

Anterior Verses Posterior Tooth Wear and Associated Risk Factors Among Patients Attending Oral Medicine OPD of Karachi



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BACKGROUND: The objective of the present study was to evaluate the prevalence of anterior and posterior tooth wear among dental patients visiting the Oral Medicine and Diagnosis outpatient department (OPD) of Bahria University Medical and Dental College, Karachi (BUMDC) and to assess the associated risk factors related to anterior and posterior tooth wear. **METHODOLOGY:** It was a cross sectional study conducted from January 2017 to June 2017. Total 526 participants with the chief complain of sensitivity and tooth wear were included in this study and were examined by trained dental surgeons. The examiners were trained on degree of attrition (Tooth Wear Index TWI; by Smith & Knight 1984) via using structured questionnaire. Descriptive analysis, Pearson Chi square test and ordinal regression analysis was performed on SPSS version 23 for future predictions.

RESULTS: In this study, tooth wear was found to be more prevalent among individuals aged 31-40 years (n=215) 40.9% and (n=145) 27.6% in those who were in social class III_m (manual skilled workers like bus driver, carpenter etc). The prevalence of anterior tooth wear was (n=169) 32.1%, posterior (n=208) 39.5% and both anterior and posterior location were (n=149) 28.3%. It was observed in this study that multiple risk factors had a significant impact on the location of the tooth wear. Majority of participants (n=409) 77.8% were practicing tooth brushing as a mode of oral hygiene with posterior tooth wear as most common finding (n=170, 41.5%, P-value=0.0001). Regarding parafunctional habits, majority (n=419, 79.7%, P-value=0.0001) participants were in habit of clenching. There was a remarkable effect of gastro intestinal reflux disease (GERD) on tooth wear, (n=299) 56.8% participants had GERD, (n=147) 49.1% participants had posterior tooth wear (n=55) 18.3% had anterior tooth wear and (n=97) 32.4% had both anterior and posterior tooth wear (P-value=0.0001). There was a significant effect of oral habits (betel nuts chewing) on tooth surfaces (n=243) 46.2% participants were consuming betel quid in which (n=129) 53.08% participants were found with more posterior then anterior tooth wear (P-value=0.0001). A total of 184 (75.5%) participants were consuming 5-10 packets/day of betel quid and of these 51.6% (n=95/184) participants reported with posterior tooth wear (P-value=0.0001). To assess the future predictions, ordinal regression analysis were carried out. It was observed that location of tooth wear would be effected by GERD, parafunctional habits (clenching), oral habits (betel nuts chewing) and frequency of oral habits.

CONCLUSIONS: We conclude from this study that there were multiple risk factors associated with tooth wear. It was observed that posterior tooth wear, younger age group, social class III_m, parafunctional habits (clenching), betel nut usage, history of GERD, abrasive oral hygiene practices and technique of brushing were most common findings.

KEY WORDS: Abrasion, attrition, erosion, oral habits, tooth wear.

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INTRODUCTION

Tooth wear is one of the frequent oral problems encountered worldwide at any age¹⁻⁴ and one of the most common complains for seeking dental treatment

in last 20 years.^{2,5,6} Patients with tooth wear visit the dentist with the chief complain of sensitivity⁵ which has multiple etiological risk factors.⁷ Tooth wear is found in 80% of children⁷ and 43% in adult population and in old age due to multiple co-morbidities.⁸ Tooth wear is a broad term used for the structural loss of hard tooth substance in absence of any trauma or dental caries. Multiple mechanisms are involved in this process of tooth wear, such as attrition, abrasion and erosion.^{9,10,11,12} All these types of tooth wear may be found separately or at times collectively in a single case.¹²

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There are multiple tooth wear indices reported in the literature and are either laboratory based or clinical. The indices are categorized in two broad types; qualitative and quantitative.¹³ Multiple tooth wear frameworks were used in an Indian study (Manipal) and reported prevalence was 5-50%.¹² Among native population of India the reported occurrence of dental erosion was 22% .¹⁴ Tooth wear is a global phenomenon that affects all age groups; however it is more frequent in old age.^{8,15,16} Tooth wear is presented in two different types which are clinical and anatomical. Clinical presentation is known as qualitative or subjective method assessed as mild, moderate and severe. The objective and physical measurement of tooth wear is known as quantitative method/anatomical presentation which entail the quantitative data of tooth wear. In this study anatomical presentation of crown provided the quantitative data for reporting tooth wear by using Smith and Knight -tooth wear Index to measure the anatomical crown.¹⁷

Moreover, there are multiple risk factors associated with tooth wear like socioeconomic status, (Gastro intestinal reflect diseases) GERD, some eating disorders like bulimia or anorexia and dietary habits like acidic food intake.^{4,7,8,18} However normal level of tooth wear is age dependent and evidenced in some literature.^{9,16} There are multiple parafunctional habits which have a direct link with any type of tooth wear like clenching, bruxism, hard food biting, pen biting and oral hygiene methods. Certainly, tooth wear is irreversible process and until its risk factor and etiology is investigated, it becomes severe as age progresses. Therefore, to prevent tooth wear and its associated management, diagnosis prevention and treatment are the foundations for the management of tooth wear.¹⁰

Conversely, there is not such kind of study conducted in Pakistan which can create the association between location of tooth wear (anterior, posterior or anterior and posterior) and risk factors of tooth wear by using the quantitative method of tooth wear, however some studies revealed the frequency of acidic food intake and prevalence of tooth wear in Pakistan. It was hypothesized that parafunctional habits, consumptions of oral habits and its frequency, gastro intestinal regurgitation disorders have an impact on location of tooth wear and its scoring among Pakistani sample gathered from oral medicine OPD of Bahria Dental College. The primary objective of the study was to investigate prevalence of anterior verses posterior tooth wear among different age groups of patients and among different occupational classification of participants reporting to BUMDC. The secondary objectives of this study were to find out the impact of oral habits on tooth wear and to find out the association of tooth wear with gastric diseases.

METHODOLOGY

2.1: Study Design:

It was a cross sectional study conducted in Oral Medicine and Diagnosis, OPD of Bahria University of Medical and Dental College (BUMDC). This study was conducted after the permission granted by the Ethical Review Committee of Bahria University Medical and Dental College (Ref no. 31/17). To assess the time required for each participant and to evaluate viability and feasibility of the study, pilot study was carried out before the commencement of actual study among 26 patients who reported to BUMDC with the chief complain of sensitivity and fulfilled the inclusion criteria. The information acquired from pilot study was later included in original study. The study population involved the patients with tooth wear and sensitivity, having 20 teeth or above, willing to participate in the study and fall under the age bracket of 12-70 years via purposive sample technique. Those patients having lesser than 20 teeth, mentally challenged, having neurological disorder, wearing denture, having multiple restoration and unwilling to participate were excluded from the study. The duration of study was 5 months from Feb 2017 to June 2017. On the basis of 50% prevalence, the sample size was calculated by using the following standard formula as 384 which was increased to 526.

$$N = \frac{(Z)^2XP(1-P)}{d^2}$$

2.2: Questionnaire:

There were fourteen questions in tooth wear proforma; which was formulated by demographic variables and other associated factors established in literature like para functional habits, history of gastrointestinal pathologies, oral hygiene related questions (mode of oral hygiene and technique/texture of tooth brush, frequency of fizzy drinks, consumption of oral habits and its frequency, and scoring of tooth wear recorded by Smith and Knight tooth wear Index 1984¹⁷ and location of tooth wear was marked after dental examination executed by two calibrated dentists who were trained on degree of attrition (by Tooth Wear Index, TWI; Smith & Knight 1984)¹⁷ via using structured questionnaire. The questionnaire comprised of qualitative and quantitative variables. Qualitative variables were age, gender, social classes (Registrars general classification of Social Class-Scrambler-1991)¹⁹, socioeconomic status, history of gastrointestinal pathologies, mode and technique of oral hygiene, texture of tooth brush; para functional habits, oral habits and its frequency, and scoring of tooth wear (Smith and Knight Index)^{11,17} was a quantitative variable. To assess the social classes, the Registrars general classification of Social Class-Scrambler-1991 was used, which divides the

social classes into six categories.¹⁹

Social class I: professionals including accountant, doctors, and lawyers.

Social class II: Intermediate including manager, nurse, and school teacher.

Social class IIIIn: skilled non-manual laborer including clerical worker, shop worker.

Social class IIIIm: skilled manual laborer including bus-driver; carpenter etc.

Social class IV: semi-skilled manual laborer including agricultural workers and postman.

Social class V: unskilled manual laborer including laborer and cleaner.

2.3: Clinical Examination:

The questionnaire was filled and clinical examination was performed after getting informed consent from the patients. The objectives of the study were explained and rationale was given before conducting this dental examination to all participants. The occlusal and incisal surfaces were recorded according to the Smith and Knight -tooth wear index to get objective measurements of the tooth wear. There were total five scores; from 0 in this index. Score 0 entailed characteristics of no loss of enamel surface, score 1 refers to loss of enamel surface, score 2 entailed enamel loss just exposing dentine, < 1/3 of surface and defect of 1-2mm, score 3 refers to enamel loss exposing dentine,> 1/3 of surface and defect of 1-2mm deep, score 4 entailed complete enamel loss or pulp exposure defect more than 2mm deep. The anterior group involved central incisors, lateral incisors and canines and posterior group involved premolars and molars teeth.

2.4: Statistical Analysis:

Data was analyzed on SPSS version 23. Descriptive data was calculated for categorical variables. Association between different variables were assessed through application of chi square (χ^2) and ordinal regression analysis was performed to find out the future predictions of dependent variable from independent variables. P-value less than 0.05 was taken as statistically significant.

RESULTS

A total of 526 dental patients; who gave consent were included in the study from the oral medicine OPD of BUMDC and were examined according to the questionnaire. Gender, age and social class wise results and its association with location of tooth wear is presented in table no. 1. Male participants were in greater proportion as compare to female. While majority of participants were in 31-40 age group

Table 1: Association of the location of tooth wear with gender, age and social Classes

Variables	Categories	Location of tooth wear			Total	P-Value*
		Anterior	Posterior	Ant & Post		
Gender	Male	112	144	107	363	0.564
	Female	57	64	42	163	
	total	169	208	149	526	
Age in years	12-20	1	0	0	1	0.058
	21-30	5	3	1	9	
	31-40	68	99	48	215	
	41-50	60	81	68	209	
	51-60	34	24	31	89	
	< 60	1	1	1	3	
	total	169	208	149	526	
Social Classes	I	6	1	2	9	0.0001
	II	22	15	15	52	
	IIIIn	36	47	29	112	
	IIIIm	39	58	48	145	
	IV	35	25	23	83	
	V	12	0	1	13	
	N/A	19	62	31	112	
	total	169	208	149	526	

*Chi square test was applied.

(n=215, 40.9%), and 41-50 group (n=209, 39.7%). Majority of participants belonged to social class IIIIm (n=145, 27.6%). Clinical assessment of tooth wear by Smith and Knight Index is presented in table no 2. Score 1 was most prevalent (n=247, 47%, p=0.020). Similarly, most commonly affected surface was posterior where score 1 was most

Table 2: Clinical assessment of tooth wear by Smith and Knight Index

Variables	Categories	Location of tooth wear			Total	P-Value*
		Anterior	Posterior	Ant & Post		
Score	0	0	2	2	4	0.020
	1	73	110	64	247	
	2	77	58	59	194	
	3	10	19	8	37	
	4	9	19	16	44	
	Total	169	208	149	526	

*Chi square test was applied.

common (n=110, 21%). The most severe tooth wear, score 4 was found mostly on posterior surfaces (3.6%). Association of tooth wear with gastrointestinal diseases is presented in table 3. GERD was the most common gastrointestinal disorders (n=299, 56.8%), where posterior region of dentition was mostly affected with tooth wear (n=147, 49.16%, p=0.0001). Whereas when no GI disturbance was present, anterior tooth wear was most prevalent. Clenching was found

Table 3: Effects of Risk factors on location of tooth

Variables	Categories	Location of tooth wear			Total	P-Value*
		Anterior	Posterior	Ant & Post		
GIT Disorders	GERD	55	147	97	299	0.0001
	Anorexia Nervosa	2	0	1	3	
	Bulimia	1	0	2	3	
	Nausea/Vomiting	1	1	1	3	
	No GIT Disorder	110	60	48	218	
	Total	169	208	149	526	
Mode of Oral Hygiene	Brush	129	170	110	409	0.0001
	Miswak	22	3	9	34	
	Finger	7	7	9	23	
	Nothing	5	0	1	6	
	Tooth powder	4	0	3	7	
	1 & 2	2	28	17	47	
	Total	169	208	149	526	
Parafunctional Habits	Clenching	118	182	119	419	0.0001
	Bruxism	20	21	16	57	
	Nail Biting	8	1	0	9	
	Pen Biting	17	1	6	24	
	Mouth breathing	3	1	1	5	
	1 & 2	3	2	7	12	
	Total	169	208	149	526	
Oral Habits	Pan	7	0	2	9	0.0001
	Betel nut	43	129	71	243	
	Smokeless tobacco	4	2	2	8	
	Nothing	115	77	74	266	
	Total	169	208	149	526	
Frequency of Betel Nut	Less than 2 pkts/day	11	1	5	17	0.0001
	Less than 5 pkts/day	12	39	21	72	
	5-10 pkts/day	38	95	51	184	
	Use nothing	108	73	72	253	
	Total	169	208	149	526	

*Chi square test was applied.

to be the most common parafunctional habit (n=419/5260). In clencher, the tooth wear was mostly confined to posterior dentition (n=182). Overall, when comparing parafunctional habits to location of tooth wear (n=169/526) 32.1% had tooth wear on anterior, (n=208/526) 39.54% had tooth wear on posterior and (n=149/526) 28.32% participants had tooth wear on anterior and posterior location (p-value=0.0001). Betel nut consumption was most common oral habit (n=243/526, 46.2%) and among them posterior dentition was found to be mostly affected (n=129/243, p=0.0001). To assess the future predictions that how much dependent variable (location of tooth wear) would be affected by independent variables (risk factors), ordinal regression analysis was carried out. Upon analysis; location of tooth wear was found to be effected by GERD, parafunctional habits (clenching), oral habits (betel nuts chewing) and frequency of oral habits (Table-4).

Table 4: Ordinal Regression Test of Parallel Lines^a

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	314.859			
General	254.949 ^b	59.910 ^c	13	0.0001

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.
a. Link function: Logit.
b. The log-likelihood value cannot be further increased after maximum number of step-halving.
c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.

DISCUSSION

The participants who visited with the complaints of sensitivity and tooth wear were examined in this study. We found tooth wear mostly in young and middle age group and persons belonging to social class III_m. While tooth wear was found mostly on posterior teeth, score 1 of tooth wear index was most common. We also found GERD to be most prevalent, while clenching and betel nut usage also contributed to most cases of tooth wear in our study.

Male gender was more inclined to have tooth wear as compare to female gender possibly due to majority of male participants in this study and this result was similar to other multiple studies.^{20,21,22} and the factors which results in more tooth wear in males were mainly due to age, increase bite force, reduced tendency for crowding in dental arches, increased muscle mass, decreased occlusal tactile sensitivity and increased endurance time.^{12,14,23} A high number of participants fall between 31-40 years of age and had more tooth wear on posterior teeth (p-value=0.058) and were associated with GERD, parafunctional habits, oral habits, social classes and these results were in accordance with the study of Firouzei.²⁴ Multiple oral habits are causing frequent mechanical and physical tearing of the tooth surfaces, results in sensitivity and loss of tooth structure includes oral hygiene habits (chewing betel nuts causing grinding of the posterior teeth), brushing techniques, oral and dietary habits (duration and frequency of exposure), parafunctional habits (clenching, bruxism) and regurgitation.^{11,14} We found abnormal clenching and bruxism with significant association with tooth wear and these results were in accordance with the study conducted by Pavone²⁵ and Christensen²⁶ which stated that people with habit of bruxism experience tooth wear four times more than the people without this habit. In this study, more than 50% of participants with tooth wear were found to have GERD (56.8%) only three participants had the complain of nausea and vomiting and found tooth wear one on anterior, one on posterior and one on both location (n=3/256) (p-value=0.0001). In 2008, a systematic review by Pace et al analyzed seventeen studies including case-control and observational, demonstrating a strong association between

tooth wear and GERD.^{18,27} Firouzei et al also reported that tooth erosion and GERD have strong association.²⁴ The most commonly described oral manifestation attributed to GERD (and other causes of stomach contents reaching the mouth), is tooth erosion, which has been widely investigated and reported in dental literature.²⁸⁻⁴² In multiple case-control studies GERD was associated with at least 20-30% of patients with tooth erosion and majority of clinical studies of tooth erosion had confirmed the evidence of GERD (using esophageal endoscopy and pH-metry).^{28,30,32,34-37,42,43}

Most prevalent oral hygiene practice in this study population was brushing, with horizontal technique, then miswak, some of them have the habit of using both, very few people were using finger with tooth powder and found to have more posterior tooth surface loss and the results were significant and similar to the study conducted by David and Gupta.^{12,44}

Individuals with pan chewing, betel nut chewing, and tobacco powder chewing showed increased wear rates, all these habits will lead to hard tissue changes in the form of severe occlusal and incisal attrition. Younger individuals resort to the packet forms of 'pan masala' which also leads to tooth wear depending on the frequency of consumption, the results of this study were quite significant and similar with other study.^{12,21-23,45}

In current study the posterior tooth surface were reported more amongst the participants with parafunctional habit (clenching and its severity was graded by using Knight and Smith index 1984 criteria) and the results were significant, and comparable with multiple studies^{11,25,46} mostly due to hard, stronger and frequent biting forces.

Strengths and Limitations of the study:

One of the limitations of this study was it being a single center study; secondly, there were more male participants than females, thirdly other demographic variables like ethnicity, educational status were not assessed in this study. The larger sample size and calibration of two examiners were the strengths of this study.

RECOMMENDATIONS

It is recommended that multi-centered study should be conducted and public health awareness campaign should be arranged to address the preventive measures of tooth. There is a need to provide awareness in general public regarding the causative factors of tooth wear; to address and treat the common complain of tooth sensitivity at an early stage. General public is unaware about the etiology of tooth wear and they visit to dentist when the conditions become worsen; so early diagnosis is only possible when there is an adequate awareness.

CONCLUSIONS

It was inferred from this study that there were multiple risk factors associated with tooth wear and the provided data revealed that posterior erosion was more prevalent in younger age group belonging to the social class III_m, while parafunctional habits (clenching), frequency of chewing betel nuts, history of GERD, abrasive oral hygiene practices and technique of brushing were found to have significant association with tooth wear.

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CONFLICT OF INTEREST

Not declared

REFERENCES

1. Al-Majed I, Maguire A, Murray JJ. Risk factors for dental erosion in 5-6 year old and 12-14 year old boys in Saudi Arabia. *Community Dent Oral Epidemiol.* 2002;30:38-46.
2. Hasselkvist A, Johansson A, Johansson AK. Dental erosion and soft drink consumption in Swedish children and adolescents and the development of a simplified erosion partial recording system. *Swed Dent J.* 2010; 34:187-95.
3. Baber H, Abbas Z, Maqsood S. Knowledge and Association of Dental Erosion with Age and Gender in Local OPD of Pakistan. *J Pak Dent Assoc.* 2016;25:32-37.
4. Al-Dlaigan Y, Shaw L, Smith A. Dental erosion in a group of British 14-year-old school children Part II: Influence of dietary intake. *Br Dent J.* 2001 ;190:258.
5. Lussi A, Hellwig E. Risk assessment and causal preventive measures. In *Erosive Tooth Wear 2014* (Vol. 25, pp. 220-229). Karger Publishers.
6. Mantonanaki M, Koletsi-Kounari H, Mamai-Homata E, Papaioannou W. Dental erosion prevalence and associated risk indicators among preschool children in Athens, Greece. *Clin Oral Investig.* 2013;17:585-93.
7. Shahbaz U, Quadir F, Hosein T. Determination of Prevalence of Dental Erosion in 12-14 Years School Children and Its Relationship with Dietary Habits. *J Coll Physicians Surg Pak.* 2016;26:553.
8. Department of Health and Human Services. Preventing chronic diseases: Investing wisely in health. The critical

- role of school health programs. [Online]. 2003 [cited 2010 Sep 8]; from:URL:www.cdc.gov/nccdphp/publications/factsheets/Prevention/pdf/schoolhealth.pdf.
9. Bishop K, Kelleher M, Briggs P, Joshi R. Wear now? An update on the etiology of tooth wear. *Quintessence Int.* 1997;28:305-13.
 10. Molnar S, McKee JK, Molnar IM, Przybeck TR. Tooth wear rates among contemporary Australian Aborigines. *J Dent Res.* 1983;62:562-5.
 11. 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.
 12. David K, Bhat KM. Prevalence of tooth wear in patients attending the department of periodontics, Manipal college of dental sciences, Manipal. *NJIRM.* 2012;3: 136-141.
 13. López-Frías FJ, Castellanos-Cosano L, Martín-González J, Llamas-Carreras JM, Segura-Egea JJ. Clinical measurement of tooth wear: Tooth wear indices. *J Clin Exp Dentistry.* 2012;4:48-53.
 14. Kumar S, Acharya S, Mishra P, Debnath N, Vasthare R. Prevalence and risk factors for dental erosion among 11- to 14-year-old school children in South India. *J Oral Sci.* 2013;55:329-36.
 15. Bartlett DW, Lussi A, West NX, Bouchard P, Sanz M, Bourgeois D. Prevalence of tooth wear on buccal and lingual surfaces and possible risk factors in young European adults. *J Dent.* 2013;41:1007-13.
 16. Bartlett D, Dugmore C. Pathological or physiological erosion-is there a relationship to age? *Clinic Oral Invest.* 2008;12:27-31.
 17. Smith BG, Knight JK: An index for measuring the wear of teeth. *Br Dent J.* 1984; 156:435-438.
 18. Zhang S, Chau AM, Lo EC, Chu CH. Dental caries and erosion status of 12-year-old Hong Kong children. *BMC Public Health.* 2014;14:7.
 19. <https://www.ucl.ac.uk/celsius/onlinetraining/socio/se040100> (Registrars general classification of Social Class-Scrambler-1991).
 20. Wild YK, Heyman MB, Vittinghoff E, Dalal DH, Wojcicki JM, Clark AL, et al. Gastroesophageal reflux is not associated with dental erosion in children. *Gastroenterology* 2011;141: 1605-11.
 21. Al-Zarea BK. Tooth surface loss and associated risk factors in northern Saudi arabia. *ISRDN Dent.* 2012;2012:161565.
 22. Cunha-Cruz J, Pashova H, Packard JD, Zhou L, Hilton TJ. Tooth wear: prevalence and associated factors in general practice patients. *Community Dent Oral Epidemiol.* 2010;38:228-34.
 23. Johansson A, Haraldson T, Omar R, Kiliaridis S, Carlsson GE. An investigation of some factors associated with occlusal tooth wear in a selected high wear sample. *Eur J Oral Sci.* 1993;101:407-15.
 24. Firouzei M et al. Khazaei S, Afghari P, Feiz A, Savabi O, Keshteli AH, Adibi P. Gastroesophageal reflux disease and tooth erosion: Sepahan systematic review. *J Gastro Hepato.* 2013;28:769.
 25. Pavone BW. Bruxism and its effect on the natural teeth. *J Prosthet Dent.* 1985;53:692-6.
 26. Christensen GJ. Treating bruxism and clenching. *The J Am Dent Assoc.* 2000;131:233-5.
 27. Pace F, Pallotta S, Tonini M, Vakil N, Bianchi Porro G. Systematic review: gastro-oesophageal reflux disease and dental lesions. *Aliment Pharmacol Ther.* 2008;27:1179-86.
 28. Schroeder PL, Filler SJ, Ramirez B, Lazarchik DA, Vaezi MF, Richter JE. Dental erosion and acid reflux disease. *Ann Intern Med.* 1995;122:809-15.
 29. Böhmer CJ, Klinkenberg-Knol EC, Boer MC, Meuwissen PR, Meuwissen SG. Dental erosions and gastro-oesophageal reflux disease in institutionalized intellectually disabled individuals. *Oral Dis.* 1997;3:272-5.
 30. Munoz JV, Herreros B, Sanchiz V, Amoros C, Hernandez V, Pascual I, Mora F, Minguez M, Bagan JV, Benages A. Dental and periodontal lesions in patients with gastroesophageal reflux disease. *Dig Liver Dis.* 2003;35:461-7.
 31. Dahshan A, Patel H, Delaney J, Wuerth A, Thomas R, Tolia V. Gastroesophageal reflux disease and dental erosion in children. *J Pediatr.* 2002;140:474-8.
 32. Linnett V, Seow WK, Connor F, Shepherd R. Oral Health of Children with Gastro-Esophageal Reflux Disease: A Controlled Study. *Aus Dent J.* 2002;47:156-62.
 33. Jensdottir T, Arnadottir IB, Thorsdottir I, Bardow A, Gudmundsson K, Theodors A, Holbrook WP. Relationship between dental erosion, soft drink consumption, and gastroesophageal reflux among Icelanders. *Clin oral Investig.* 2004;8:91-6.
 34. Ersin NK, Öncag Ö, Tümgör G, Aydogdu S, Hilmioglu S. Oral and dental manifestations of gastroesophageal reflux disease in children: a preliminary study. *Pediatr Dent.* 2006;28:279-84.
 35. Bartlett DW, Evans DF, Anggiansah A, Smith BG. A study of the association between gastro-oesophageal reflux and palatal dental erosion. *Br Dent J.* 1996;181:125-31.
 36. Gregory-Head BL, Curtis DA, Kim L, Cello J. Evaluation of dental erosion in patients with gastroesophageal reflux disease. *J Prosthet Dent.* 2000;83:675-80.
 37. Moazzez R, Anggiansah A, Bartlett DW. The association of acidic reflux above the upper oesophageal sphincter with palatal tooth wear. *Caries res.* 2005;39:475-8.
 38. Bartlett D. Intrinsic causes of erosion. *Monogr Oral Sci.*

2006; 20:119-39.

39. Wong BC, Wong RW, Smales RJ. Gastroesophageal reflux disease and tooth erosion. *Int J Dent.* 2012;2012:479850

40. Di Fede O, Di Liberto C, Occhipinti G, Vigneri S, Lo Russo L, Fedele S, Lo Muzio L, Campisi G. Oral manifestations in patients with gastro-oesophageal reflux disease: a single-center case-control study. *J Oral Pathol Med.* 2008;37:336-40.

41. Higo T, Mukaisho K, Ling ZQ, Oue K, Chen KH, Araki Y, Sugihara H, Yamamoto G, Hattori T. An animal model of intrinsic dental erosion caused by gastro-oesophageal reflux disease. *Oral Dis.* 2009;15:360-5.

42. Holbrook WP, Furuholm J, Gudmundsson K, Theodors A, Meurman JH. Gastric reflux is a significant causative factor of tooth erosion. *J Dental Res.* 2009;88:422-6.

43. Wilder-Smith CH, Wilder-Smith P, Kawakami-Wong

H, Voronets J, Osann K, Lussi A. Quantification of dental erosions in patients with GERD using optical coherence tomography before and after double-blind, randomized treatment with esomeprazole or placebo. *Am J Gastroenterol.* 2009;104:2788-95.

44. Gupta VV, Asawa K, Bhat N, Tak M, Bapat S, Chaturvedi P, Philip-George P, Chitkara N, Patel MN, Shinde K, Sidhu PK. 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:e649-55.

45. Petersen PE, Henmar P. Oral conditions among workers in the Danish granite industry. *Scand J Work, environ Health.* 1988;14:328-31.

46. Lobbezoo F, van der Zaag J, Naeije M. Bruxism: its multiple causes and its effects on dental implants-an updated review. *J Oral Rehab.* 2006;33:293-300.