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**ORIGINAL ARTICLE**

# The study of tooth wear patterns and their associated aetiologies in adults in Kelantan, Malaysia

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tooth wear.

**Abstract** Tooth wear is the loss of tooth tissue and structures not due to caries. It can occur in various forms either attrition, abrasion, erosion, non-caries cervical lesion (NCCL) or a combination of two or more forms. The objective of this study was to determine the patterns and associated aetiologies of tooth wear among adults in Kelantan, Malaysia. This cross-sectional study involved 81 adults with tooth wear which was visually assessed using the Smith and Knight Tooth Wear Index (TWI). A questionnaire was used to seek putative aetiologies of the wear. Data were analyzed and the results were expressed as frequencies and percentages. Six thousand three hundred and eighty four tooth surfaces were examined in 1596 teeth. 17.4% surfaces had tooth wear; 80% scored 1, 18% scored 2 and 2% scored 3. Among the 81 cases of tooth wear, 29 (35.8%) had abrasion; 25 (30.9%) had attrition; 1(1.2%) had erosion while 26 (32.1%) had the combined type. Among those with abrasion, majority had the habit of eating freshwater clams (*Corbicula fluminea*) as local delicacy where most of the times people use their teeth to pry open the clam shells. Erosion was related to the pooling of carbonated drinks or beverages in the mouth before swallowing. In conclusion, most adults experienced abrasion and the most common possible associated aetiology is the way of eating clams.

## Introduction

Tooth wear is a common problem but most often left untreated. The presence of tooth wear might become more noticeable nowadays and in future, due to the current substantial decline in dental caries. This occurrence could be due to increased dental awareness and people becoming more interested in keeping their dentition healthy for a longer time which could be exposed to wear.

Tooth wear (TW) appear in several forms such as attrition, abrasion, erosion and non-caries cervical lesion (NCCL). Both clinical and experimental observations showed that individual tooth wear type rarely exist alone but interact with each other (Addy and Shellis, 2006). Tooth wear often brings discomfort and sensitivity especially during eating, drinking or tooth brushing. If left untreated, it may lead to pain or the tooth being non-vital. At an early stage of development, patients with tooth wear might not notice their problem, but some may be concerned with the aesthetic and appearance especially if anterior teeth are involved.

The prevalence and incidence of tooth wear is increasingly being reported, especially acid erosion. Tooth wear prevalence varies around the globe. A study in Sabah (Milosevic and Lo, 1996) shows that out of 148 individuals examined, 95 have TW with moderate dentine exposure and 41 have severely worn dentition. Out of the 126 subjects with TW in a Nigeria study (Oginni and Olusile, 2002); 81 had attrition, 20 had abrasion, and 9 had erosion while the remaining 16 had combination of both attrition and abrasion. Other study that examined 155 subjects attending a university dental clinic in Trinidad, West Indies (Rafeek *et al.*, 2006) found that 72%

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of them had tooth surface loss with the majority (52%) exhibiting mild, 16% with moderate and 4% with severe tooth surface loss. They found that there is an association between tooth surface loss and age, gastroesophageal reflux disease and certain dietary patterns.

An understanding of the multifactorial nature of tooth wear and its risk factors is important in the patient's diagnostic protocol and management strategy (Tomasik, 2006). It is important to recognize that tooth wear has invariably a multifactorial aetiology, which if neglected may lead to continuous loss of tooth tissue and ultimate failure in restorative care (Kelleher and Bishop, 1997).

In Malaysia, the improvement in economic status, health care and social environment has also changed the lifestyle of the individuals. Households rely on ready-made packaged or canned foods and bottled drinks and beverages such as fruit juices, soft drinks etc. This dietary pattern had been shown to contribute to tooth wear, especially dental erosion (Zero, 1996). In Kelantan region of Malaysia, tooth wear is becoming an alarming problem. Study conducted amongst 16 years old children found that 100% of the children have tooth wear mostly in enamel (Saerah *et al.,* 2006). This study examined patients attending dental clinic at HUSM, which serve some of Kelantan population. The objective of the present study was to determine the patterns and the aetiologies of tooth wear among adults in Kelantan, Malaysia. We envision that the result of this study will be useful in planning and development of preventive strategies against TW.

## Materials and methods

This is a cross-sectional study conducted in June 2008. Eighty one patients with TW among the 324 randomly selected adult patients that attend dental clinic of University Hospital, Universiti Sains Malaysia, were examined intraorally by a dentist, who is highly experienced and knowledgeable in diagnosis of tooth wear. Ethical approval was obtained from the Research and Ethics Committee, Universiti Sains Malaysia.

The sample size of the study was determined using single proportion formula, based on proportion of tooth wear pattern from a previous study (Oginni and Olusile, 2002). The calculated sample size was 74, by expecting 10% drop out rate (missing data), a total of 81 subjects was needed.

Clinical oral examination of study subjects was done in the out-patient dental clinic using a disposable mouth mirrors, dental probes and gauzes to remove food debris when necessary under the operating light on the dental chair unit. The assessment for categorization of tooth wear types are based on previous studies (Milosevic, 1998; Gandara and Truelove*,* 1999). They were examined for frequency and severity of tooth wear using the tooth wear index (TWI) of Smith and Knight (Smith and Knight, 1984) as shown in Table 1. This index was chosen due to it is user friendly, easily comparable and widely used. All examinations were carried out by the operator seated behind and the assistant to record in front of the subjects. Separate records were made of the cervical (C) surface, the remainder of the buccal (B) surface, the lingual (L) surface or palatal (P) surface and the incisal (I) or occlusal (O) surface. The approximal surfaces were not recorded. Restored or carious tooth surfaces were excluded from the analysis. Scores from 0-4 were given according to the severity of wear.

A clear history of possible aetiological factors such as parafunctional habits, oral hygiene methods, dietary habits and medical history were used in allocating the patients to the tooth wear type. A classification 'combined' was used where there was clear evidence that more than one aetiological factor is responsible for the tooth wear. Possible aetiological factors were investigated using a modified version of the questionnaire (Saerah *et al.,* 2006) which was modified by adding the history of eating freshwater clams (*Corbicula fluminea*), locally called as '*etak*', a well-known delicacy among Kelantan people that are suspected of contributing to tooth abrasion. In order to complete the questionnaire, the researcher will explained and ask the patient regarding the questionnaire's questions before filling in the information.

SPSS version 12.0 statistical software was used (SPSS Incorporation Chicago, 2003) for data entry and analysis, and the results were expressed as frequencies and percentages.

**Table 1** Smith and Knight Tooth Wear Index Scoring (1984)

| Score | Surface | Criteria |
|---|---|---|
| 0 | B/L/O/I | No loss of enamel surface characteristics |
| | C | No change in contour |
| 1 | B/L/O/I | Loss of enamel characteristics |
| | C | Minimal loss of contour |
| 2 | B/L/O | Loss of enamel exposing dentine for less than 1/3 of the surface |
| | I | Loss of enamel just exposing dentine |
| | C | Defect less than 1mm deep |
| 3 | B/L/O | Loss of enamel exposing dentine for more than 1/3 of the surface |
| | I | Loss of enamel and substantial loss of dentine but not exposing the pulp or secondary dentine |
| | C | Defect 1 - 2mm deep |
| 4 | B/L/O | Complete loss of enamel or pulp exposure of secondary dentine |
| | I | Pulp exposure or exposure of secondary dentine |
| | C | Defect more than 2mm deep or pulp exposure or exposure of secondary dentine |

## Ethical approval

Ethical approval was obtained from Research Ethics Committee (Human) of Universiti Sains Malaysia (USMKK/PPP/JEPeM [202.3(11)].

## Results

The subject population is 81 patients who had tooth wear, with ages ranging from 18 to 80 years old (mean 31.07±1.495 SD), 39 (48.1%) males and 42 (51.9%) females. 77 (95.1%) of them were Malays while 4 (4.9%) were Chinese. Among the 81 subjects, 29 (35.8%) had abrasion, 25 (30.9%) had attrition, 1 (1.2%) had erosion while 26 (32.1%) had combined type and none had NCCL (Table 2).

**Table 2** Distribution of tooth wear pattern by individuals

| Tooth wear pattern | Freq (%) |
|---|---|
| Abrasion | 29 (35.8) |
| Attrition | 25 (30.9) |
| Erosion | 1 (1.2) |
| Combination:- | 26 (32.1) |
| Attrition and abrasion | 18 |
| Abrasion and erosion | 5 |
| Attrition and erosion | 3 |
| NCCL | 0 (0) |

Freq = frequency

A total of 6384 tooth surfaces were examined in 1596 teeth. 1108 (17.4%) of these surfaces had tooth wear; 886 (80%) scored 1, 203 (18%) scored 2 and 19 (2%) scored 3, while none of the surfaces scored 4 (Table 3).

**Table 3** The scoring of tooth wear

| Tooth | Freq (%) |
|---|---|
| Total teeth | 1596 |
| Total tooth surfaces | 6384 |
| Total surface with TW | 1108 |
| Smith and Knight Score:- | |
| - Score 1 | 886 (80) |
| - Score 2 | 203 (18) |
| - Score 3 | 19 (2) |
| - Score 4 | 0 |

Freq = frequency

For the aetiological factors specifically associated with the tooth wear type, out of 29 (35.8%) adults who had abrasion , 100% of them consume freshwater clams or '*etak*' with 22 (75.9%) taking it at least once in a day, 4 (13.8%) eating it at least once in a month, and 3 (10.3%) eat it occasionally. Twenty six (32.1%) have a combined types of toothwear, 25 (30.9%) adults have attrition of which with 3 (12%) exhibiting are bruxer. For the erosion, only 1 subject is involved who has the habit of pooling the drinks in the mouth before swallowing it (Table 4).

**Table 4** Table of tooth wear pattern and its associated factors

| Tooth wear pattern and associated etiological factors | Freq (%) |
|---|---|
| **Abrasion (n=29)** | |
| Type of bristle brush used | |
| ▪ Hard | 0 (0) |
| ▪ Medium | 25 (86.2) |
| ▪ Soft | 4 (13.8) |
| Tooth brushing technique | |
| ▪ Up and down | 11 (37.9) |
| ▪ Combination | 9 (31) |
| ▪ Forward and backward | 3 (10.3) |
| ▪ Not specific | 6 (20.7) |
| Consume '*etak*' | |
| ▪ Yes - at least once in a day | 22 (75.9) |
| - at least once in a month | 4 (13.8) |
| - sometimes | 3 (10.3) |
| ▪ No | 0 (0) |
| **Attrition (n=25)** | |
| Tooth grinding | |
| ▪ Yes | 3 (12) |
| ▪ No | 22 (88) |
| **Erosion (n=1)** | |
| Way of drinking carbonated drinks | |
| ▪ Pooling in the mouth before swallowing it | 1 (100) |
| Swimming in the pool | |
| ▪ Never | 0 (0) |
| Taking chewable vitamin C supplement | |
| ▪ Did not take | 0 (0) |
| Frequency of drinking carbonated drinks | |
| ▪ Sometimes | 0 (0) |
| Frequency of vomiting | |
| ▪ Only when sick | 0 (0) |

Freq = frequency

## Discussion

The subject population was drawn from the HUSM dental clinic because it is one of the biggest dental clinics where the patients came from all areas in Kelantan, and is a good representative of the Kelantan population. In this study, abrasion constitutes majority of the total respondents (35.8%) followed by combined type. These patterns were different from the Nigerian experience (Oginni and Olusile, 2002), where the most tooth wear type was attrition. It was also different from that observed in European countries where erosion rather than attrition or abrasion is the major cause of tooth wear (Smith and Robb, 1996). The European pattern of tooth wear could be related with contemporary lifestyle habits and diet such as high consumption of acidic drinks and beverages. In Nigeria (Africa), a more fibrous diet was claimed to be the cause of tooth wear unlike in Europe where the food is more refined. Occlusal wear has also been reported and attributed to significant high bite force coming from habit such as crushing or biting bones.

Results of this study found that most worn surfaces have Smith and Knight score of 1, which is loss of enamel characteristics and minimal loss of contour, and there was no surface with score of 4 (severe). The results suggest that most Kelantan population have minimal TW compared to the three ethnic groups of Sabah (Northern Borneo), Malaysia; reported from a previous study (Milosevic and Lo, 1996).

**Figure 1** Photo of freshwater clams or '*etak*' gathered for consumption.

**Figure 2** Photo of patient's teeth with abrasion that might be caused by eating '*etak*'.

In this study, eating freshwater clams or '*etak*' was suspected to have a significant relationship to tooth wear problem among Kelantan population because the regular eaters like to pry open the clam shells with their anterior teeth so that they could eat the flesh inside. The bite on the hard shell could abrade the teeth especially incisors of upper and lower jaw, which usually ended up with rough blunt incisor tips. Figure 1 showed the picture of freshwater clams or '*etak*' and Figure 2 showed the feature of abrasion that might be caused by eating '*etak*'.

The other factor considered to be important in causing tooth abrasion was tooth brushing technique (Milosevic, 1998). Abrasion could present clinically as a V-shaped lesion in the cervical portion of teeth known as NCCL, but none was observed in this study. In the present study, 11 (37.9%) use the "up and down" technique which normally should not be harmful, 9 (31%) use combination technique, and 3 (10.3%) use "forward and backward" techniques while the other 6 (20.7%) were not specific. The second most common tooth wear type is the combined form (32.1%). As the occurrence of tooth wear is multifactorial, thus it can lead to the combined type of tooth wear. Enamel softened by acids (erosion), may be brushed away with toothbrushing (abrasion) and worn away by mastication or tooth grinding (Saerah *et al*., 2006).

This study revealed only 3 (12%) out of 25 individuals with attrition type of tooth wear have positive history of bruxism habits while the others was unknown.

The other type of tooth wear found in this study is erosion but only one patient is affected. The result was similar to the study done by Smith and Robb (1996) where this condition is infrequent compared with other type of wear. In this patient, a typical clinical presentation involving the buccal surfaces of the upper anterior teeth and lingual surfaces of lower anterior teeth was observed. Dental history revealed that this patient had a peculiar way of taking carbonated drinks, by pooling it in the mouth before swallowing. This is called soda 'swishing'. It is a habit of retaining each mouthful of carbonated drinks in the mouth for a few seconds before swallowing it. This could cause the wear because carbonated drinks were held in the mouth for long enough to dissolve the tooth.

In the present study, the severity of tooth wear was considered low since most of the tooth surfaces scored 1. It may appear unimportant but dental professionals are still worried about the situation becoming worse with time. The tooth wear that occur in adolescents may probably continue into adulthood and furthermore into the elderly stage (Saerah *et al.,* 2006). In this study, majority (69.1%) had experienced tooth sensitivity.

Tooth wear is a preventable and treatable condition. In order to prevent this problem from becoming worse and become a burden in future, we should try to combat the problem from its early stages. One of the ways is to increase the awareness amongst practitioners and public as well as developing a prevention programme.

## Conclusion

The findings from this study showed that a majority of adults attending HUSM Dental Clinic have abrasion type of tooth wear and the second common type is a combination with some degree of wear. Within the limitation of this study, a significant habit of eating '*etak'* was predicted to cause the abrasion problem while for the erosion type; soda swishing might be the aetiology. Prevention and awareness among the population need to be enhanced. Emphasis about the importance of good dietary intake and habits or ways of taking food is essential. Further investigation is needed to elicit the possible causes and risk factors that may lead to the condition.

## Limitation of study and recommendations

In this study, some biological factors such as saliva, tooth composition and structure, type of occlusion and behavioral factors were not considered. For toothbrushing methods employed by subjects, factors such as the vigorosity of the techniques should be measured. Tooth wear is an accumulative lifetime process which is irreversible and multifactorial in nature. The clinical expression of dental wear largely depends on the strength, frequency and duration of exposure to the abrasive and erosive challenges that can be modified to a certain extent by those biological factors. Further investigations and continuous follow-up of cases may allow the mapping of the relationship of biological factors with the occurrence of tooth wear.

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