannot be colleagues at the contributors’ institution or present or former collaborators.

All authors must approve and sign the Copyright Transfer Agreement of the manuscript concerned. Manuscripts will not be reviewed until the completed form has been sent to the editorial office. In addition, authors will need to obtain permission to reproduce a previously published figure or table. The approval letter must be submitted to the editorial office.

Manuscripts can be submitted to the Editor-in-chief electronically. Electronic copy of the manuscript can be submitted by sending it as an e-mail attachment to the following address: editor.adum@um.edu.my

II. GENERAL REQUIREMENT

For hard copy submissions, print the manuscript on ISO A4 (212mm by 279mm) paper with margins at least 25mm. A margin of 40mm is required on the left border of the manuscript. Print only on one side of the paper and use double spacing throughout. Number pages consecutively beginning with the title page. Numbers shall be placed on the lower right corner of each page. Each manuscript component should begin on a new page in the following sequence:

1. Title page
2. Abstract, key words, running title
3. Text (inclusive of illustrations, figures, and/or tables)
4. Conclusions (where applicable)
5. Funding/Acknowledgement (where applicable)
6. References
7. Legends

Title Page

The title page should carry the title of the article, which should be concise but informative. It should include sufficient detail for indexing purposes but be general
Abstract, key words and running titles
The second page should carry an abstract of not more than 250 words and should state the purpose of study, brief materials and methods, the findings and principal conclusion. Please repeat the main title at the beginning, and followed by a short running title. Please provide a minimum of 6 keywords. Key words should be selected from Medical Subject Headings (MeSH) to be used for indexing of articles.

Text
The main text should include Introduction, Material and Methods, Results, Discussion, Conclusion, Acknowledgement and References, in that order respectively.

a) Introduction
Begin with a concise introduction by outlining the purpose of the research and making reference to previous relevant publications. Mention any limitation or gap in existing knowledge related to the study in question. Do not review the subject extensively and do not include data or conclusion for the work reported.

b) Materials and Methods
Describe precisely the materials/subjects used. Identify the methods, apparatus and procedures used in sufficient detail so as to allow other workers to replicate the study. Give references to established method, including statistical methods. Provide reference and brief description for methods that have been published but not well known. Describe new or modified methods and give reasons for using them and evaluate their limitations. Identify all drugs and chemicals used including generic names, dose and route of administration.

c) Results
Present results in a logical sequence in the text, tables and figures. Do not repeat in the text all the data in the tables and figures. Emphasise or summarise only important observations. Specify statistical methods used to analyse results and describe them with sufficient detail to enable a knowledgeable reader with access to original data to analyse results.

d) Discussion
Emphasise the new and important aspects of the study and the conclusion that follow from them. Do not repeat in detail, data or other materials given in Introduction or Results section. Include in the Discussion section the implication of the findings and their limitation, including implications for future research. Relate the observations to other relevant studies.

e) Conclusion
Link the conclusion to the purpose of the study to avoid unqualified statements and conclusions not supported by your data.

f) Acknowledgments
Authors are required to report all sources of support for their project or study, including but not limited to: grant funds, commercial sources, funds from a contributors’ institution. Do not refer to a study being “partially funded by the cited sources.” Consultancies and funds paid directly to investigators must also be listed. Any perceived or actual conflicts of interest need to be identified in the acknowledgments section. ADUM abides by the International Committee of Medical Journal Editors guidelines for the Ethical Considerations in the Conduct and Report of Research (http://www.icmje.org/ethical4conflicts.html). Authors are requested to include this information in the acknowledgments section and the corresponding author must confirm that all co-authors have reported any potential conflicts.

g) Figures and tables requirements
Figures (including illustrations) submitted to the ADUM should be embedded in Word documents according to the sequence they appear in the text. Tables should be viewable in a portrait view. When necessary, tables can be created in a landscape view. Original drawings, figures, charts and graphs should be professionally drawn, and lettered large enough to be read after reduction. High quality computer generated diagrams are acceptable. Prints of radiographs should be sharp and clear. Photomicrographs must include a scale and magnification shall be stated. Figures and tables should be spelt out in full when referred to in the text e.g. Figure 2 or Table 3. Figures/ images should be in TIFF, JPEG or EPS format in either greyscale or colour. Please ensure that photographs are at a high resolution of 300 pixels per inch. If a person is recognisable from a photograph, written consent of the patient to publication must be obtained by the author and a copy sent to the ADUM.

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References should be carefully checked, as their accuracy is the responsibility of the author(s). In the text, citations should be arranged in alphabetical order by last name of the first author without numbering. When citing a reference in the text, provide attribution for the subject under discussion. “et al” should be used when the cited work is by six or more contributors. When the cited work is by
two contributors, use both surnames cited in the following manner: Last Name1, Last Name2. When citing multiple references by the same author(s) in the same year, use “a,” “b,” etc. (e.g., Jones, 1980b). Multiple references should be listed in chronological order of publication, separated by semicolons. Avoid using abstracts as references. When citing a Web site, list the authors and title if known, then the URL, include the date it was accessed in parentheses. Include among the reference papers accepted but not yet published; designate the journal and add “in press.” Information from manuscripts submitted but not yet accepted should be cited in the text as “unpublished observations” in parentheses. The references must be verified by the author(s) against the original documents and checked for correspondence between references cited in the text and listed in the “References” section. All items should be listed alphabetically by the author’s last name. For multiple entries by the same author/authors, they should be cited as follows:

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4. Same author, same publication, chronologically by date of publication, using a), b), etc., to designate order

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In summary, the reference list must be attached at the end of the paper using the following format:

**Journal**


**Book, monograph & agency publication**


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Each figure must have a legend that is clear without references to the text. All legends must be summarised and printed on a single page with corresponding figure number clearly indicated.

In summary, the abstract, text, conclusion, figure legends, and tables should be combined into a single Word document. Illustrations, figures and/or tables must be embedded into the Word document according to the sequence they appear in the text. The cover letter, copyright transfer form and permission to reprint images/figures should be submitted as separate documents.

**III. SPECIFIC REQUIREMENTS**

**Guest Editorials**: Manuscripts are to be submitted by invitation only. A clear and substantiated position on issues of interest to the readership community can be considered for this manuscript type. Guest Editorials are limited to 1,000 words. No figures or tables are permitted.

**Reviews**: These manuscripts should summarize information that is well known and emphasize recent developments over the last three to five years with a prominent focus on critical issues and concepts that highlight the latest discovery and gaps of the topic being discussed. Authors interested in submitting to this section

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must contact the Editor-in-chief for submission approval and instructions. Manuscripts submitted are limited to 4,000 words (inclusive of the main text of the manuscript and acknowledgments; excluding figure legends and references) with a total of 8 figures or tables; up to a maximum of 60 references; and must contain a 250 word abstract. It is best that the authors summarize important concepts in tables or flow charts or show critical data in the form of figures.

Systematic Review: These manuscripts are generally reviews undertaken on topics of high clinical relevance to oral, dental and craniofacial research. Meta-analyses should be undertaken with sufficient numbers of studies. Manuscripts submitted are limited to 4,000 words (inclusive of the main text of the manuscript and acknowledgments; excluding figure legends and references) with a total of 8 figures or tables; up to a maximum of 60 references; and must contain a 250 word abstract. It is best that the authors summarize important concepts in tables or flow charts or show critical data in the form of figures.

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Manuscripts submitted to the ADUM are accepted for consideration giving the understanding that it contains original material that has not been submitted for publication or has been previously published elsewhere. Any form of publication other than an abstract only constitutes prior publication.

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For protocols involving the use of human subjects, authors should indicate in their Methods section that subjects’ rights have been protected by an appropriate Institutional Review Board and written informed consent was granted from all subjects. When laboratory animals are used, indicate the level of institutional review and assurance that the protocol ensured humane practices.

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