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# Tooth Wear and Associated Factors in School Children with Primary Dentition in Kathmandu Valley

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## ABSTRACT

**Background:** Tooth wear is the loss of tooth structure from physical or chemical attack of nonbacterial origin. Predominant causative factor for tooth wear in primary dentition is erosion. This study was conducted to assess the prevalence of tooth wear and its associated factors in primary dentition.

**Methods:** Analytical cross-sectional study was conducted after obtaining ethical approval among 425 children aged two to 12 years, enrolled in different preschools/schools located in Kathmandu valley. Informed consent from parents as well as assent from children were obtained. Oral examination for assessing tooth wear was done using Smith and Knight Tooth Wear Index. Self-administered questionnaires were sent to parents for considering the factors associated with tooth wear. Data were entered in Microsoft Excel Sheet and analysed in Statistical Package of Social Sciences. The chi-square/fisher's exact test was done to establish the association between tooth wear and various factors.

**Results:** Among total participants, 295 (69.4%) had tooth wear in at least one or more teeth. Tooth wear was seen significantly higher in children with increasing age ( $p < 0.001$ ). It was significantly associated with brushing technique ( $p = 0.022$ ), type of toothbrush ( $p = 0.005$ ), increasing duration of bottle feeding ( $p = 0.003$ ), in children frequently taking sour food stuffs ( $p = 0.019$ ) and soft drinks/juices ( $p < 0.001$ ).

**Conclusions:** Prevalence of tooth wear was high in primary dentition that increased with age. The condition was significantly associated with type of brushing technique, brushing frequency, materials used and type of diet. Tooth wear is a major problem in young age group having multifactorial etiology. It may lead to dental hypersensitivity and pulpal involvement if not followed up in early stages.

**Keywords:** Factors; primary dentition; Kathmandu valley; tooth wear

## INTRODUCTION

Tooth wear is defined as the loss of tooth structure from a physical or chemical attack of a nonbacterial origin. Irreversible tooth wear constitutes a combination of four distinct chronic processes: attrition, abrasion, abfraction and erosion.<sup>1</sup> The predominant causative factor of tooth wear in primary dentition is erosion.<sup>2</sup> Erosion frequently occurs in combination with attrition, the wear involving tooth to tooth contact and abrasion, the wear involving tooth structure to external object contact.<sup>3,4</sup>

In comparison to permanent enamel, deciduous enamel has significantly lower surface micro-hardness and elasticity. It is significantly softer than permanent

enamel which could make it more susceptible to dissolution and more liable to abrasion and attrition.<sup>5-7</sup>

Only few studies have been conducted globally on tooth wear in primary dentition.<sup>8-11</sup> Therefore, this study was conducted to assess the prevalence of tooth wear and its associated factors in a sample of Nepalese school children with primary dentition.

## METHODS

Analytical cross-sectional study was conducted from 2018 October to 2019 September in different preschools/schools of Kathmandu valley to assess the prevalence and associated factors of tooth wear in primary dentition of preschool/school going children aged two to 12

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years. Ethical approval was taken from the Institutional Review Committee of Kathmandu Medical College (ref no. 080820186) before starting the study. Two stage cluster sampling technique was used to select the pre-schools or primary schools and children of Kathmandu, Lalitpur, and Bhaktapur districts of Kathmandu Valley. Simple random sampling was done to select 36 children each from 12 randomly selected preschools. Permission for conducting the study was taken from Principals of respective schools along with informed consent from the parents. Assent was obtained from the children selected for the study.

Sample size was calculated using data of similar study done by Choudhary et al.<sup>12</sup> for assessment of tooth wear in deciduous teeth where the prevalence was found to be 81%. Using formula,  $n = Z^2pq/e^2$ ; where,  $Z = 1.96$  at 95% Confidence Interval;  $n =$  Sample size;  $p =$  Prevalence of tooth wear in pre-school children = 81%;  $q = 100 - p$ ;  $e =$  margin of error; as 5% of  $p$ ;  $n = 360.29$ . Adding 20% of non-response rate (72.06), total sample size was  $432.35 \approx 433$ . Non-response in questionnaire was obtained from eight study participants, so analysis was done for 425 children.

School children in primary or mixed dentition period were included in the study. Children with acute infections of oral cavity (oral ulcers, stomatitis) which interfere with oral examination; differently abled children and children with developmental disorders were excluded.

Data regarding associated factors of tooth wear were collected with the help of pretested structured questionnaire<sup>2</sup> consisting of questions regarding demographic profile of the child including socio-economic status, dietary pattern, tooth brushing methods and oral habits like bruxism to see the influence of these factors on tooth wear. These self-administered questionnaires were sent to the parents to receive the appropriate response of questions asked and collected on the next day from respective schools.

Oral examination was done with the help of mouth mirror and explorer. Smith and Knight Tooth Wear Index (1984) was used which is a valid index for measurement of tooth wear.<sup>13</sup> Examiners were trained and calibrated for examination and recording tooth wear index. All the surfaces of deciduous teeth (buccal (B), occlusal/incisal (O/I), lingual (L), cervical (C)) were examined for tooth wear. Tooth wear in carious or restored tooth was not assessed.

Pretesting of the questionnaire was done among

25 preschool children before the main study and modifications were made for questions having inappropriate or invalid response. Oral examination for tooth wear was repeated at the interval of two weeks. The children included in the pilot study were not included in the final sample. Cohen's Kappa was calculated to check for inter-examiner reliability and there was strong agreement seen (0.84).

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

Score	Surface	Criteria
0	B/L/O/I C	No loss of enamel surface characteristics No loss of contour
1	B/L/O/I C	Loss of enamel surface characteristics Minimal loss of contour
2	B/L/O I C	Loss of enamel exposing dentine for less than one third of surface Loss of enamel just exposing dentine Defect less than 1 mm deep
3	B/L/O I C	Loss of enamel exposing dentine for more than one third of surface Loss of enamel and substantial loss of dentine Defect less than 1-2 mm deep
4	B/L/O I C	Complete enamel loss-pulp exposure- secondary dentine exposure Pulp exposure or exposure of secondary dentine Defect more than 2 mm deep-pulp exposure- secondary dentine exposure

The data were entered in Microsoft Excel Sheet and analysed using Statistical Package of Social Sciences version 20. Descriptive statistics including mean, standard deviation, percentage and proportion were calculated. Inferential statistics including Chi-square test and Fisher's exact test were used to explain the tooth wear by the variables under the study.

## RESULTS

Among 425 children surveyed, 295 (69.4%) had tooth wear in at least one or more teeth. Mean age of the school children examined was  $5.49 \pm 2.84$  years including 215 (50.6%) males and 210 (49.4%) females. Total of 36 (8.5%) children had severe tooth wear involving pulp (Table 2). Most commonly affected teeth were lower posteriors (Table 3). Children less than six years old had significantly lower prevalence of tooth wear than those

of age six years or above ( $p < 0.001$ , Chi square test, Figure 1). Out of 425 children, 153 (71.2%) males and 142 (67.6%) females had tooth wear present and there was no significant association of gender with tooth wear seen (Chi square test,  $p = 0.42$ ). Association of tooth wear with different other factors is shown in table 4, 5 and 6.

Table 2. Highest individual score of tooth wear.

Smith and Knight score	Total children examined	Number of individuals n (%)
0	425	130 (30.6)
1		112 (26.4)
2		97 (22.8)
3		50 (11.8)
4		36 (8.5)

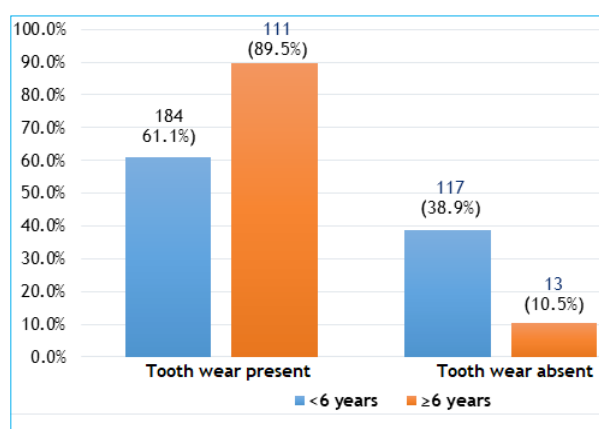


Figure 1. Distribution of children with presence of tooth wear according to age n (%).

Table 3. Pattern of distribution of tooth wear n (%).

Teeth	Number of participants examined	Participants with missing teeth n (%)	Presence of tooth wear n (%)	Tooth wear among children with teeth present n (%)
Upper anterior	425	28 (6.6)	142 (33.4)	142 (35.8)
Upper posterior	425	8 (1.9)	162 (38.1)	162 (38.8)
Lower anterior	425	15 (3.5)	109 (25.6)	109 (26.6)
Lower posterior	425	5 (1.2)	192 (45.2)	192 (45.7)

Table 4. Association of tooth brushing with tooth wear.

Questions	Options	Tooth wear present n (%)	Tooth wear absent n (%)	P-value
Frequency of brushing	Never	11 (44.0)	14 (56.6)	0.02*
	Sometimes	65 (73)	24 (27)	
	≥once a day	219 (70.4)	92 (29.6)	
Aids used in tooth brushing	Toothbrush	282 (70.9)	116 (29.1)	
	Datiwan	1 (100)	0 (0)	
	Finger	1 (100)	0 (0)	
Method of tooth brushing	Horizontal	52 (67.5)	25 (32.5)	0.04†
	Vertical	110 (67.9)	52 (32.1)	
	circular	1 (25.0)	3 (75.0)	
	Combination	121 (77.1)	36 (22.9)	
Material used in tooth brushing	Toothpowder	141 (80.1)	35 (19.9)	0.001†
	Toothpaste	141 (63.8)	80 (36.2)	
	Others	2 (66.7)	1 (33.3)	
Time of tooth brushing	≤2 minutes	231 (71.7)	91 (28.3)	0.43*
	3-5 minutes	49 (70)	21 (30)	
	>5 minutes	4 (50)	4 (50)	
Type of tooth brush bristles used	Soft	190 (68.3)	88 (31.7)	0.17*
	Medium	87 (77.7)	25 (22.3)	
	Hard	3 (37.5)	5 (62.5)	

\*Chi square test, †Fisher's exact test

Table 5. Association of dietary habits with tooth wear.

Questions	Options	Tooth wear present n(%)	Tooth wear absent n(%)	P-value
Exposure to bottle feeding	None	90 (59.6)	61 (40.4)	0.002*
	≤6 months	134 (72)	52 (28)	
	> 6 months	71 (80.7)	17 (19.3)	
Type of diet	Vegetarian	43 (65.2)	23 (34.8)	0.41*
	Mixed diet	252 (70.2)	130 (29.8)	
Frequency of intake of sour/acidic food (Pickles, fruits, etc.)	Never	33 (55.0)	27 (45.0)	0.02*
	Sometimes	65 (68.4)	30 (31.6)	
	Often	197 (73)	73 (27)	
Frequency of intake of soft drinks/fresh juices	Never	17 (39.5)	26 (60.5)	<0.001*
	Sometimes	236 (72.8)	88 (27.2)	
	Often	42 (72.4)	16 (27.6)	
Holding of soft drinks/fresh juices in mouth for sometimes before swallowing	Yes	278 (75.7)	104 (27.2)	0.01*
	No	50 (61.7)	31 (38.3)	
Consumption of food after going to bed	Never	8 (51.7)	6 (42.9)	0.41*
	Sometimes	65 (66.3)	33 (33.7)	
	Often	222 (70.9)	91 (29.1)	
Frequency of intake of hard food	Never	79 (65.8)	41 (34.2)	0.60*
	Sometimes	193 (70.7)	80 (29.3)	
	Often	23 (71.9)	9 (28.1)	

\*Chi square test

Table 6. Association of other factors with tooth wear.

Questions	Options	Tooth wear present n (%)	Tooth wear absent n (%)	P-value
Vomiting	Never	168 (68.9)	76 (31.1)	0.15*
	Sometimes	118 (72.4)	45 (27.6)	
	Often	9 (50)	9 (50)	
Sour burp	Never	240 (67.8)	114 (32.2)	0.21*
	Sometimes	48 (78.7)	13 (21.3)	
	Often	7 (70)	3 (30)	
Habit of grinding, clenching, or bruxism	Yes	73 (68.9)	33 (31.1)	0.88*
	No	222 (69.6)	97 (30.4)	
Duration of grinding, clenching, or bruxism if present	<1 year	23 (60.5)	15 (39.5)	0.21*
	1-3 years	26 (68.4)	12 (31.6)	
	4-6 years	24 (80)	6 (20)	
Habit of nail biting	Yes	63 (74.1)	22 (25.9)	0.28*
	No	232 (68.2)	108 (31.8)	

\*Chi square test

## DISCUSSION

It is very important to screen children for non-carious lesions like tooth wear so that early preventive and therapeutic management can be implemented. In the context of Nepal, the occurrence of tooth wear in

primary dentition is actually not known. Therefore, this study is the first attempt to assess the prevalence and associated factors of tooth wear in primary dentition among Nepalese children of Kathmandu Valley.

In the present study, tooth wear was seen in 295 (69.4%)

school children indicating that tooth wear is very common in deciduous dentition. According to a literature review done by Linnett et al., prevalence of erosive tooth wear in children varies widely between 2 and 57%.<sup>9</sup> However, study done in Iowa, United States found no child being completely free from the condition.<sup>14</sup> The varying prevalence in different studies can be explained by the difference in diagnostic criteria or type of study design used and the influence of various factors over the outcome.<sup>11</sup> Most severe form of tooth wear in the current study was seen among 36 (8.5%) study population. On contrary to this finding, a study done in Greece showed lower (4.9%) prevalence of severe tooth wear.<sup>8</sup> However, higher occurrence of severe tooth wear was seen in Iowa, United States<sup>14</sup> (15.8%) and in New Zealand<sup>15</sup> (27.9%).

In primary dentition, tooth wear has been reported to be more common and severe in the incisors and canines and in comparison to molars.<sup>16-18</sup> However, in the current study, tooth wear was seen more prevalent in posterior teeth (molars) than in the anteriors (incisors and canines). This finding could have resulted because posterior teeth have to bear more functional load. Additionally, deciduous teeth until mixed dentition period was taken into consideration in this study where some children had lost the primary anterior teeth and only the molars were present. Hence, due to presence of more number of deciduous molars during the study period, they were found to have tooth wear.

The higher prevalence of tooth wear on the primary teeth was observed in older age group in comparison to younger ones and is probably related to their longer exposure time for tooth wear. Likewise, a systematic review done by Kreulen et al. showed significant relationship of extensive tooth wear to age in the deciduous dentition, but not in the permanent dentition suggesting that the deciduous teeth are less wear resistant than permanent teeth.<sup>3</sup> However, the condition was not associated with gender. In contrast to this finding, a study done in Melbourne reported males to have significantly higher tooth wear than females with an almost three-fold increased risk.<sup>10</sup> There are other studies finding no gender predilection.<sup>19-20</sup>

A meta-analysis done by Corica and Caprioglio<sup>21</sup> could not identify a specific factor influencing the prevalence of wear in young age groups, nor could they explain the role of diet in the development of severe wear on the basis of the existing data. Conversely, in this study, children who never brushed their teeth had significantly lower prevalence of tooth wear than those who regularly or occasionally brushed their teeth. This finding supports that minimal wear to enamel results

while tooth brushing with or without toothpaste in the absence of acids.<sup>22</sup> Overzealous brushing by improper brushing technique makes surfaces of teeth more prone to abrasion.<sup>23</sup> Tooth wear in primary dentition in the current study was significantly associated with brushing technique and type of tooth material used. Children brushing with combination, vertical and horizontal method had higher occurrence of tooth wear than those brushing with circular method. Study participants using tooth powder and other materials like charcoal or neem paste had tooth wear more than those using tooth paste. Tooth powder has probably more abrasive potential which make teeth more susceptible to wear.<sup>24</sup> In contrast to this study, a study done in Melbourne showed no significant associations between tooth wear and tooth brushing frequency, duration and strength of toothpaste.<sup>10</sup>

In this study, tooth wear in deciduous dentition was found to be significantly associated with frequency of intake of sour/acidic food, soft drinks/fresh juices and habit of holding soft drinks/fresh juices in mouth for sometimes before swallowing ( $p= 0.02, <0.001, 0.01$ ; respectively). Similar to these findings, an *in vivo* investigation done among Saudi Arabian children showed that high intake of acidic drinks and fruits may constitute possible etiological and/or aggravating factors for severe dental erosion.<sup>5</sup> Likewise, in another *in vitro* study done in United Kingdom, an exposure of enamel to cola and lemonade led to significant surface softening of the enamel and it increased with longer exposure times enamel.<sup>6</sup>

In this study, the association between tooth wear and para-functional habits could not be established. This was most probably due to the fact that many parents are not aware of these habits and thus did not report these habits in the questionnaire. Similar finding was reported in study done in Abu Dhabi where no significant association of tooth wear with bruxism was seen.<sup>25</sup>

This study has some limitations. A more comprehensive sample collection from more schools would have provided a better representation of the population. A better selection of schools and participants including private schools might have lent better credibility to the study sample. In order to better understand the possible causative factors of tooth wear, assessing the presence and the severity of tooth wear for all the tooth surfaces instead of tooth only, might have provided a clearer understanding of the relationship.

The questionnaires were sent home to be completed by the parents. This yielded a considerable number of questionnaires (eight) only partially answered and thus

excluded from the study. A direct interview with the parents might have yielded a more reliable and complete response. Awareness of contributing factors will assist in identifying the risk and establishing a preventive scheme. The questionnaire recorded parentally recalled information that may be unreliable as cross-sectional study addresses one particular time only while habits may change. Further longitudinal follow up study of the same study sample should be done to elucidate the rate of progression of tooth wear and to assess the contributing risk factors of tooth wear.

## CONCLUSIONS

The prevalence of tooth wear was high in the primary dentition that increased with increasing age. The condition was seen significantly associated with type of tooth brushing technique, frequency of brushing, materials used in brushing and type of diet. Tooth wear is a major problem of young age group which may continue in permanent dentition. It has multifactorial aetiology that requires early diagnosis followed by appropriate preventive and management strategies.

## CONFLICT OF INTEREST

None

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