Erosive tooth wear and its related risk factors among Myanmar residents in Japan

Wa Than Lin, BDS, PhD (1), Kaung Myat Thwin, BDS, PhD (2), Takashi Zaitsu, DDS, PhD (2), Yuichi Kitasako, DDS, PhD (1,3), Junji Tagami, DDS, PhD (1), and Yoko Kawaguchi, DDS, PhD (2)

(1) Department of Cariology and Operative Dentistry, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, (2) Department of Oral Health Promotion, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, and (3) Dental Clinic, Ministry of Foreign Affairs, Tokyo, Japan

Purpose: The aim of this study was to assess oral health status and erosive tooth wear with related risk factors among Myanmar residents in Japan.
Materials and Methods: One hundred and five Myanmar volunteers who aged 20-64-year-old participated in this study. A cross-sectional epidemiological survey including a structured questionnaire and clinical oral examination was conducted in Tokyo, Japan in 2018.
Results: The prevalence of dental caries and periodontal disease of all participants were 68.5% and 82.9%, respectively. About two-third of participants (68.6%) had higher erosive scores (score 2-3). A significant difference was observed in missing teeth ($p = 0.049$) and erosive score ($p = 0.001$) by length of stay in Japan. Maxillary anterior teeth were most commonly affected by dental erosion, while the most severe erosive status was found only in mandibular posterior teeth. The participants who took pickled foods ($p = 0.048$), lime ($p = 0.028$), vinegar drinks ($p < 0.001$), and citrus juices ($p = 0.003$) almost every day were significantly higher erosive scores. Frequent consumption of acidic drinks was significantly related with dental erosion ($p = 0.004$). There were significant differences in heartburn ($p = 0.024$) and gastroesophageal reflux ($p < 0.001$) by erosive score. The participants who brushed their teeth with soft texture of toothbrush showed a significant lower erosive wear ($p = 0.027$).
Conclusion: Erosive tooth wear is a public health issue among Myanmar residents in Japan. Expansion of awareness on erosive tooth wear and dietary counselling would be necessary to improve the condition.

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Key Words: erosion, Myanmar, risk factor, wear

Introduction

Oral health is an essential part for people's general health and quality of life as it is considered to contribute general as well as social well-being and not merely absence of disease [1]. Dental erosion, recently recognized as one of the common oral health problems, can be defined as the chronic, pathologic, irreversible loss of dental hard tissue due to the exposure of intrinsic and extrinsic acids without any bacteria involvement [2]. It is often widespread and may involve the entire dentition. This chemical wear process is almost always complicated by other forms of tooth wear such as attrition and/or abrasion [3]. Clinically, those dental hard tissue loss in combined with mechanical wear can be referred to as erosive tooth wear (ETW) [4,5]. The etiology of erosive tooth wear is multifactorial and complex with chemical, biological and behavior factors in its process. Its prevalence seems to be trending higher in recent decades and became a globally growing concern due to increased consumption of acidic soft drinks together with life style and behavioral changes [6,7].

Many studies concerned with dental erosion have been performed worldwide, showed as a high prevalence especially in developed countries [8]. The reported prevalence of dental erosion varies greatly in the literature, which can be partially explained as differences by age, gender, country, types of teeth and frequent consumption of acidic drinks and foods [9-13]. Many studies were performed in European countries, but a few studies in Asian countries were noted [14].

Studies on oral health status and behaviors changes of foreign residents has become focus of attention as the migrants or immigrants constitute substantial portion of population in many countries [15]. Myanmar, one of the developing countries, which is in transition period and Myanmar people are trying to develop in each and every sector. Nowadays, there are many Myanmar migrants who are working or studying abroad in other countries especially in developed countries.

There was an increasing trend of Myanmar migrants in Japan, which accounts for nearly 15,000 people in 2016 [16]. As studying or working aboard is quite difficult to settle in daily life, and the migrants may also be affected by many stressful barriers. Therefore, they would change their life style and also eating behaviors. Modernization associated with life style changes including dietary habits might result an impact on individual's oral health and also increased rate of erosive wear as their frequent consumption of acidic foods and drinks [9]. Therefore, to know the impacts for changing life style to oral health situation of migrant adults, the aim of this study was to assess oral health status and erosive tooth wear with related risk factors among Myanmar residents in Japan.

Materials and Methods

Subjects

A cross-sectional study was performed in Tokyo, Japan in April, 2018. The subjects were Myanmar people who came to charity dental consultation of Myanmar Family Clinic & Garden (MFCG) group. A total of 105 volunteer participants who aged 20-64-year-old (male 59, female 46) were included after a sign on written consent form. Data was collected with two parts; a structured questionnaire and a clinical oral examination.

Questionnaire survey

The participants were asked to answer a structured questionnaire, inquiring about socio-demographic characteristics (gender, age, occupation, educational level, length of stay in Japan and health insurance status), consumption of acidic foods (grape fruit, orange, apple, pickled foods, lime, tamarind) and acidic drinks (carbonated soft drinks, sport drinks, vinegar drinks, fermented dairy juices, citrus juice, wine), drinking habits of acidic drinks (frequency of acidic drinks, drinking habits before sleep), symptoms of gastric disease (heartburn, gastroesophageal reflux, repeated vomiting), and oral hygiene behaviors (texture of tooth brush, brushing pressure). The participants answered frequency for consumption of acidic drinks and foods by selecting one choice; 'almost every day: 5 or more days per week', 'sometimes: 1 to 4 days per week' or 'never'.

Clinical oral examination

All trained examiners were calibrated with a principal investigator before the study. The inter-examiner reliability was performed using Kappa statistics > 0.79. A clinical oral examination was performed with a registered dentist and a recorder by using a dental mirror, a WHO-CPI probe and a handheld light. Dentition status was assessed with DMFT index score based on WHO criteria for dental caries. Periodontal status was evaluated using a WHO-CPI probe with the Community Periodontal Index (CPI) score [17]. The six index teeth were probed and the highest score was recorded.

The ETW was examined with the Basic Erosive Wear Examination (BEWE) index [18], which has four scores; score 0: no surface loss, score 1: initial loss of enamel surface texture, score 2*: distinct defect, hard tissue loss < 50% of the surface area, and score 3*: hard tissue loss ≥ 50% of the surface (*dentine can involve). The buccal/labial, lingual/palatal, and occlusal/incisal surfaces of each tooth except third molars were examined

and the surface with highest score was noted. Then BEWE sum score was calculated by adding scores of all sextants for risk level assessment (sum score 0-2: no risk, sum score 3-8: low risk, sum score 9-13: medium risk, and sum score14-18: high risk).

Statistical analysis

Descriptive statistics were computed mean or percentages of variables. Chi-square test for categorical data and ANOVA test for continuous data were used for analysis of the associations between variables. The statistical analysis was performed by using the Statistical Package for Social Sciences (SPSS 18.0, IBM, Chicago, IL, USA). The level of statistical significance for all tests were set at $p < 0.05$.

Ethical approval

This study was approved by the Ethical Committee of Human Research of Tokyo Medical and Dental University (Approval No. D2016-097) and also permitted by the Embassy of Republic of the Union of Myanmar, Tokyo, Japan.

Results

A total of 105 participants were included with mean age of 29.4 ± 8.4 years (minimum age 20 years, maximum age 64 years). Nearly half of participants (46.7%) came to Japan for work (25.7% for part-time and 21.0% for full-time), 43.8% came to Japan for study, and 9.5% had no work or were dependent. About 89.5% of participants were university education level, only 10.5% were high school education level. More than half of participants (53.3%) stayed in Japan for 2 years or less while 46.7% were more than 2 years. Most participants (80.0%) were covered by Japanese public health insurance.

Table 1 shows oral health status including erosive tooth wear in mean BEWE score of Myanmar people by length of stay in Japan. Overall caries prevalence of all participants was 68.5% with mean DMFT of 2.40 ± 2.60. Decay teeth (1.30 ± 1.83) was the major component of DMFT, followed by filled teeth (0.86 ± 1.79) and missing teeth (0.25 ± 0.58). The prevalence of periodontal disease (CPI code ≥ 1) was 82.9% in the present study. About two-third of participants (68.6%) had higher BEWE scores (score 2 and score 3), but 31.4% of participants had ETW with initial loss of surface texture on their teeth (score 1). A significant difference was observed in missing teeth ($p = 0.049$) and mean BEWE score ($p = 0.001$) by length of stay in Japan. There were no significant differences in dentition status, periodontal disease and mean BEWE score by age or gender.

Table 1 Oral health status of Myanmar residents in Japan

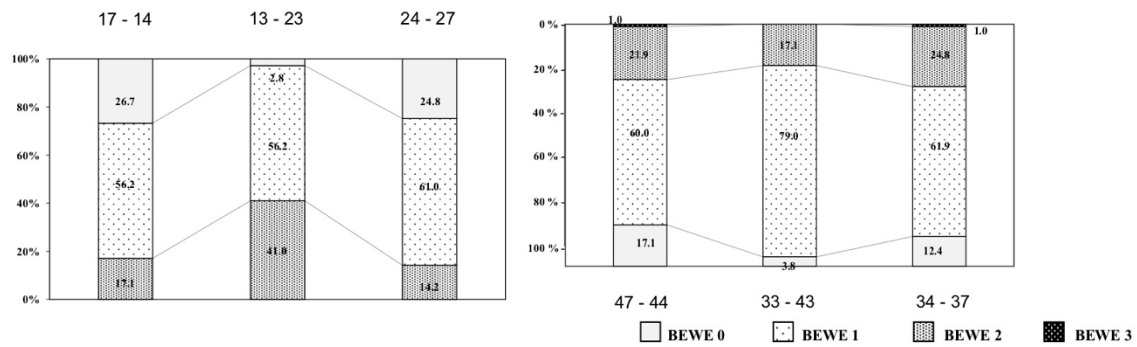|	Total	Length of stay in Japan		*p*-value
	(n = 105)	≤2 years (n = 56)	>2 years (n = 49)	
Caries prevalence (%)	68.5	62.5	75.5	0.152
DT (mean ± SD)	1.30 ± 1.83	1.29 ± 2.04	1.31 ± 1.58	0.955
MT (mean ± SD)	0.25 ± 0.58	0.14 ± 0.40	0.37 ± 0.73	0.049
FT (mean ± SD)	0.86 ± 1.79	0.62 ± 1.56	1.12 ± 2.01	0.157
DMFT (mean ± SD)	2.40 ± 2.60	2.05 ± 2.65	2.80 ± 2.53	0.146
Periodontal disease (%) (CPI code ≥ 1)	82.9	85.7	79.6	0.406
Mean BEWE score (%)				
Score 0	0.0	0.0	0.0	
Score 1	31.4	46.4	14.3	0.001
Score 2	67.6	51.8	85.7	
Score 3	1.0	1.8	0.0	

Fig. 1 Distribution of erosive tooth wear by teeth sextants

Table 2 Erosive tooth wear and types of acidic foods and drinks

	Total (n = 105)	Erosive tooth wear, n (%)		p-value
		mean BEWE score 0-1 (n = 33)	mean BEWE score 2-3 (n = 72)	
Grape fruit				
Almost everyday	10 (9.5)	3 (9.1)	7 (9.7)	
Sometimes	72 (68.6)	22 (66.7)	50 (69.4)	0.925
Never	23 (21.9)	8 (24.2)	15 (20.8)	
Orange				
Almost everyday	5 (4.8)	2 (6.1)	3 (4.2)	
Sometimes	83 (79.0)	25 (75.8)	58 (80.6)	0.838
Never	17 (16.2)	6 (18.2)	11 (15.3)	
Apple				
Almost everyday	6 (5.7)	1 (3.0)	5 (6.9)	
Sometimes	85 (81.0)	29 (87.9)	56 (77.8)	0.463
Never	14 (13.3)	3 (9.1)	11 (15.3)	
Pickled foods				
Almost everyday	21 (20.0)	3 (9.1)	18 (25.0)	
Sometimes	62 (59.0)	24 (72.7)	38 (52.8)	0.048
Never	22 (21.0)	6 (18.2)	16 (22.2)	
Lime				
Almost everyday	25 (23.8)	3 (9.1)	22 (30.6)	
Sometimes	66 (62.9)	22 (66.7)	44 (61.1)	0.028
Never	14 (13.3)	8 (24.2)	6 (8.3)	
Tamarind				
Almost everyday	5 (4.8)	1 (3.0)	4 (5.6)	
Sometimes	63 (60.0)	18 (54.6)	45 (62.5)	0.536
Never	37 (35.2)	14 (42.4)	23 (31.9)	
Carbonated soft drinks				
Almost everyday	24 (22.9)	7 (21.2)	17 (23.6)	
Sometimes	64 (61.0)	22 (66.7)	42 (58.3)	0.668
Never	17 (16.2)	4 (12.1)	13 (18.1)	
Sport drinks				
Almost everyday	12 (11.4)	3 (9.1)	9 (12.5)	
Sometimes	62 (59.0)	18 (54.5)	44 (61.1)	0.56
Never	31 (29.5)	12 (36.4)	19 (26.4)	
Vinegar drinks				
Almost everyday	23 (21.9)	2 (6.1)	21 (29.2)	
Sometimes	56 (53.3)	6 (18.1)	50 (69.4)	<0.001
Never	26 (24.8)	25 (75.8)	1 (1.4)	
Fermented dairy juices				
Almost everyday	11 (10.5)	3 (9.1)	8 (11.1)	
Sometimes	78 (74.3)	24 (72.7)	54 (75.0)	0.828
Never	16 (15.2)	6 (18.2)	10 (13.9)	
Citrus juices				
Almost everyday	21 (20.0)	4 (12.1)	17 (23.6)	
Sometimes	76 (72.4)	23 (69.7)	53 (73.6)	0.003
Never	8 (7.6)	6 (18.2)	2 (2.8)	
Wine				
Almost everyday	5 (4.8)	2 (6.1)	3 (4.2)	
Sometimes	45 (42.9)	12 (36.4)	33 (45.8)	0.64
Never	55 (52.4)	19 (57.6)	36 (5.0)	

Table 3 Erosive tooth wear and related risk factors

	Total	Erosive tooth wear, n (%)		p-value
	(n = 105)	mean BEWE score 0-1 (n = 33)	mean BEWE score 2-3 (n = 72)	
Acidic drinks per day				
Three times and above	29 (27.6)	8 (24.2)	21 (29.2)	
1-2 times	70 (66.7)	20 (60.6)	50 (69.4)	0.004
Never	6 (5.7)	5 (15.2)	1 (1.4)	
Drinking habits before sleep				
Almost everyday	7 (6.7)	2 (6.1)	5 (6.9)	
Sometimes	25 (23.8)	9 (27.3)	16 (22.2)	0.85
Never	73 (69.5)	22 (66.6)	51 (70.9)	
Heartburn				
≥ once a week	2 (1.9)	0 (0.0)	2 (2.8)	
≥ twice a month	13 (12.4)	1 (3.0)	12 (16.7)	0.024
Never	90 (85.7)	32 (97.0)	58 (80.5)	
Gastroesophageal reflux				
≥ once a week	15 (14.3)	2 (6.1)	13 (18.1)	
≥ twice a month	36 (34.3)	24 (72.7)	12 (16.7)	<0.001
Never	54 (51.4)	7 (21.2)	47 (65.2)	
Repeated vomiting				
≥ once a week	0 (0.0)	0 (0.0)	0 (0.0)	
≥ twice a month	5 (4.8)	3 (9.1)	2 (2.8)	0.281
Never	100 (95.2)	30 (90.9)	70 (97.2)	
Texture of tooth brush				
Hard	10 (9.5)	2 (6.1)	8 (11.2)	
Medium	83 (79.1)	24 (72.7)	59 (81.9)	0.027
Soft	12 (11.4)	7 (21.2)	5 (6.9)	
Brushing pressure				
Hard	12 (11.4)	3 (9.1)	9 (12.5)	
Medium	87 (82.9)	27 (81.8)	61 (84.7)	0.342
Soft	5 (4.7)	3 (9.1)	2 (2.8)	

Maxillary anterior teeth were most commonly affected by dental erosion, followed by mandibular anterior teeth, while maxillary posterior teeth were least affected. BEWE score 1 was highest prevalence in all sextants but the most severe erosive status (BEWE score 3) was found only in mandibular posterior teeth (Fig. 1).

According to BEWE guideline, 76 participants (72.4%) were low risk of ETW (BEWE sum score 3-8), and 21.0% of them (n = 22) were medium risk (BEWE sum score 9-13). Only seven participants (6.7%) were no risk (BEWE sum score 0-2), while no participant was high risk (BEWE sum score 14-18).

There were significant differences in association between consumption of some acidic foods and drinks with respect to ETW (Table 2). The participants who took pickled foods ($p = 0.048$), lime ($p = 0.028$), vinegar drinks ($p < 0.001$), and citrus juices ($p = 0.003$) almost every day showed significantly higher mean BEWE scores (score 2-3) in this study.

Table 3 shows the ETW with related risk factors by mean BEWE score. About two-thirds of participants (66.7%) took acidic drinks 1-2 times per day. The participants with frequent consumption of acidic drinks per day had a significantly higher ETW than those without ($p = 0.004$). Most participants had never experience on symptoms of heartburn (85.7%), gastroesophageal reflux (51.4%), and repeated vomiting (95.2%). There were significant differences in heartburn ($p = 0.024$) and gastroesophageal reflux ($p < 0.001$), but no significant difference was found in repeated vomiting by mean BEWE score. Most participants used medium texture of tooth brush (79.1%) with medium brushing pressure (82.9%). The participants who brushed their teeth with soft texture of toothbrush showed a significant lower mean BEWE score in the present study ($p = 0.027$).

Discussion

A pervious study reported oral health status and oral health care barriers for Myanmar residents in Japan [15], but available data regarding erosive wear is still lacking. This is the first study to investigate ETW with its related factors and risk levels for Myanmar residents in Japan. Although there are many indices to investigate, there is no universal method to access erosive tooth wear [19]. In this study, BEWE index was used as it was developed with simple system for scoring not only to access the severity but also to guide for management of the lesions [18]. The prevalence of erosive wear with BEWE score 2 and 3 of Myanmar residents in Japan was 69%, which apparently higher than that of Japanese people (26%) [10]. Further, hard tissue loss by erosive wear (score 2 and 3) were significantly predominant in participants who stayed in Japan more than 2 years. These might be due to changing food culture and eating habits after migration [20], with adoption of some specific food items like vinegar drinks which has high potential to develop erosive wear [12], and increased consumption of acidic soft drinks accompanying with their stressful lives.

The present study approved the previous reports, which frequent consumption of acidic drinks per day was strongly related to develop ETW and increase wear progression [11,12,21,22]. This could be due to mineral loss from enamel surface increased with continuous acidic attack and subsequent softening of enamel which prone to predispose erosive tooth wear [23]. Pickled foods, lime, vinegar drinks and citrus juices were significantly associated with high ETW scores. Pickled foods and lime in the form of juice are widely used in cuisine and salad in Myanmar, but not popular in Japan. On the other hand, vinegar drinks are rarely used in Myanmar though increasingly use in Japan [10]. Some participants might be changed their food culture after migration, or others seem to be already experienced erosive wear before coming to Japan and these wear process became progression as food culture changes after they arrived at Japan.

Participants with symptoms of heartburn and gastroesophageal reflux are significantly related with higher tooth wear scores in the present study. Regurgitation of gastric contents are main intrinsic source of acids, also a causative factor of ETW [21]. Gastric juice consists mainly of hydrochloric acid, produced by the parietal cells in the stomach. The presence of the highly acidic gastric juice (pH 1.0-3.0) in the oral cavity may lead to dental erosion [22]. Frequent gastric regurgitation in patients with symptoms of gastroesophageal reflux and heartburn were increased risk indicators for dental erosive wear [12].

Regular oral hygiene care is important for removal of dental plaque and control of plaque related oral diseases [24]. On the other hand, texture of tooth brush is considered to be predisposing factor for tooth wear process [22,25]. Tooth brush with texture of hard or medium bristles was a significant risk factor in the present study, which was similar with a previous report [26]. Therefore, mechanical wear together with chemical wear process could be proved to produce more progression of ETW.

The distribution of erosive lesions showed a highest prevalence in maxillary anterior teeth which was in line with previous findings [9,13,27]. The possible reason is that these teeth have exposed to oral environment for longer period than other teeth, thus being more susceptible to negative effects of the acid challenges. Moreover, those teeth were poorly bathed in saliva whereas limited saliva flow tends to inadequate buffering [13]. BEWE score 3 was found only in mandibular posterior teeth in the present study. It could be explained that increased occlusal force in molars in addition with acidic attack might lead to severe ETW in these regions. Over one-fifth of participants was in medium risk level according to BEWE guideline which indicates that the specific

etiological factors (intrinsic or extrinsic origin or combination of both) were needed to identify in addition to dietary advice with close monitoring.

In the present study, caries prevalence of participants was 69% with mean DMFT of 2.40, and the prevalence of periodontal disease was 83%. Since caries experience and periodontal status were high, these findings revealed that Myanmar residents in Japan can't access adequate oral care even though most participants involved in health insurance system, which was similar to previous report [15]. Several reasons for limited access to oral care of Myanmar residents in Japan are considered. First, language barrier could be a significant limitation for accessing adequate oral care. Second, lack of familiarity with seeking oral care and health care system of the country would be a considerable barrier. Third, time arrangement to get necessary oral health services would be difficult as more than 90% of participants were engaged in work or study in this study.

There were some limitations in the present study. First, we collected a small convenient sample in Tokyo thus the sample could not be generalized to all Myanmar residents in Japan. Second, we didn't record the distribution of erosive wear in each tooth level and tooth surface level in this study. Therefore, further cross-sectional and longitudinal studies should be needed with more details ETW status in future. Third, we have no information about their oral health status before coming to Japan. So, we could not compare oral health status including ETW of participants before and after coming to Japan. Nevertheless, this cross-sectional study could provide the useful information about erosive wear and could aid in conducting further epidemiological studies. It was found as a public health issue among Myanmar residents in Japan. Therefore, it is important to provide expansion of awareness on erosive tooth wear and dietary counselling in particular with avoidance of frequent consumption of acidic foods and drinks.

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Correspondence to:

Dr. Kaung Myat Thwin

Department of Oral Health Promotion, Graduate School of Medical and Dental Sciences,

Tokyo Medical and Dental University

1-5-45, Yushima, Bunkyo-ku, Tokyo 113-8549, Japan

Fax: +81-3-5803-0194   E-mail: neko1189@gmail.com