

ASSESSMENT OF TOOTH WEAR AND ITS ASSOCIATED FACTORS IN ADULT PATIENTS VISITING A DENTAL HOSPITAL IN KATHMANDU, NEPAL

Joshi R, Gautam S, Joshi B

Department of Conservative Dentistry and Endodontics, College of Dental Sciences and Hospital, Nepal Medical College and Teaching Hospital, Attarkhel, Gokarneshwor-8, Kathmandu, Nepal

ABSTRACT

Tooth wear is a universal consequence of aging. It is an irreversible, multifactorial and destructive loss of dental hard tissues caused by either a mechanical or chemical process in the absence of caries or trauma. It can be a physiological and age dependent process. The risk factors that contribute to tooth wear are diet, bruxism, environment, occupation, oral health behaviour, acid regurgitation and use of tobacco. This study was done to find out if there is an association between tooth wear and its associated factors. So that we can educate the patients about the various factors causing tooth wear and minimise it. This cross sectional study was done amongst 339 patients. The clinical assessment of tooth wear was done using tooth wear index developed by Smith & Knight. A specifically designed questionnaire was used to seek information on risk factors of tooth wear. All patients were categorised into one of the following groups: Low Tooth Wear group, Moderate Tooth Wear group, Severe Tooth Wear group based on their individual tooth wear surface scores. Data were analyzed using Pearson's chi-square test and descriptive statistics were calculated. We can see that the severity of tooth wear increases with age i.e, $p \leq 0.05$ which is statistically significant. Patients with self reported tooth sensitivity (60.5%) had a higher total tooth wear score than those who didn't (39.5%) and the result was statistically significant. The results of our study show that tooth wear is a consequence of aging and there is an association between tooth wear and dentinal hypersensitivity.

KEYWORDS

Tooth wear, dentinal hypersensitivity, Smith and Knight

CORRESPONDING AUTHOR

Dr. Rojin Joshi,
Assistant Professor
Department of Conservative Dentistry and Endodontics,
College of Dental Sciences and Hospital,
Nepal Medical College and Teaching Hospital,
Attarkhel, Gokarneshwor-8, Kathmandu, Nepal
Email: rozinjoshi@yahoo.com
Orcid No: <https://orcid.org/0000-0003-3914-3837>
DOI: <https://www.doi.org/10.3126/nmcj.v22i4.34196>

INTRODUCTION

Tooth wear is a universal consequence of aging.¹ It can be defined as an irreversible, multifactorial and destructive loss of dental hard tissues caused by mechanical and chemical processes or either a mechanical or chemical process in the absence of caries or trauma.^{2,3} This is a common problem but most often isn't treated. 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.⁴

To some degree, tooth wear is a physiological and age-dependent process. However, a pathological status may be reached when the teeth are so worn that their appearance is affected or their functionality is impaired.⁵ The cause of pathological levels of tooth wear is difficult to diagnose and is generally a result of abrasion, attrition, and erosion.⁶ Attrition is the loss of tooth tissue due to tooth in contact with opposing tooth, no foreign substance intervening and it's usually due to parafunctional habits such as bruxism or grinding of the teeth.⁵ Abrasion is the pathological loss of tooth substance caused by abnormal and repetitive mechanical wears other than tooth contact.⁷ Erosion is the progressive loss of hard dental tissue by a chemical process not involving bacterial action.⁸ Ganses *et al* has shown that incisal and occlusal tooth surface loss in the form of cupping or grooving is not pathognomic for tooth erosion but the loss of substance may be explained as acid accelerated abrasion. In occlusal and palatal erosive wear other factors than acid may play a role in the occurrence of tooth substance loss.⁹ The workers of the industry are highly exposed to harmful elements, acids in their work environment which is considered responsible for dental erosion.¹⁰ Factors such as attrition abrasion and even friction of tongue can interact with acid and result in accelerated wear of the teeth.¹¹

Excessive tooth wear leads to hypersensitivity, pulpitis, periapical periodontitis, pulp necrosis and can cause serious damage to the oral health of an individual.¹² Factors like teeth grinding, jaws clenching, gastric reflux disease, use of Vitamin C supplements, carbonated drinks and citrus fruits were found to be related with tooth wear.¹³

Several studies have investigated diet, foreign objects, bruxism, parafunctional activities,

environment, occupation, oral health behaviour, medicaments, gastrointestinal problems, and acid regurgitation among the risk factors that contribute to tooth wear.¹⁴ Hence, it is important to understand the etiology of tooth wear and diagnosis for effective management.

In present day abrasive components in the diet may be the cause of occlusal breakdown in only a few cases. However, many factors have been found to cause incisal and occlusal breakdown which includes dietary variables, the composition of the saliva, muscular forces and parafunctional habits.¹⁶

Data for tooth wear in the general population and related factors have not been extensively reported and the comparison of study results is limited because of the variability of assessment indices.¹⁷ Several indices used to describe the severity of tooth wear have been outlined in literature. Indices grade tooth wear by recording tooth surfaces, individual teeth or the whole mouth.¹⁸ One of the most commonly used indices was developed by Smith and Knight and has been adapted by many researchers. This index is easy to use and is not based on etiology.¹⁹ So, this study was designed to assess tooth wear and the associated factors that causes it in adult patients.

MATERIALS AND METHODS

This cross sectional study was performed in the Department of Conservative Dentistry and Endodontics at Nepal Medical College and Teaching Hospital, Kathmandu, Nepal for 6 months after receiving ethical approval from Nepal Medical College Institutional Review Committee, (reference no.008-076/077). The patients were informed about the study and written consent was taken from patients who were willing to participate in the study. The sample size was calculated by using the formula $n=4pq/L^2$. Hence, the sample size of 339 was taken. Patients who were willing to participate in the study and those who had associated habits of tooth wear were included in the study. Patients undergoing orthodontic treatment, those who had restored, carious, periodontally compromised teeth and were not willing to participate were excluded from the study.

The clinical assessment was done using the Tooth Wear Index developed by Smith & Knight (Table 1).²⁰ In this comprehensive system all four visible surfaces (buccal, cervical, lingual and occlusal/ incisal) of all teeth present were scored for tooth wear.

In both maxilla and mandible, teeth were divided into incisor, canine, premolar and molar groups. Among the incisor groups; the central and lateral incisors were included, in the canine groups; the canines were included, the premolar groups consisted of the first and second premolars, and the molar groups included the first and second molars. A total of eight groups (four maxillary and four mandibular) were formed. According to the severity of tooth wear, scores of 0–4 were assigned to the teeth after examination.¹⁰

After the clinical examination, participants were interviewed using a specifically designed validated questionnaire based on the literature search and expert opinion¹⁰ (Table 4). Through the questionnaire, the participants were asked to provide information on risk factors of tooth wear like the presence of clenching/grinding of teeth, the consumption of hard or acidic foods, working environment (related to dust or acid gas), clicking of the temporomandibular joint, acid reflux, tobacco habits, oral hygiene practices (toothbrush/ neemstick / finger / other), type of toothbrush bristle and method of tooth brushing. The responses of the participants were recorded as yes/no. In addition, information regarding presence or absence of tooth sensitivity was also obtained. All patients were categorised into one of the following groups based on their individual tooth wear surface scores.⁷

- Low Tooth Wear (TW) group for patients with score of 1
- Moderate Tooth Wear (TW) group for patients with score of 2
- Severe Tooth Wear (TW) group for patients with score of 3

RESULTS

The data was entered, edited and coded in Microsoft Excel version 7.0. The data was exported and analyzed with the help of Statistical Package for Social Sciences (SPSS) version 17. Descriptive statistics and Chi square test were calculated.

A total of 339 patients had participated in this study. 151 were male patients (44.5%) and 188 were female patients (55.5%). Among the male patients 97.4% of tooth wear was seen in maxilla and 99.3% of tooth wear was seen in mandible. Where as in female patients 97.3% of tooth wear was seen in maxilla and 100% in mandible (Fig. 1).

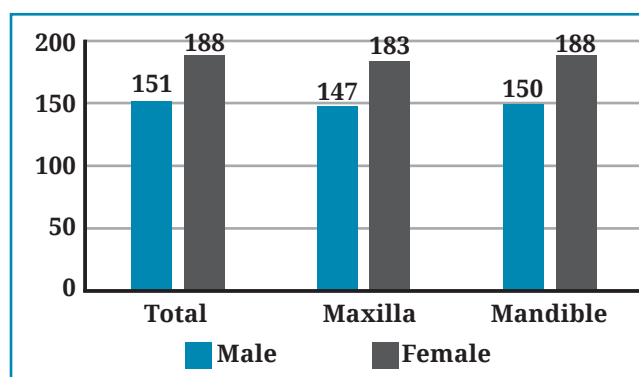


Fig. 1: Distribution of study participants with tooth wear in maxilla and mandible according to gender

In the age group of 18-29 years, tooth wear was seen in 93.3% of maxillary teeth and 97.8% in mandibular teeth. In the age group of 30-44 years, 95.6% of tooth wear was seen in maxillary teeth where as there was 100% of tooth wear in mandibular teeth. In the age group of 45-59 years, 99.1% of tooth wear was seen in maxillary teeth whereas there was 100% of tooth wear in mandibular teeth. In patients

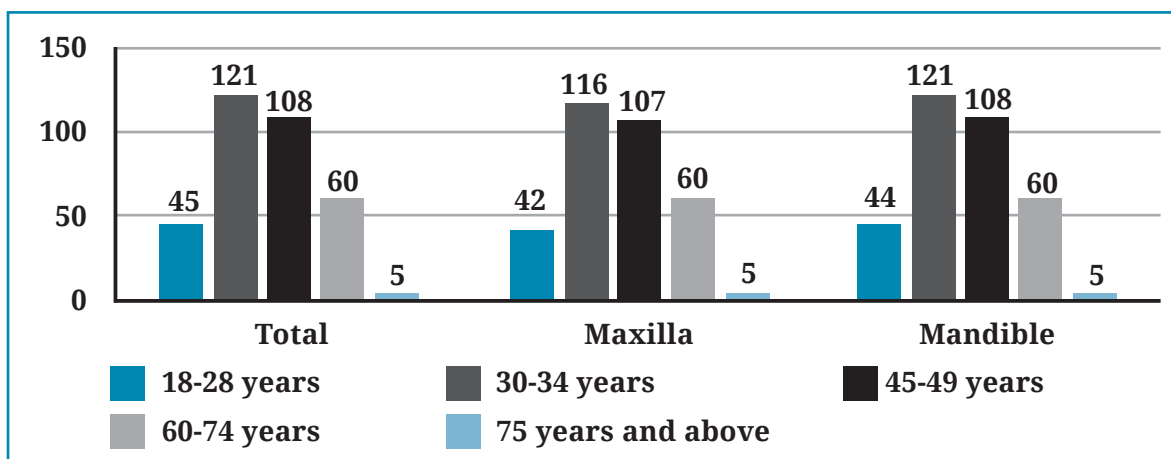


Fig. 2: Distribution of study participants with tooth wear in maxilla and mandible according to age-group

of 60-74 years 100% of tooth wear was seen in maxillary as well as mandibular teeth. Patients of 75 years and above 100% of tooth wear was seen in both maxillary and mandibular teeth (Fig. 2).

It was found that in the distribution of participants with tooth wear score in various teeth in maxilla and mandible. The majority of low tooth wear score was seen for both maxilla and mandible followed by moderate tooth wear

Table 1: Smith and Knight Index

Score	Surface	Criteria
0	B/L/O/I	No loss of enamel surface characteristics
1	B/L/O/I	Loss of enamel surface characteristics
2	B/L/O/I	Loss of enamel exposing dentin on less than one-third of surface Loss of enamel, just exposing dentin
3	B/L/O/I	Loss of enamel exposing dentin on more than one-third of surface Loss of enamel and substantial loss of dentin
4	B/L/O/I	Complete enamel loss, pulp exposure, secondary dentin exposure Pulp exposure or exposure of secondary dentin

B=buccal; L=lingual; O=occlusal; I=incisal

Table 2: Distribution of participants with tooth wear score in various teeth in maxilla and mandible

Variables	Tooth Wear n (%)	Low TWS n (%)	Moderate TWS n (%)	Severe TWS n (%)
Maxilla				
Molars	276 (81.4)	157 (46.3)	101 (29.8)	18 (5.3)
Premolars	214 (63.1)	139 (41)	68 (20.0)	7 (2.1)
Canine	219 (64.6)	136 (40.1)	74 (21.8)	9 (2.7)
Incisors	236 (69.6)	150 (44.2)	74 (21.8)	12 (3.6)
Mandible				
Molars	284 (83.8)	138 (40.7)	128 (37.8)	18 (5.3)
Premolars	236 (69.6)	149 (44.0)	77 (22.7)	10 (2.9)
Canine	226 (66.7)	134 (39.5)	85 (25.1)	7 (2.1)
Incisors	278 (82.0)	160 (47.2)	108 (31.9)	10 (2.9)

Table 3: Distribution of participants according to tooth wear score

Variables	Low TWS n (%)	Moderate TWS n (%)	Severe TWS n (%)	p-value
Sex				
Male	42 (39.6)	89 (45.6)	20 (52.6)	0.34
Female	64 (60.4)	106 (54.4)	18 (47.4)	
Age group				
18-29 years	25 (23.6)	19 (9.7)	1 (2.6)	<0.05*
30-44 years	49 (46.2)	64 (32.8)	8 (21.1)	
44-59 years	27 (25.5)	64 (32.8)	17 (44.7)	
60-74 years	5 (4.7)	44 (22.6)	11 (28.9)	
75 years and above	0 (0.0)	4 (2.1)	1 (2.7)	

Chi-square test, p-value < 0.05 statistically significant *

Table 4: Tooth wear score and its relation with different factors

Variables	Low TWS n (%)	Moderate TWS n (%)	Severe TWS n (%)	Total n (%)	p-value
Clenching or grinding teeth					
Yes	24 (22.6)	52 (26.7)	8 (21.1)	84 (24.8)	0.63
No	82 (77.4)	143 (73.3)	30 (78.9)	255 (75.2)	
Consumption of hard or acidic food					
Yes	51 (48.1)	111 (56.9)	24 (63.2)	186 (54.9)	0.19
No	55 (51.9)	84 (43.1)	14 (36.8)	153 (45.1)	
Work environment involving dust or acid gas					
Yes	9 (8.5)	20 (10.3)	1 (2.6)	30 (8.8)	0.31
No	97 (91.5)	175 (89.7)	37 (97.4)	309 (91.2)	
Clicking of Temporomandibular joint					
Yes	10 (9.4)	31 (15.9)	7 (18.4)	48 (14.2)	0.22
No	96 (90.6)	164 (84.1)	31 (81.6)	291 (85.8)	
Acid reflux					
Yes	34 (32.1)	75 (38.5)	16 (42.1)	125 (36.9)	0.43
No	72 (67.9)	120 (61.5)	22 (57.9)	214 (63.1)	
Tobacco use					
Yes	19 (17.9)	41 (21.0)	9 (23.7)	69 (20.4)	0.71
No	87 (82.1)	154 (79.0)	29 (76.3)	270 (79.6)	
Forms of tobacco (n=69)					
Smoking	12 (63.2)	18 (43.9)	1 (11.1)	31 (44.9)	NA
Smokeless	3 (15.8)	11 (26.8)	6 (66.7)	20 (29.0)	
Both smoking and smokeless	4 (21.0)	12 (29.3)	2 (22.2)	18 (26.1)	
Oral hygiene practices					
Toothbrush	105 (99.1)	193 (99.0)	38 (100.0)	336 (99.1)	NA
Neemstick	1 (0.9)	2 (1.0)	0 (0.0)	3 (0.9)	
Type of toothbrush bristle					
Ultrasoft	7 (6.6)	10 (5.1)	3 (7.9)	20 (5.9)	0.87
Soft	44 (41.5)	78 (40.0)	15 (39.5)	137 (40.4)	
Medium	48 (45.3)	99 (50.8)	17 (44.7)	164 (48.4)	
Hard	7 (6.6)	8 (4.1)	3 (7.9)	18 (5.3)	
Method of toothbrushing					
Horizontal	49 (46.2)	72 (36.9)	14 (36.8)	135 (39.8)	0.39
Vertical	9 (8.5)	26 (13.4)	3 (7.9)	38 (11.3)	
Mixed	48 (45.3)	97 (49.7)	21 (55.3)	166 (48.9)	
Self-reported tooth sensitivity					
Yes	54 (50.9)	119 (61.0)	32 (84.2)	205 (60.5)	0.001*
No	52 (49.1)	76 (39.0)	6 (15.8)	134 (39.5)	

Chi-square test, p-value<0.05 statistically significant*

NA: Not Applicable

score and severe tooth wear score. In maxillary teeth the low tooth wear score was more for molars followed by incisors, premolars and least for canines. For moderate tooth wear molars had the highest score followed by incisors, canines and premolars. The severe tooth wear score was highest for molars followed by incisors, canines and premolars. In the mandibular teeth the low tooth wear score was more for incisors, premolars, molars and least for canines. For moderate tooth wear molars had the highest score followed by incisors, canines and premolars. The severe tooth wear score was highest for molars followed by incisors, premolars and canines (Table 2).

According to gender, females had a higher low (60.4%) and moderate (54.4%) tooth wear score compared to males. Males had a higher severe tooth wear score of 52.6% compared to females with a p value of 0.34. It has been found that the severity of tooth wear increases with age i.e, $p \leq 0.05$ which is statistically significant (Table 3).

In our study when tooth wear score was related with different factors. It was seen that clenching or grinding of teeth didn't seem to have any effect on the tooth wear. The total tooth wear score was higher for those patients who didn't grind their teeth (75.2%). The total tooth wear score was high for patients who consumed hard and acidic food compared to those who didn't (54.9%). Less participants worked in places with acid and dust. The total tooth wear score was more for patients who didn't have clicking of the temporomandibular joint (85.8%) compared to those who had (14.2%). The total tooth wear score for patients who didn't have acid reflex (63.1%) compared to those who had (36.1%) was not found to be higher. A significant difference wasn't seen for patients who consumed tobacco and those who didn't. The results weren't applicable for the different forms of tobacco and different forms of oral hygiene practices like toothbrush and neemstick. Among the various toothbrush bristles a high percentage of total tooth wear score was seen for participants who used medium bristle and hard bristle tooth brush. The total tooth wear score was more for patients who followed mixed method of tooth brushing followed by horizontal method and vertical method was the least. Patients with self reported tooth sensitivity (60.5%) had a higher total tooth wear score than those who didn't (39.5%) and the result was statistically significant (Table 4).

DISCUSSION

Tooth wear is a multifactorial disease and is considered a global epidemic.^{2,21} Our study was conducted to assess tooth wear and its associated factors in adult patients visiting a dental hospital in Kathmandu, Nepal. In this study Tooth Wear Index developed by Smith and Knight was used. This is the most widely used index. Smith and Knight introduced the tooth wear index, which attempted to provide a solution to some of the problems associated with measuring tooth wear at individual and community level. The Tooth Wear Index and modified versions of it have been used in a large number of studies, which suggests widespread acceptance.²²

Tooth wear may become a dental problem of great importance among the old people because of retention of natural teeth and the prevalence of tooth wear which has been increasingly seen in the elderly population.¹⁹ Similar results have been seen in our study also. There was a significant increase of tooth wear score as age increased. The findings were consistent with some other studies.^{6,23,24} It was seen that more tooth wear was seen in mandibular teeth than maxillary teeth for both male and female. Similar findings were reported by Ahuja *et al*¹⁰, Liu *et al*¹⁵, Taiwo *et al*.²⁵

Females had a higher low and moderate tooth wear score than males. Where as males had a higher severe tooth wear score compared to females. This is in accordance with clinical experience and observation made in a study conducted by Karabekiroglu.⁷ This is in contrast to some others studies.^{26,27} Many studies have suggested that tooth wear was observed to be greater among males than females.²⁸ The increase in severity of tooth wear may be related to increased tooth retention in men. In addition, males may generate greater forces during functional and parafunctional activity. Producing greater stresses to which the dentition is exposed.²⁹

In our study more tooth wear was seen in molars and premolars in both the maxillary and mandibular dentition. The result is consistent with a Turkish, Nigerian and a Dutch study.^{7,24,30} According to a Nigerian study high fibrous diet and the habit of chewing and crushing of bones promoted attrition but this dietary habit caused tooth wear on the molars and premolars since these teeth were used for mastication and receives the masticatory forces generated during mastication.³⁰ This can be possible for

our population also. More tooth wear has been seen in incisors and canine in many studies.^{2,10} This variation can be attributed to differences in the indices used, study criteria and diagnostic criteria.

Several studies have shown an association of increase of tooth wear in patients with a habit of clenching of teeth and bruxism.^{6,10,14} The high biting and masticatory forces due to clenching/grinding of teeth are thought to be responsible for the increased wear seen in incisal/occlusal surfaces of teeth.³¹ In our study we couldn't find increase in tooth wear related to clenching of teeth. There was increase in tooth wear in patients who consumed acidic food. The role of acidic foods and beverages is important in the progression of tooth wear. There is plenty of evidence from laboratory studies indicating that acidic foods and beverages with a low pH cause enamel and dentin erosion.^{32,33} Among the 339 patients who participated in this study, there was an increase in tooth wear in patients who consumed hard food. The same result was seen in several studies.¹⁵ In this present study work environment involving dust or acid gas didn't seem to have a relation with tooth wear. In several studies it was seen that severity and prevalence of tooth surface loss increased with the duration of employment in the factory among factory employees.^{10,34}

In this study there is no association between clicking of temporomandibular joint and tooth wear. Although an association between tooth wear and temporomandibular joint disorder has been reported in some studies.³⁵ Where as most studies indicate that temporomandibular joint disorder is not a risk factor for tooth wear.^{14,36}

Acid reflux has shown to be related to tooth wear in many studies. Some studies have found a significant association between acid reflux and palatal surface wear.³⁷ But in our study acid reflux didn't have any effect on tooth wear.

In this study tobacco use wasn't associated with tooth wear. The score for different forms

of tobacco wasn't applicable. Whereas several studies have shown a strong association between use of smokeless form of tobacco and tooth wear.^{6,10} Tobacco contains abrasive silica particles which when mixed with saliva and chewed forms an abrasive paste that over a period of time can wear down the teeth. In addition, the number of pathologically worn surfaces increases with the simultaneous increase in the frequency and duration of chewing tobacco.³⁸

This study observed that the use of hard and medium bristled toothbrushes were related to tooth wear. In addition, a horizontal and mixed brushing technique, which is one of the most important reasons for wedge shaped defects, was positively associated with tooth wear.

In our study it was observed that tooth wear leads to hypersensitivity and the result was statistically significant. Dentinal hypersensitivity has been reported on all worn tooth surfaces; occlusal/incisal, as well as buccal and lingual.^{39,40} Pathological tooth wear, due to its speed and inability of the pulp to lay down sufficient dentine, most commonly causes dentinal hypersensitivity in contrast to physiological tooth wear.⁴¹

In Conclusion, the results of our study show that tooth wear is a consequence of aging, increases on consuming hard and acidic food. There is an association between tooth wear and dentinal hypersensitivity. There are multifactorial causes of tooth wear. Hence, the dentist should educate the patient and spread awareness of tooth wear.

ACKNOWLEDGEMENT

We would like to acknowledge Dr. Anju Khapung, Lecturer department of Community Dentistry Nepal Medical College, Attarkhel, Gokarneshwor-8, Kathmandu, Nepal for her help in statistical analysis and all the patients who had agreed to be a part of the study.

REFERENCES

1. Smith BG, Robb ND. The prevalence of tooth wear in 1007 dental patients. *J Oral Rehabil* 1996; 23: 232-9.
2. Sun CK, Wang W, Wang X, Shi X, Si Y, Zheng S. Tooth wear: a cross-sectional investigation of the prevalence and risk factors in Beijing. *Brit Dent J Open* 2017; 3: 1-7.
3. Wei Z, Du Y, Zhang J, Tai B, Du M, Jiang H. Prevalence and indicators of tooth wear among Chinese adults. *Plos one* 2016; 9: 1-14.
4. Wirdatu R, Daly R, Zaripah W *et al.* The study of tooth wear patterns and their associated etiologies in adults in Kelantan, Malaysia. *Arch Orolfac Sci* 2010; 2: 47-52.

5. Bartlett D, Dugmore C. Pathological or physiological erosion is there a relationship to age? *Clin Oral Investig* 2008; 12: 27-31.
6. Deshpande S. Investigation of Tooth Wear and its Associated Etiologies in Adult Patients Visiting Dental Institute in India. *Dentistry* 2015; 5: 2-5.
7. Karabekiroglu , Sener S, Magat GD, AkdemirI, Unlu N. Occlusal and incisal tooth wear in Turkish adult patients. *Said Int'l J Med Health Res* 2017; 3: 54-60.
8. Barbour ME, Rees GD. The role of erosion, abrasion and attrition in tooth wear. *J Clin Dent* 2006; 17: 88-93.
9. Ganss C, Klimick J, Borkowski N. Characteristics of tooth wear in relation to different nutritional patterns including contemporary and medieval subjects. *Eur J Oral Sci* 2002; 110: 54-60.
10. Ahuja N, Ahuja N. Prevalence of tooth wear and its associated risk factors among industrial workers in Daman, India: a cross-sectional study. *Int'l J Community Med Public Health* 2017; 4: 4445-51.
11. Gregg T, MaceS, West NX, Addy M. A study in invitro the abrasive effect of tongue on enamel and dentine softened by acid erosion. *Caries Res* 2004; 38: 557-60.
12. Al-Omiri MK, Lamey PJ, Clifford T. Impact of tooth wear on daily living. *Int'l J Prosthodont* 2006; 19: 601-5.
13. KitasakoY, SasakiY, TakagakiT, SadrA,TagamiJ. Age-specific prevalence of erosive tooth wear by acidic diet and gastroesophageal reflux in Japan. *J Dent* 2015; 43: 418-23.
14. Cunha-Cruz J, Pashova H, Packard JD, Zhou L, Hilton T. Tooth wear: Prevalence and associated factors in general practice patients. *Community Dent Oral Epidemiol* 2010; 38: 228-34.
15. Liu B, Zhang M, Chen Y, Yao Y. Tooth wear in aging people: an investigation of the prevalence and the influential factors of incisal/ occlusal tooth wear in northwest China. *BMC Oral Health* 2014; 14: 65-9.
16. Petersen PE, Gormsen C. Oral conditions among German battery factory workers. *Community Dent Oral Epidemiol* 1991; 19: 104-6.
17. Bartlett DW, Lucci A, West NX, Bouchaerd P, Sanz M, Bourgeois D. Prevalance of tooth wear on bucal and lingual surfaces and possible risk factors in young European adults. *J Dent* 2013; 41: 1007-13.
18. Lussi A, Schaffner M, Hotz P, Suter P. Dental erosion in a population of Swiss adults. *Community Dent Oral Epidemiol* 1991; 19: 286-90.
19. Spijkera AV, Rodriguez JM, Kreulenc CM et al. Prevalence of tooth wear in adults *Int'l J Prosthodont* 2009; 22: 151-58.
20. Lopez-Frias FJ, Castellanos-Cosano L, Martin-Gonzalez J, Llamas-Carreras JM, Segura- Egea JJ. Clinical measurement of tooth wear: Tooth Wear Indices. *J Clin Exp Dent* 2012; 4: 48-53.
21. Fareed K, Johansson A, Omar R. Prevalence and severity of occlusal tooth wear in a young Saudi population. *Acta Odontol Scand* 1990; 48: 279-85.
22. Milosevic A, Bardsley PF, Taylor S. Epidemiological studies of tooth wear and dental erosion in 14 year old children in North West England. Part 2: Association of diet and habits. *Brit Dent J* 2004; 197: 479-83.
23. Shrestha D, Rajbhandari P. Prevalence and Associated Risk Factors of Tooth Wear. *J Nepal Med Assoc* 2018; 56: 719-23.
24. Wetselaar P, Vermaire JH, Visscher CM, Lobbezoo F, Schuller AA. The Prevalence of Tooth Wear in the Dutch Adult Population. *Caries Res* 2016; 50: 543-50.
25. Taiwo JO, Ogunyinka A, Onyeaso CO, Dosumu OO. Tooth wear in the elderly population in south east local government area in Ibadan, Nigeria. *Odontostomatol Trop* 2005; 28: 9-14.
26. Hugoson A, Bergendal T, Ekfeldt A, Helkimo M. Prevalence and severity of incisal and occlusal wear in an adult Swedish population. *Acta Odontol Scand* 1988; 46: 255-65.
27. Donachie MA, Walls AWG. Assessment of tooth wear in an ageing population. *J Dent* 1995; 23: 157-164
28. Ekfeldt A, Hugoson A, Bergendal T, Helkimo M. An individual tooth wear index and an analysis of factors correlated to incisal and occlusal tooth wear in an adult Swedish population. *Acta Odontol Scand* 1990; 48: 343-49.
29. Donachie MA, Walls AWG. Assessment of tooth wear in an ageing population. *J Dent* 1995; 23: 157- 64
30. Braimoh OB, Alade GO. Prevalence and distribution of tooth wear in an elderly cohort in Port Harcourt, Nigeria. *J Dent Res Rev* 2018; 5: 80-3.
31. Solanki S, Gupta I, Prasad S, Chinmaya BR. Prevalence and severity of tooth wear in 12 to 15 year old school children in the Gurgaon district, Haryana, India: a cross-sectional study. *Arch Oral Res* 2013; 9: 193-9.
32. Attin T, Weiss K, Becker K, Buchalla W, Wiegand A. Impact of modified acidic soft drinks on enamel erosion. *Oral Dis* 2005; 11: 7-12.
33. Bartlett DW, Fares J, Shirodaria S, Chiu K, Ahmad N, Sherriff M. The association of tooth wear, diet and dietary habits in adults aged 18-30 years old. *J Dent* 2011; 39: 811 -16.
34. Gupta V, Asawa K, Bhat N, Tak M, Bapat S. Assessment of oral hygiene habits, oral hygiene

- practices and tooth wear among fertilizer factory workers of Northern India: A Cross sectional study. *J Clin Exp Dent* 2015; 7: 649-55.
35. Carlsson GE, Egermark I, Magnusson T. Predictors of signs and symptoms of temporomandibular disorders: a 20-year follow-up study from childhood to adulthood. *Acta Odontol Scand* 2002; 60: 180-5
36. Schierz O, John MT, Schroeder E, Lobbezoo F. Association between anterior tooth wear and temporomandibular disorder pain in a German population. *J Prosthet Dent* 2007; 97: 305-9.
37. Bartlett DW, Evans DF, Anggiansah A *et al.* A study of the association between gastro-oesophageal reflux and palatal dental erosion. *Br Dent J* 1996; 181: 125-31.
38. Deshpande S. Investigation of Tooth Wear and its associated etiologies in adult patients visiting dental institute in India. *Dentistry* 2015; 5: 271-75.
39. Olley R C, Moazzez R, Bartlett D. The relationship between incisal/occlusal wear, dentine hypersensitivity and time after the last acid exposure in vivo. *J Dent* 2015; 43: 248-252.
40. West N X, Sanz M, Lussi A, Bartlett D, Bouchard P, Bourgeois D. Prevalence of dentine hypersensitivity and study of associated factors: A European population-based cross-sectional study. *J Dent* 2013; 41: 841-51.
41. Olley RC, Sehmi H. The rise of dentine hypersensitivity and tooth wear in an ageing population. *Brit Dent J* 2017; 4: 293-97.