

Erosive Tooth Wear among 3-6 Year Old Kindergarten Children in Nellore District of Andhra Pradesh

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ABSTRACT

Aim: To estimate the prevalence of erosive tooth wear in deciduous dentition among 3-6 year old kindergarten children in Nellore district of Andhra Pradesh.

Materials and method: A descriptive cross-sectional study was carried upon a total of 1550, 3-6 year old kindergarten children drawn through stratified cluster random sampling from across Nellore district. Dental erosion was measured using O'Sullivan index specially designed for children.

Results: Prevalence of erosive tooth wear (ETW) among kindergarten children was 40.25%. Boys (42.13%) showed slightly higher prevalence of ETW than girls (38.22%). Prevalence of ETW showed gradual increase with increasing age. Primary maxillary central incisors were the most affected teeth with ETW (40.13%). Most of the ETW was distributed on combination with lingual/palatal and incisal/occlusal surfaces (55.25%). Loss of enamel (83.65%) including more than half of the surface (83.35%) was the commonest finding.

Conclusion: Primary maxillary central incisors were the most affected teeth with ETW. Most of the ETW was distributed on combination with lingual/palatal and incisal/occlusal surfaces. Loss of enamel including more than half of the surface was the commonest finding.

Keywords: Erosive tooth wear, kindergarten children, deciduous dentition, prevalence.

INTRODUCTION

The clinical term dental erosion or erosio dentium is defined as the result of a pathologic, chronic, localized, painless loss of dental hard tissue chemically etched away from the tooth surface by acid and/or chelation without the involvement of microorganisms¹. Since the evolution of mankind drastic changes have occurred in dietary patterns, with much emphasis placed on consumption of healthy food and drinks². The changing trend in lifestyle has replaced the commonly consumed fluids like milk and water with carbonated soft

drinks and fruit juices³. Global sales of soft drinks have increased by 56% and is estimated that it will keep rising at about 2-3% every year⁴. Apart from milk, fruit juices and carbonated drinks are also introduced in to child's diet at a younger age. Consumption of these drinks by children of all ages is popular worldwide as they are sweet⁵.

The etiology of dental erosion is multifactorial and not fully understood. It usually results from acids acting on the tooth surface. This process may be caused by either extrinsic or intrinsic agents^{3, 6}. Intrinsic causes are recurrent vomiting as a part of

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eating disorders, anorexia or due to regurgitation of gastric contents^{7, 8}. Extrinsic causes include acidic substances, beverages, food, medication and environmental exposure to acidic agents^{9, 10}. Over the last decade, occurrence of dental erosion seems to have increased presumably due to an increase in the consumption of soft drinks and fruit juices^{10, 11}. These acidic beverages have been recognized as an important cause of tooth structure loss not only in adults, but also in children¹².

The prevalence of dental erosion ranges between 25 to 60%, as reported in the scientific literature based on a wide variety of indices of erosion in different countries and population groups^{13, 14,15}. Most epidemiologic studies addressing dental erosion have been conducted in developed countries¹⁶. As a result, dental erosion is thought to be linked with high socioeconomic background, but inconsistent findings on the relationship between erosion and social factors have been reported¹⁷. Dental disorders, such as dental erosion, have begun to receive more attention, but the information about dental erosion is scarce¹⁸.

Dental erosion in children may be associated with many clinical problems such as dental hypersensitivity, altered occlusion, eating difficulties, poor aesthetics, pulp exposure and abscesses^{19, 20}. Hence, examination of erosion-induced tooth structure loss in children seems to be important to allow for administration of preventive measures as early as possible²¹. Currently, dental erosion is a great challenge for the practitioner as far as diagnosing the condition, identifying the etiological factors, executing an adequate treatment, and instituting preventive measures. So the present study was under taken to assess the prevalence of erosive tooth wear in deciduous dentition among 3-6 year old kindergarten children in Nellore district of Andhra Pradesh.

MATERIALS AND METHODS

A descriptive cross-sectional study was carried out over period of six months from March 2014 to August 2014 among 3-6 year old kindergarten children in Nellore district of Andhra Pradesh, to estimate the prevalence, site, severity, area of surface affected. The study was carried out in their respective school premises.

Inclusion Criteria:

1. Kindergarten children aged 3-6 year parents of whom gave informed consent were involved in the study.
2. Kindergarten children aged 3-6 year who were present on the day examination.

Exclusion Criteria:

1. Kindergarten children with special needs and who were uncooperative, in whom clinical examination will not be possible.

Ethical clearance:

The ethical clearance was obtained from the institutional review board. Permission to conduct the study was obtained from the district educational officer of Nellore district. Permission was also obtained from the head masters/head mistress of the selected schools to conduct the study in their schools. The purpose of the study was explained to all head masters/head mistress and parents/guardians of the children and informed consent was obtained from them before the start of the study.

The estimated sample size was 1550 based on the prevalence rate of 50% as reported in a study conducted by Deshpande SD and Hugor SM⁹. The required sample was drawn across the district through stratified cluster random sampling procedure with stratification based on five administrative divisions. Five mandals were randomly selected from each administrative division. List of schools from the 25 mandals which were selected from these five administrative divisions was obtained from the District Educational Office, Nellore and one school from each mandal was selected by table of random numbers. From each included school 62 kindergarten children were selected till the desired sample size was obtained.

Data was collected by interview and clinical examination. Data was recorded using a specially designed proforma translated in to Telugu language. The proforma consisted of three parts. First part recorded the socio-demographic data including assessment of socio-economic status. The second part collected necessary data from their

Table 1: Distribution of children according to their demographic characteristics.

Factors	No. of respondents	% of respondents
1. Sex		
a. Male	807	52.06
b. Female	743	47.94
2. Age groups		
a. 3 Years	407	26.26
b. 4 Years	533	34.39
c. 5 Years	424	27.35
d. 6 Years	186	12
3. Socioeconomic status		
a. Upper	84	5.42
b. Upper-Middle	183	11.81
c. Lower-Middle	598	38.58
d. Upper-Lower	685	44.19
Total	1550	100

Table 2: Prevalence and distribution of erosive tooth wear according to gender.

Sex	Total no. of children	With erosive tooth wear		p-value
		N	%	
Male	807	340	42.13	0.1176
Female	743	284	38.22	
Total	1550	624	40.26	

Statistical Analysis: Chi-square test. Statistically significant if $P < 0.05$

Table 3: Prevalence and distribution of erosive tooth wear according to different age groups in the study population.

Age groups	Total no. of children	With erosive tooth wear		p-value
		N	%	
3 Years	407	91	22.36	0.00001*
4 Years	533	226	42.40	
5 Years	424	237	55.90	
6 Years	186	70	37.63	
Total	1550	624	40.26	

Statistical Analysis: Chi-square test. Statistically significant if $P < 0.05$

Table 4: Prevalence of erosive tooth wear according to different socio economic status in the study population.

Socioeconomic status	Total no. of children	With erosive tooth wear		p-value
		N	%	
Upper	84	54	64.29	0.00001*
Upper-Middle	183	96	52.46	
Lower-Middle	598	243	40.64	
Upper-Lower	685	231	33.72	
Total	1550	624	40.26	

Statistical Analysis: Chi-square test. Statistically significant if $P < 0.05$

Table 5: Prevalence of erosive tooth wear in the study population in relation to their parental education.

Variable	Total no. of children	With erosive tooth wear		p-value
		n	%	
1.Mother's education				
a. Profession/Honour	0	0	0.0	0.081
b. Graduate/Post-graduate	54	30	55.55	
c. Intermediate	50	23	46	
d. High school certificate	185	97	52.43	
e. Middle school certificate	169	74	43.78	
f. Primary school certificate	422	152	36.01	
g. Illiterate	670	248	37.01	
2.Father's education				
a. Profession/Honour	5	2	40	0.000 *
b. Graduate/Post-graduate	223	127	56.95	
c. Intermediate	101	49	48.51	
d. High school certificate	381	160	41.99	
e. Middle school certificate	215	65	30.23	
f. Primary school certificate	194	66	34.02	
g. Illiterate	431	155	35.96	

Statistical Analysis: Chi-square test. Statistically significant if $P < 0.05$

Table 6: Prevalence of erosive tooth wear in relation to the habit and frequency of consumption of fruit juices and soft drinks.

Variable	Total no. of children	With erosive tooth wear		p-value
		N	%	
1.Any habit of giving/drinking fruit juices				
a. Yes	514	242	47.08	0.013 *
b. No	1036	382	36.87	
If yes how frequently				
a. Daily	2	2	100%	0.000*
b. Weekly once	170	162	95.29	
c. Monthly once	334	78	23.35	
2.Any habit of giving/drinking soft drinks				
a. Yes	480	371	77.29	0.000 *
b. No	1070	253	23.64	
If yes how frequently				
a. Daily	3	2	66.66	0.010*
b. Weekly once	216	206	95.37	
c. Monthly once	261	163	62.45	
3.Any habit of giving/drinking fruit juices/soft drinks before going to bed				
a. Yes	73	73	100	0.000 *
b. No	1477	551	37.30	

If yes how frequently				
a. Daily	0	0	0.0	1.000
b. Weekly once	61	61	100	
c. Monthly once	12	12	100	

Statistical Analysis: Chi-square test. Statistically significant if $P < 0.05$

Table 7: Prevalence of erosive tooth wear in relation to frequent vomiting, GERD, asthma and medication.

Variable	Total no. of children	With erosive tooth wear		p-value
		N	%	
1.Frequent vomiting				
a. Yes	175	172	98.28	0.000 *
b. No	1375	452	32.87	
2.Gastroesophageal reflux disease				
a. Yes	205	196	95.60	0.000 *
b. No	1345	428	31.82	
3.Asthmatic				
a. Yes	102	102	100	0.000 *
b. No	1448	522	36.04	
If yes is child under medication				
a. Yes	102	102	100.0	1.000
b. No	0	0	0.0	

Statistical Analysis: Chi-square test. Statistically significant if $P < 0.05$

Table 8: Distribution of erosive tooth wear according to site of teeth/surfaces affected.

Site of teeth/surfaces	Total no. of teeth/surfaces	% of teeth/surfaces
Labial or Buccal only	0	0.00
Lingual or Palatal only	258	15.40
Occlusal or Incisal only	492	29.35
Labial/Buccal and Incisal/Occlusal	0	0.00
Lingual/Palatal and Incisal/Occlusal	926	55.25
Multi-surface	0	0.00
Total	1676	100

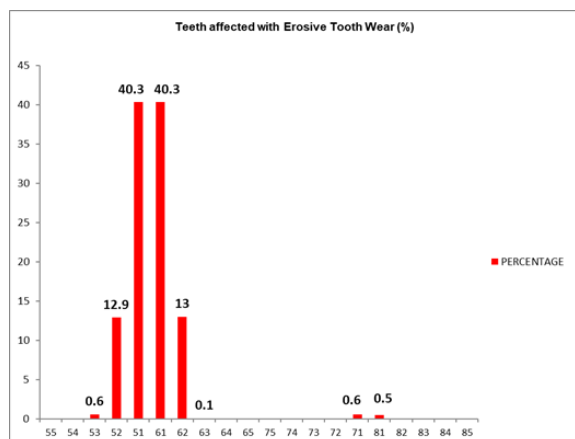
Statistical Analysis: Chi-square test. Statistically significant if $P < 0.05$

Table 9: Distribution of erosive tooth wear according to severity of teeth/surfaces affected .

Severity of teeth/surfaces	no of teeth/surfaces	% of teeth/surfaces
Normal enamel	4	0.32
Matt appearance of the enamel surface with no loss of contour	270	17.36
Loss of enamel only	1402	83.65
Loss of enamel with exposure of dentine	0	0.00
Loss of enamel and dentine beyond EDJ	0	0.00
Loss of enamel and dentine with exposure of pulp	0	0.00
Unable to assess	0	0.00
Total	1676	100

Table 10: Distribution of erosive tooth wear according to area of the surfaces affected

Area of surface affected	No teeth/surfaces	% of teeth/surfaces
Less than half of surface affected	279	16.65
More than half of surface affected	1397	83.35
Total	1676	100



Graph 1: Distribution of erosive tooth wear according to the teeth affected.

parents/caregivers regarding oral hygiene practices, dietary habits and medical history of their children. Finally data regarding the dental erosion was collected by clinical examination using O'Sullivan index (2000)²². Type-III clinical examination as recommended by American Dental Association was performed using size 4 plane mouth mirrors under adequate illumination. The examinations were carried out by the investigator himself and recordings were done with the help of an assistant recorder.

Statistical Analysis

The collected data was entered in the Microsoft Excel Sheet and analyzed using the SPSS Version 18 statistical package. Both descriptive and analytical approaches were used in the data analysis.

RESULTS

A total of 1550 kindergarten children aged 3-6 years were involved in the study with a mean age of 4.25 ± 0.975 years. Majority of the participants were from upper lower socio economic class (44.19%) followed by lower middle class (38.58%), upper middle (11.81%) and upper class (5.42%) (Table 1).

Over all prevalence of erosive tooth wear in deciduous dentition was 40.25%. There was no significant difference in prevalence of erosive tooth wear between boys and girls with boys (42.13%) having slightly higher prevalence compared to girls (38.22%). (Table 2).

The prevalence of erosive tooth wear in deciduous dentition showed gradual increase with increasing age. The prevalence of erosive tooth wear in 3 year old children was 22.36%, in 4 years 42.40%, in 5 years 55.90% and in 6 years was 40.26% (Table 3).

The prevalence of erosive tooth wear in deciduous dentition was high in children from upper socio economic class (64.29%) and it gradually decreased with decreasing socio economic status (Table 4).

The prevalence of erosive tooth wear in deciduous dentition was higher in children of parents with high educational status. The prevalence of erosive tooth wear was high in children whose mothers were graduates/postgraduates (55.56%) (Table 5) and in children whose fathers were graduates/postgraduates (56.76%) (Table 5). It decreased with decreasing educational qualification of parents.

When prevalence of erosive tooth wear was assessed in relation to habit of consumption of fruit juices and soft drinks, the prevalence of erosive tooth wear was high in children having the habit of drinking soft drinks (77.29%) and children having the habit of drinking fruit juices (47.08%). The prevalence of erosive tooth wear in relation to the frequency of consumption of fruit juices and soft drinks was high in subjects who consume them at weekly intervals (Table 6).

The prevalence of erosive tooth wear in deciduous dentition was 98.28% in children having the history of frequent vomiting. 95.6% of children with history of gastroesophageal reflux disease had dental erosion in deciduous dentition and 100% of

children with asthma and who were under medication for asthma had dental erosion in deciduous dentition (Table 7).

Figure 1 shows the distribution of erosive tooth wear according to the teeth affected. The most affected teeth were maxillary central incisors (40.3%) followed by maxillary lateral incisors (13%). Mandibular central incisors (0.5-0.6%) and maxillary canines (0.1-0.6%) were the teeth which were least affected. Erosive tooth wear was not noticed on any of the other teeth of the oral cavity.

When the distribution of erosive tooth wear on tooth surface was assessed in the deciduous dentition among the study participants 55.25% of the erosion was distributed on combination lingual/palatal and incisal/occlusal surfaces followed by incisal/occlusal surface only (29.35%). Interestingly erosion in deciduous dentition was not noticed in labial/buccal surface (Table 8).

When the distribution of erosive tooth wear according to severity of teeth/surfaces was assessed in the deciduous dentition among the study participants loss of enamel (83.65%) was the commonest finding, followed by matt appearance of the enamel with no loss of contour (16.11%) (Table 9).

When the distribution of erosive tooth wear according to area of the surfaces affected was assessed in the deciduous dentition among the study participants 83.35% of the affected surfaces exhibited more than half of the surface affected by erosion which was the common finding followed by 16.65% of the affected surfaces exhibited less than half of the surface affected by erosion (Table 10).

DISCUSSION

Erosive tooth wear in pre-school children is becoming a serious modern day problem for dentistry and it is currently considered as significant clinical challenge due to its multi factorial nature. Modern standard of living have changed food selection and eating habits. A high consumption of acidic beverages, medications and apparent increase in prevalence of various gastro intestinal diseases and especially eating disorders are seen to be risk factor for non-carious tooth destruction among children. There is evidence that

the prevalence of erosive tooth wear is gradually increasing^{20,23,24}.

O'Sullivan index²² that has adapted and validated by Peres et al²⁴ was used in the present study as it is simple, easy to use and sensitive to small changes. This index is especially designed for epidemiological surveys, diagnosis and treatment options of erosion in the deciduous dentition. This index also has the advantage of evaluating different criteria: site of erosion, severity and affected tooth surface area. Many of the other indices which are available have certain limitations because some types are not specific to erosion²⁵

This study focussed on prevalence of erosive tooth wear in the age groups of 3 to 6 year old kindergarten children because enamel and dentine structure of deciduous teeth are different from permanent dental hard tissues. Enamel and dentine layers of primary teeth are known to be thinner than those of their permanent successors and demonstrate a lower degree of mineralization²⁶. Furthermore, deciduous enamel shows a higher degree of enamel porosity²⁷ and a different mineral content compared with permanent tissue²⁸. Therefore, several in-vitro studies have investigated the demineralization behaviour of deciduous dentition compared with permanent dental hard tissues^{13, 29}. The outcomes of these studies were contradictory, showing either a higher susceptibility of deciduous enamel to erosion³⁰ or no difference in their demineralization behaviour³¹. Nevertheless, after an erosive attack, microhardness of primary enamel seems to be significantly lower compared with that of permanent enamel leading to a decrease of abrasion resistance^{32,33}.

The prevalence of erosive tooth wear in the present study population amounted to 40.25% and is therefore considerably higher compared with the prevalence data of the permanent dentition ranging from 4 to 25%^{34, 35}. However, Truin et al³⁶ found 24% prevalence in Holland; Murakami et al³⁷ reported a 58% prevalence of dental erosion among children and adolescents in the city of Sao Paulo; and Wiegand et al²¹ found a 32% prevalence among German children between 2 and 7 year-old; and Al-Malik et al³⁸, Harding et al³⁹, found that 31% of 2-5 year old children had dental erosion and Deshpande SD et al⁹ found that 28.57% of 5 year old and

30.70% of 6 year old with dental erosion. In contrast, the prevalence data do not agree with the results of the UK Children's Dental Health Survey⁴⁰ and the epidemiological study in Saudi Arabian children⁴¹. They found 50-80% prevalence of dental erosion in 5-15 year old children. The differences in the prevalence data between these studies may be partly explained by the differences in diagnostic criteria and indices and varying socioeconomic, excessive consumption of soft drinks, cultural and geographical factors which could influence the outcome of prevalence data.

In this study only a small difference in prevalence of erosive tooth wear between girls (38.22%) and boys (42.13%) existed. This is in agreement with the study of Wiegand et al²¹, but most studies assessing erosive tooth wear in deciduous dentition have not found differences between gender^{21, 42-44}. The reason for gender difference in the occurrence of erosive tooth wear was not clear.

The prevalence of erosive tooth wear in relation to age showed some evidence of an increase in prevalence with increase in age. In the present study the prevalence of erosive tooth wear in deciduous dentition showed gradual increase with increasing age. The results are consistent with those found by Wiegand et al²¹ and Al-Malik et al³⁸. It is obvious that prevalence of erosive tooth wear in primary dentition increases with increase of children's age²¹. The results are suggestive of time being a major determining factor in the progression and severity of dental erosion observed within the deciduous dentition.

The maxillary central incisors were affected predominantly, followed by the maxillary lateral incisors corroborating with the findings of previous investigations^{9, 20, 21, 22}. The findings that the upper incisors were affected predominantly, could be explained by the fact that these are first erupting teeth, which, as a consequence, are exposed to erosive challenges for a longer period of time. The upper canines and lower central incisors were less affected by erosive tooth wear. Moreover, the location of incisors and canines in the oral cavity makes them predisposable to erosion by extrinsic acids such as acidic beverages. Possibly lower incisors were less affected due to the covering and protecting of their labial surfaces by the maxillary

incisors and the potential for neutralization by saliva excreted by the submandibular and sublingual glands. These facts may explain the low prevalence of erosive tooth wear in the mandibular incisors. It may be assumed that due to the late eruption of the primary molars the prevalence of erosive tooth wear was distinctly lower compared to incisors and canines.

The predominance of erosive tooth wear on combination with palatal/lingual and incisal/occlusal surfaces seen in this study is in agreement with previous studies^{18,21, 25}. In the posterior dentition, the occlusal surfaces were found to be affected far more frequently compared with anterior dentition where majority of the lesions were observed on the palatal/lingual and incisal/occlusal surfaces. The location of maxillary anterior dentition together with their earlier eruption time subjects these teeth to the influences of intrinsic and extrinsic acids for longer periods of time. The occlusal surfaces of the posterior dentition would be more prone to the effect of extrinsic dietary acids.

Analysing the severity of erosive tooth wear, the most prevalent severity grade was loss of enamel in the present study corroborating with findings of the previous study¹⁸. Several surveys found that all affected children of their study samples exhibited erosive tooth wear with no exposed dentin. No pulp exposure was observed as reported in the majority of the studies^{22, 45}. The frequent consumption of soft drinks, fruit juices and medical conditions could contribute to the high percentage of pronounced erosive tooth wear in these kindergarten children.

The area of surface affected by erosive tooth wear in this study demonstrated that the most of the affected surfaces exhibited more than half of the surface affected in accordance with the previous study¹⁹. Several surveys showed that all affected children with erosive tooth wear exhibited less than half of the surface affected^{21, 25}.

CONCLUSION

Prevalence of erosive tooth wear in deciduous dentition among 3-6 year old kindergarten children was 40.25% in Nellore district of Andhra Pradesh. Primary maxillary central incisors were the most affected teeth with erosive tooth wear. Most of the

erosive tooth wear was distributed on combination with lingual/palatal and incisal/occlusal surfaces. Loss of enamel including more than half of the surface was the commonest finding.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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