ORIGINAL ARTICLE

INVESTIGATION OF ABRASION RELATED TOOTH SURFACE LOSS AND ITS ASSOCIATION WITH ORAL HYGIENE BEHAVIOURS

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ABSTRACT

The purpose of this study was to explore the frequency and severity of dental abrasion related tooth surface loss and its association with tooth brushing behaviors in residents of Karachi, visiting Bahria University Dental Hospital. This cross-sectional survey comprised of clinical examination to assess the abrasive lesions and an interview session via structured questionnaire to explore the oral hygiene habits. Assessment of dental abrasion using the diagnostic criteria of Smith and Knight Index of tooth surface loss was carried out by a prosthodontist. The data analysis was done using SPSS software and chi- square test was applied to obtain the reliability between the variables. Out of 261 study population, 61(23.4%) cases were encountered with abrasive cervical lesions. Most of the cases around 81.9%, were found to be localized especially in premolar region. Maxillary arch showed predominance with 47.0 % of lesions. In relation to Smith and Knight Tooth wear index, majority of the patients, that is 54.0 % fell into the grade 1 severity score. An insignificant correlation was noted between variables of tooth brushing behaviors and abrasive lesions.

Key Words: *Cross sectional survey, dentist, habits, oral hygiene, software, tooth brushing, tooth wear.*

INTRODUCTION

Tooth surface loss is a composite terminology which broadly covers non-carious tooth surface loss due to attrition, abrasion, abfraction and erosion.[1,2] Physiological tooth surface loss causing vertical loss in a healthy individual is approximately 0.02-0.04 mm per year.3Pathological tooth surface loss occurs beyond the scope of what is considered typical.

Both clinical and experimental observations reveal that individual etiology correlate and overlap each other. Non-carious cervical lesions (NCCL) is used as a blended terminology for tooth surface loss due to erosion, abrasion and abfraction.[4] It is characterized by a non-carious loss of dental tissue near the cemento-enamel junction as enamel is thinnest at this vulnerable area.[4] Numerous epidemiological studies reveal that the prevalence of cervical tooth wear has been reported approximately 5-85%.[5,6]

One of the factors associated with NCCL is dental abrasion. It is an abnormal mechanical wearing away of the tooth substance principally by tooth brushes and/or abrasive dentifrices.[4] Others are flossing, tongue action, abrasive foods, and rubbing from opposing surfaces that are hard or rough, such as unpolished porcelain crowns.[7] Studies reported side effects of tooth brushing with dental abrasion as one of the adverse effects of overzealous tooth brushing behavior.[8] It has been suggested that hard toothbrush, excessive brushing pressure,[9,10] stiffness of the bristle[11] and abrasive toothpaste may be the causative factors. A meta analysis regarding consequences of improper tooth brushing reveals positive association of abrasion related NCCLs with tooth brushing frequency and its method.[12]

American Dental Association recommends teeth brushing twice a day with gentle force accompanied with circling or sweeping movement.[13] In vitro assessment done via profilometric study to assess the role of toothbrush and toothpaste in abrasion process states that brushing with toothpaste caused more abrasion.[14] Secondly, softer toothbrush can cause more abrasion than harder ones.[14] This is due to the fact that soft bristles have better flexibility therefore, cover a larger surface area and thus retain more toothpaste.[14]

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To the best of our knowledge, there is limited literature on abrasion related tooth surface loss on national level and its association with tooth brushing behaviors. Therefore, an effort has been made to assess the different aspects of dental abrasion that is its frequency, arch and pattern dominancy and severity. Secondly, to determine whether there is any correlation between abrasive lesions and variables of oral hygiene habits.

METHODOLOGY

This cross-sectional survey was conducted from February 2014 to August 2015. 261 samples were collected among randomly selected adult patients that visited the Dental Hospital, Bahria University Medical and Dental College, Pakistan. Ethical approval was obtained from the local Research and Ethics Committee, Bahria University Medical and Dental College. Candidates were examined by a Prosthodontist. The sample size was determined using single proportion formula. Purposive sampling technique was employed. Patients aged above 18 years, with permanent dentition were included. Edentulous, partially dentulous, restored or carious tooth surface, primary dentition; patients who underwent orthodontics treatment, developmental anomalies or syndromes associated to dental hard tissues were excluded from the analysis. All participants were interviewed by a modified version of questionnaire which comprised of demographic details and an interrogation about the maintenance of oral hygiene. Clinical examination was done by a prosthodontist using disposable mouth mirror, dental probe, tweezers and gauzes if required to remove food debris under the operating light on the dental chair unit. They were examined for frequency and severity of abrasion using the tooth wear index (TWI) of Smith and Knight where 0=no change, 1=minimal loss of contour, 2=defect< 1mm in depth, 3=defect 1-2mm in depth and 4=defect> 2mm in depth or pulp exposure or exposure of secondary dentin.[15] Abrasion records were documented from cervical (C), the buccal (B), the lingual (L) /palatal (P) and the incisal (I) or occlusal (O) surfaces. The approximal surfaces were not recorded. The variables of tooth brushing were cleaning mode, brushing technique, brush type, cleaning agent, duration of adopting brushing habit,brushing time, frequency of brushing. Data was admitted into Statistical Package for Social Science version 17.0 software. Frequencies and percentages of numerical variables were generated. Chi-square test was used to test association between categorical variables at the level of significance of 5%.

RESULTS

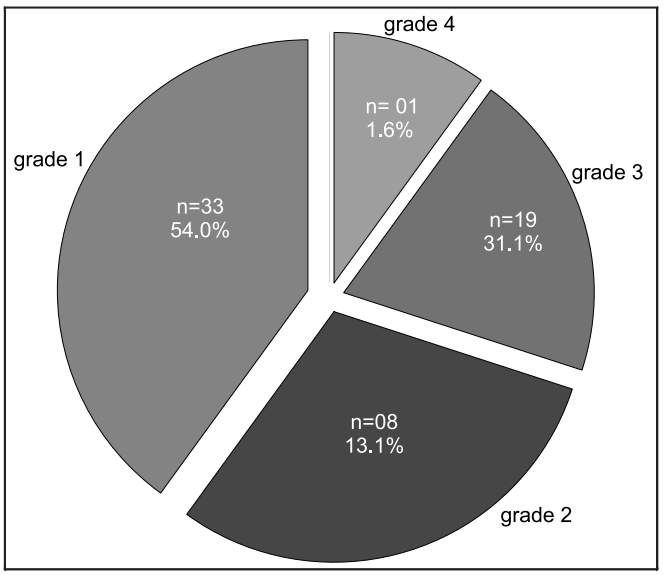
The study population consisted of 261 patients with age ranging from 18 to 72 years, 114 (43.7%) were males and 147 (56.3%) were females. Among the 261 subjects, 61 (23.4%) were seen with abrasive cervical lesions.

Upon analyzing the arch, 47.0% abrasion cases were encountered in the maxilla, 31.7% were in the mandible while 21.3% cases had tooth surface loss in both the maxillary and mandibular arches. While interpreting its pattern, 81.9% cases were found to be localized especially in premolar region while 18.1% cases were of generalized abrasion. Determining the severity of abrasive lesions, majority 33 candidates (54.0%) cases fell into grade 1 severity score in relation to Smith and Knight tooth wear index. (Fig 1)

While assessing the correlation of tooth brushing variables specifically associated with abrasive lesions, 212(81.2%) subjects utilized toothbrush as a cleaning mode of maintaining their oral hygiene. 120(47.1%) participants employed horizontal brushing technique. 115 (45.3%) candidates used medium brush type and 221(85.7%) entrants applied tooth paste as an oral cleaning agent. 227(88.7%) study population had been brushing their teeth for 10 years or above. 155(59.4%) subjects employed brushing time of 1 minute only with once daily application of tooth brush by 118(45.2%) candidates. However, the dental abrasion and variables of oral hygiene habits showed no statistically significant correlation. (p>0.05) (Table 1)

DISCUSSION

Abrasion is extracted from the latin word 'abradere'meaning to scrape of.[16] It is the pathological wearing away of hard tissues through abnormal mechanical process involving foreign objects. Multifactorial reasons are responsible for causing abrasion. The mechanical means used to ensure adequate oral hygiene in preventive dentistry has been incriminated as the principle factor in the formation of abrasive cervical lesions.[8] Other factors like pipe smoking, tooth pick use, thread biting can cause notches on the incisal or occlusal surface[17] or rarely coarse diet may be the culprit involved.



n refers to frequency while % refers to percentage.

Fig 1: Frequencies and percentages of abrasive cervical lesions in terms of Smith and Knight Tooth wear index

TABLE 1: CORRELATION BETWEEN ABRASIVE CERVICAL LESIONS AND ORAL HYGIENE FACTORS

	Oral hygiene habits variables	Responses	Abrasion absent	Abrasion present	P-value
			n	n	
1	Cleaning mode	Toothbrush	56	156	.634
		Finger	2	10	
		Misvak	0	11	
		Combination	4	22	
2	Brushing technique	Horizontal	23	84	.518
		Vertical	22	29	
		Circular	3	09	
		Combination	10	32	
3	Brush type	Soft	21	71	.066
		Medium	26	78	
		Hard	9	7	
4	Cleaning agent	Tooth paste	48	173	.218
		Tooth powder	7	18	
		Manjhan	1	5	
		Combination	5	4	
5	Duration of brushing	1-5 years	3	19	.925
		6-10 years	2	5	
		10 years or above	51	132	
6	Brushing time	1 minute	29	110	.156
		3minutes	22	31	
		5 minutes	5	15	
7	Frequency of brushing	Once a day	20	78	.136
		Twice a day	15	70	
		Thrice a day	3	10	
		More than above	8	8	

Our present study mainly focuses on abrasion related non-carious cervical lesions and its association with the mechanical factors employed for maintaining oral hygiene.

While interpreting materials and method of the undertaken study, the research work subdivided tooth brushing variables into mode of cleaning, brushing technique, brushing time, frequency and duration of adopted brushing habit as the patient's dependent factors; while brush type and cleaning agent were taken as the material factors as assessed by Bhardwaj.[18] The current study applied 'Modified Smith and Knight Index' for assessing tooth surface loss. It measures tooth wear per se irrespective of the etiology. However, the accuracy of indices to estimate tooth surface loss will probably be superseded by more accurate methods like scanning techniques and profilers and study casts along with photographs.[15] Presently, the only clinically feasible method to assess non-carious cervical lesions is indices.[19]

The undertaken study revealed the overall frequency rate of abrasion related tooth surface loss is 23.4%. This is closely in line with the incidence of cervical abrasion investigated by Sud N et al[20] as 13% whereas Sexena V et al[21] (68.6%) and Borcic J et al[22] (60-70%) who reported higher than the current study.6.1% as reported by David K[23] which is lower than the present investigation rate. A study in Romania[24] while spotlighting the etiologies behind tooth surface loss explores abrasion (55.7%) to frequently affect the natural dentition as compared to the other etiologies associated with non-cervical tooth surface loss. Disparity with the compared studies may be due to the variations in sample size and methodology. As non-carious cervical

lesions are not only the outcome of abrasive phenomena alone, most likely have the possibility of interaction with other deteriorating processes especially dental erosion and abfraction which was not assessed in our study. Moreover, literature review suggests that the etiology behind non-carious cervical lesions is multifactorial.[7,19,25,26] which may also be accountable to the low frequency rate in the current investigation.

Commonly affected arch according to the present study is maxillary arch with localized premolar region predominance. Similar trends were reported by Brandini et al[27] and Afolbi et al[28] where more frequency of non-carious cervical lesions in posterior region and maxillary arch were observed. However, Barllet et al[19] and Boliu[29] with his coworkers revealed prevalence more in mandibular jaw specifically anterior teeth. This might be because of the precise focus on one specific etiology of tooth surface loss in the present study as compared to the above mentioned studies; and variations in applied brushing force or affected technique in particular arch and segment. Premolars were the most severely and commonly suffered tooth in relation in the under taken study which is similar to Ahmed H et al.[4] Tomasik M,[25] Afolabi AO et al,[28] Jiang H et al,[30] Que K et al.[31] Dissimilarities was found in the research work did by Boiliush owing 87.22% incisors teeth affected.[29]

The present investigation also revealed abrasive severity score to be grade 2 in the sample of population as detected by Smith and Knight Index of tooth surface loss. Mushtaq et al[15] showed the mean tooth wear index of 1.70±1.22 affecting right mandibular lateral incisor which is quite close to the present study results.

Moreover, our research work also revealed non-significant relationship between tooth brushing behavior variables and abrasive cervical lesions. A similar cross sectional survey was conducted in Karachi[32] to assess the tooth surface loss in association with tooth brushing/ soft drink consumption among adult aged group. Regarding tooth brushing behaviors, females who brushed their teeth once a day reported 55.0% localized tooth surface loss and 60.0% generalized tooth surface loss. 70.4% of males who brushed their teeth for one min reported 70.4% localized tooth surface loss in anterior teeth. 66.7% males claimed tooth surface loss. The compared study output is in contradiction to the current one. Dissimilarity in outputs may be due to the soft drink consumption as an additional variable that was not determined in the present investigation. Elderly aged individuals may also have an impact on positive findings of compared study whereas the undertaken research comprises of candidates with wide range of age groups with lesser amount and duration of stimulus.

An Indian study regarding abrasion related tooth surface loss was conducted to associate tooth brushing behaviors and hard tissue abrasion among population residing in Shimla city.[18] The investigators concluded insignificant linkage among variables of type of tooth brush used, brushing technique and dental abrasions which is quite similar to our results. However, significant bond was observed between frequency of tooth brushing and abrasive lesions that is in contrast to the present finding. This may be due to the fact that the majority of the undertaken sample population applies tooth brush once a day for 1 minute only.

Depending on the diameter of the bristles, toothbrushes have been categorized as soft (0.2 mm), medium (0.3 mm) and hard (0.4 mm).[33] Candidates who use hard toothbrushes showed more abrasive cervical lesions than those using soft toothbrushes. But here the force used may have supplemental effect. Yadav et al[6] and Borcic et al[22] research workouts have reported the above stated facts. Mushtaq F[15] et al also observed significant association between participants using different types of tooth brushes and hard tissue abrasive lesions ($p= 0.05$) but our analysis did not find any significant correlation which may be due to the reason that the major part of sample population employed medium tooth brush. Moreover, the current study did not assess the force while tooth brushing which is a noteworthy factor in the development of cervical lesions.

The current study solely relied upon the feed backs from the study participants as in brushing techniques, employment of type of toothbrush which in itself may lead to insignificant correlation between tooth brushing factors and non-carious cervical abrasive lesions. Moreover review of evidence-based literature[34] does not establish any tooth brushing factor as the baseline etiology behind the cervical lesions because of inherent methodological limitations and conflicting results. As stated previously, literature review encourages the opinion of multifactorial nature causing cervical lesions.[7,19,25,26]

CONCLUSIONS

Within the limitations of the current investigation, it provides baseline statistics regarding abrasive cervical lesions in relation to our local community of Karachi. Secondly, no significant association was observed between tooth brushing factors and occurrence of abrasive lesions. However,further studies and continuous follow-up should be carried out in future to isolate factors related to oral hygiene behaviors and the prevalence of dental abrasion.

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6 Fatima Hassan:	Literature Review.