A Cyclopedic View of Tooth Wear in Adults: A Descriptive Epidemiological Survey in Andhra Pradesh

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Abstract: To assess the distribution and severity of tooth wear among adult population of Andhra Pradesh. A descriptive cross sectional study was conducted by trained and calibrated examiner. A stratified random sample of 1611 individuals with the age of 35-44 years were examined for tooth wear using Smith and Knight tooth wear index (1984). Descriptive statistics were applied to the data. Prevalence of tooth wear amounted to 70.62%. The highest frequency of score 1 was found for mandibular right 1st molar (41.6%) and score 2 for maxillary left central incisor (20.8%), score 3 for mandibular left 1st molar (6.3%) and score 4 for mandibular left 2nd premolar (7.3%). Occlusal surfaces were most commonly affected with tooth wear when compared to buccal, lingual and cervical surfaces. It also shows that occlusal surfaces of maxillary and mandibular anterior teeth were more commonly affected than the posterior teeth. No tooth wears on the lingual surfaces of posterior teeth of both the arches. Tooth wear remains a common finding in study population. Furthermore, the question of whether tooth wear is a public health problem remains open for debate.
Keywords: Attrition, Abrasion, Calibration, Erosion, Tooth wear, Tooth wear index

INTRODUCTION

Loss of tooth tissue occurs in a number of ways, dental caries and trauma being the most obvious ones. But tooth wear in its own right now is assuming greater importance [1]. It occurs by attrition, abrasion and erosion. According to Nunn *et al.* 1996, wear lesions seen on teeth result from the contribution of above mentioned three conditions [2]. Lussi *et al.* [3] have also reported that two or more types of tooth surfaces loss can coexist and the presence of erosion could make the tooth surface more susceptible to attrition and abrasion as well. This indicates the difficulty in differentiating these types of lesion clinically.

There is a strong evidence to suggest that tooth wear is an age related phenomenon and it is common. The irreversible and multi factorial aspects of wear on the teeth make it one of the most difficult dental problems to manage and easy diagnosis of pathological forms is therefore important. These lesions pose not only an esthetic problem but also a functional one with the possibility of loss of masticatory units. This is causing several unpleasant symptoms and serious problems in the stomatognathic system. Wasting diseases of teeth are becoming more significant as the life expectancy of mankind is increasing.

Over the past 20 years there have been a number of studies evaluating the prevalence of tooth wear in different populations. By far the majority of prevalence studies [15, 12, 8, 13, 5] have been reported on children and adolescents as these groups are easier to investigate and recruit. Studies on adults on the other hand tend to be less common because of the difficulty in recruiting them[4].

For the majority of population, any wear on teeth is often limited to enamel and dentin involvement only occurs in a relatively small population of the population. A study by Dugmore and Rock reported that 59.7% of 1753, 12 year old children had evidence of tooth wear of which 2.7% had exposed dentin, and this rose to 8.9% by the age of 14years. Another study by Bardsely *et al*. reported that 53% of 2385, 14 year old adolescents had exposed dentin. Smith and Ross observed that tooth wear in an adult was an almost universal experience with up to 97% of all ages experiencing some wear on their teeth with the older

aged cohorts' dentin exposure became more common[5].

Measurement of tooth wear has been performed over the years using a large variety of both quantitative and qualitative methods. A number of indices have been developed such as Parma[30], Eccles[31], WHO[32], Carlson *et al.* [33] and Johannson *et al.*[34], typically using grading or scoring designed to identify increasing severity or progression of the condition, but traditionally with a focus on only one etiological factor.[6] There are too many indices proposed and used, with lack of standardization in terminology, there are many epidemiological studies reported but it is difficult to quantify increase in prevalence reported internationally, as results are not easily comparable[7]. One of the most commonly used indices was developed by Smith and Knight, 1984 index, and it has adapted by many researchers. This index classifies toot wear on a 5 point scale at 4 sites per tooth, including all the teeth irrespective of the cause. This index is easy to use and is not based on etiology [4].

There is abundance of literature available on the prevalence of tooth wear among children and adolescents but to date, comprehensive assessment of tooth wear has not been assessed among adults in India. Therefore the aim of the study was to assess the distribution and severity of tooth wear among adult populations of Andhra Pradesh, India.

MATERIALS AND METHODS

The present study is a descriptive cross sectional epidemiological survey conducted to assess the severity and distribution of tooth wear among adult populations of Andhra Pradesh. For sample selection, a stratified random sampling procedure was employed. A sample of 1611 individuals in the age group of 35-44 years was selected based on the findings of the pilot study. Individuals willing to participate, who agree to give informed consent were included. Individuals with ongoing orthodontic treatment, those with full dentures and the presence of crowns, bridges or multiple fillings, individuals with restricted mouth opening and uncooperative individuals were excluded from the study.

Training and calibration of the use of the index was carried out prior to the study. The calculation produced a Kappa value of 0.85 and 0.90 for inter and intra examiner reliability and this was acceptable. The calibrated examiner performed the clinical examinations using WHO probe and plane mouth mirror. The Clinical examination included recording of tooth wear according to Smith and Knight Tooth wear index (1984). The incisal/occlusal (O/I), buccal (B), lingual (L) and Cervical surfaces (C) surfaces of all the teeth were examined. The criterion used in this study was as follows:

- Score 0 was given if there was no loss of enamel characteristics on B/L/O/I and no change in contour on C.
- Score 1 was given if there was loss of enamel characteristics on B/L/O/I and minimal loss of contour on C.
- Score 2 was given if there was loss of enamel exposing dentine for less than 1/3 of the surface on B/L/O/I and defect less than 1 mm deep on C.
- Score 3 was given if there was loss of enamel exposing dentine for more than 1/3 of the surface on B/L/O/I and defect 1-2 mm deep on C.
- Score 4 was given if there was loss complete loss of enamel or pulp exposure on B/L/O/I and defect more than 2 mm deep on C.

Lower scores were assigned when examiner was unsure as to which code was applicable. Ethical clearance vote was taken from the institutional review Board. Descriptive statistical analysis has been carried out for the collected data. The Statistical software namely SPSS 15.0 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables**.**

RESULTS

Out of 1611 individuals, 55.1% were males and 44.9% were females. The prevalence of tooth wear was found to be 70.62%. Tables 1 and 2 shows the severity of tooth wear for maxillary and mandibular arches respectively. The highest frequency of score 1 was found for mandibular right 1st molar (41.6%) and score 2 for maxillary left central incisor (20.8%), score 3 for mandibular left 1st molar (6.3%) and score 4 for mandibular left 2nd premolar (7.3%).

Table-1: Severity of tooth wear for maxillary teeth and surfaces

		18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
C	0	73.6	56.1	58.1	62.4	70.8	80	75.4	66.7	70.3	80.1	100	73.9	58.5	53.2	71.3	52.5
	1	0	8.9	16.8	22.8	14.2	8.3	8.9	7.6	5.6	10.2	0	13.2	20.5	18.2	11.6	0
	2	0	3.6	7.6	2.3	9.2	2.3	4	6.3	8.9	2.6	0	5.9	9.2	10.2	7.3	0
	3	0	2	4	5	3.6	0	4	0.7	2.3	0	0	2	5	4.6	1	0
	4	0	2.3	5.3	5.3	0	0	1.3	3	2.6	0	0	3	4.3	5.6	2.6	0
	M	26.4	27.1	8.3	2.3	2.1	9.4	6.4	14.9	10.2	7.1	0	2	2.6	8.2	6.3	47.5
B	0	73.6	69.9	83.1	94.5	96	93.7	94.7	76.1	81.9	86.7	100	89	90.8	84.5	89.3	52.5
	1	0	2.3	8.3	2.3	1.6	2.8	2.7	6.3	5.1	4.3	0	8.1	6.2	5.2	3.2	0
	2	0	0.7	0.3	0.9	0.3	2.1	2.2	2.7	2.8	1.9	0	0.9	0.3	2.1	1.2	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	M	26.4	27.1	8.3	2.3	2.1	1.4	0.4	14.9	10.2	7.1	0	2	2.7	8.2	6.3	47.5
O/I	0	73.6	60.1	62	83.8	89.6	84.7	45.1	46.9	50.8	34.2	92.4	81.3	83.2	58.4	84.4	52.5
	1	0	7.3	14.9	6.6	7.6	13.9	23.1	9.6	19.1	44.2	7.6	7.6	7.6	9.6	8.3	0
	2	0	2.6	6.3	7.3	0	0	19.5	19.8	**20.8**	14.5	0	8.1	6.3	12.5	0	0
	3	0	1.3	3.3	0	0	0	5.9	4.6	4.6	0	0	0	0	3.3	0	0
	4	0	1.7	3.3	0	0	0	4	4.3	5	0	0	0	0	5.6	0	0
	M	26.4	27.1	10.2	2.3	2.8	1.4	0.4	14.9	10.2	7.1	0	3	2.9	10.6	7.3	47.5
L	0	73.6	72.9	91.7	97.7	97.9	91.2	98.7	77.1	80.6	92.9	92.1	98	97.4	91.8	93.7	52.5
	1	0	0	0	0	0	0.3	0.7	7.9	8.9	7.9	0	0	0	0	0	0
	2	0	0	0	0	0	0.1	0.2	0.1	0.3	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	M	26.4	27.1	8.3	2.3	2.1	9.4	0.4	14.9	10.2	7.1	0	2	2.6	8.2	6.3	47.5

Foot notes* C= cervical, B= buccal, O/I= occlusal/incisal, L=lingual, M=missing

Table-2: Severity of tooth wear for mandibular teeth and surfaces

|		48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
C	0	65.7	85.2	33.8	56	83.7	83.5	83.5	74.6	74.7	73.3	91.1	77.7	59.7	47.9	71	52.5
	1	0	12.5	**41.6**	32	12.5	8.3	8.3	16.5	0.7	7.6	8.9	7.6	21.5	13.9	16.5	0
	2	0	0	16.2	9.9	0	0	0	0	16.5	10.6	0	6.6	4	19.8	6.3	0
	3	0	0	0	0	0	0	0	0	0	1.7	0	0	5.3	**6.3**	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	**7.3**	5	0	0
	M	34.3	2.3	8.4	2.1	3.8	8.3	8.3	8.9	8.1	6.9	0	8.1	4.3	7.2	6.3	47.5
B	0	65.7	89.4	79.9	84.4	84.6	91.7	84.6	76.5	78	84.3	100	75.5	84.1	83.8	87.3	50.8
	1	0	8.3	8.3	12.4	10.7	0	6.3	6.3	6.3	6.7	0	10.3	8.2	5.7	4.3	0
	2	0	0	3.4	3.1	0.9	0	0.8	8.3	7.6	2.1	0	6.1	3.4	3.3	2.1	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	M	34.3	2.3	8.4	2.1	3.8	8.3	8.3	8.9	8.1	6.9	0	8.	4.3	7.2	6.3	49.2
O/I	0	65.7	71.6	65.7	72.8	73.7	76.9	47.1	36.4	41	42.6	92.4	70.6	64.9	41.3	86.1	52.5
	1	0	22.1	8.3	13.2	22.1	14.9	27.4	29.7	22.8	33.3	7.6	12.5	24.1	15.8	7.6	0
	2	0	0	15.2	5.9	0	0	5.3	11.2	18.2	5	0	8.1	2.3	7.6	0	0
	3	0	0	0	0	0	0	8.6	7.9	5.9	6.3	0	0	0	0	0	0
	4	0	0	0	0	0	0	3.3	5.9	4	5.9	0	0	0	0	0	0
	M	34.3	6.3	10.8	8.1	4.2	8.3	8.3	8.9	8.1	6.1	0	8.8	8.7	35.3	6.3	47.5
L	0	65.7	97.7	91.6	97.9	96.2	91.4	85.1	83.5	84.7	91.7	98.9	91.9	95.7	92.8	93.7	52.5
	1	0	0	0	0	0	0	6.3	0.7	6.3	6.3	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	6.3	0.7	0.7	0	0	0	0	0	0
	3	0	0	0	0	0	0.2	0.1	0.2	0.1	0.2	0.3	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	M	34.3	2.3	8.4	2.1	3.8	8.3	8.3	8.9	8.1	0.9	0	8.1	4.3	7.2	6.3	47.5

Foot notes* C= cervical, B= buccal, O/I= occlusal/incisal, L=lingual, M=missing

Graphs 1 and 2 represent the surface distribution of tooth wear on maxillary and mandibular arches respectively. It shows that occlusal surfaces were most commonly affected when compared to buccal, lingual and cervical surfaces. It also shows that occlusal surfaces of maxillary and mandibular anterior teeth were more commonly affected than the posterior teeth. No tooth wears on the lingual surfaces of posterior teeth of both the arches. It was observed only on the lingual surfaces of anterior teeth and it was more common in the maxillary teeth when compared to mandibular teeth. Cervical surfaces of posterior teeth were more

commonly affected than anterior teeth and it was more

common in mandibular teeth.
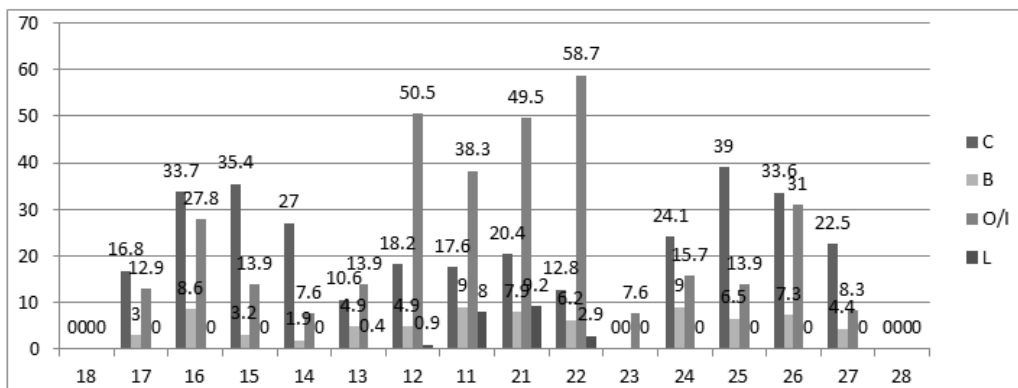
Graph-1: Distribution of tooth wear among 35-44 years age group for maxillary teeth
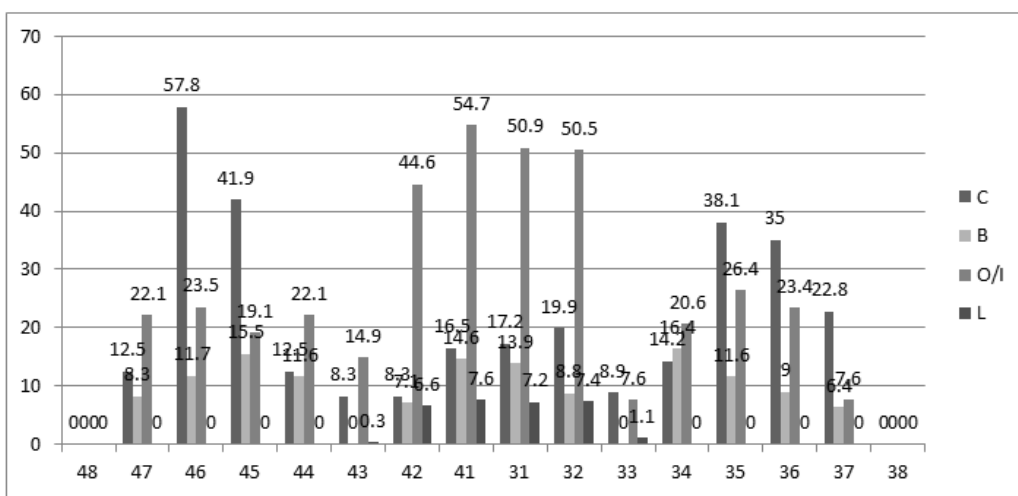
Graph-2: Distribution of tooth wear among 35-44 years age group for mandibular teeth

DISCUSSION

The present study is unique in its way of assessing the tooth wear in a most comprehensive way in the dental literature. The results revealed the prevalence of tooth wear among the study population was 57.47%. Findings from recent studies indicate that the prevalence of tooth wear ranged between 27% and 40% [8-10]. Variations in prevalence rates observed between the studies could be due to differences in the burden of tooth wear as well as due to methodological differences. The later include the use of different indices to record tooth wear, the differences in the types of teeth considered for recording tooth wear, variations in the terminology used to report tooth surface loss and differences in the age groups considered[11].

The findings of the present study showed almost a symmetrical distribution of tooth wear in both maxillary and mandibular arches. In both the arches, first molars and incisors were the most frequently affected teeth as they could be exposed to risk factors associated with tooth wear for a considerable period of time. These findings are in agreement with other studies conducted by Ogunyinka *et al.* Bradsley *et al.* [12,13].

On the other hand, in studies conducted by Milosevic *et al.* [14], Barlett *et al.* [15] reported that premolars and molars had little wear compared to the incisors suggesting that etiological factors responsible for causing tooth wear are different for different populations. Linkosalo and Marikkanen in a random sample of Swiss adult patients found that the amount of tooth wear varied according to site and age, mostly affecting the mandibular molar teeth while the least commonly affected teeth were maxillary incisors [16]. In a recent study conducted by El Aidi *et al.*[17]found that the prevalence of tooth wear was predominant on the incisors, molars of permanent dentition. The evidences supported the fact that these teeth were most affected by all non-carious lesions for a longer period of time [17]. Lussi *et al.* found more lesions on maxillary teeth, mainly on the canines and premolars. It should be pointed out that they examined only erosive lesions whose frequency was greater in the upper jaw[18]. Zipkin and Mc Clure obtained similar results with 27% of the people affected by tooth wear situated in the maxilla on the evaluating wear in children and young adults at age 3, 5, 10, 15 and 20 years, only 63% of the 3 year olds, 19% of the 5 year olds had tooth wear and

for the 10, 15, and 20 years olds the corresponding data were 78%, 51% and 35% representing the prevalence of tooth wear decreases with increasing the age [19]. Bergstorm and Eliasson reported more lesions on the left side and Radentz *et al.* reported more on the right side[20,21].

The site of tooth wear can be used to some extent to suggest the source of the etiological factor. In the present study, it was found that the cervical and occlsal/incisal surfaces were most frequently affected and the buccal, lingual surfaces were least frequently affected surfaces. Typically, but not always, acid originating from the stomach strikes the palatal surfaces of the maxillary incisors, eroding enamel and in due course dentin. Possibly, in the early stages of the process the tongue protects the other surfaces of the teeth. As the erosive action persists the protective mechanisms of the mouth are overwhelmed and a more generalized pattern of erosion emerges, commonly affecting the occlusal surfaces of the mandibular molars, followed by the maxillary occlusal and posterior palatal surfaces. The lingual surfaces of the mandibular teeth are seldom affected[22]. In agreement with other studies, it was found that the occlusal surface was the most frequently affected tooth surface, palatal surface was the least affected and palatal lesions were only seen in the anterior teeth. Labial surfaces of anterior teeth were most frequently affected by tooth wear than the buccal surfaces of the posterior teeth [23,24]. In a study conducted by S.H.C. Sales-Peres *et al.* [10]**;** it was found that the mean tooth wear across all participants was 16% with the incisal/occlusal surfaces most frequently affected by tooth wear in primary and permanent dentition (92.4% and 15% respectively)[25]. In contrast, a similar study conducted by Ganss C Klimek *et al.* revealed that 10% of the children had erosive lesions of the buccal and 19% of the palatal surfaces of their incisors were affected[26].

An important factor in measuring tooth wear is the extent of damage. If dentin is exposed on the incisal edges of the maxillary anterior teeth in a 15 year old and the situation remains relatively stable for the next 40 years it is unlikely to be a significant problem. However, if the wear continues and ultimately compromises the appearance and function of the teeth there is a problem. Most of the studies on the prevalence of erosion, attrition, or tooth wear report that early wear is common and severe wear, by comparison, is not[22]. In this study, majority of the population had score 1 involving only the enamel surface mostly and the index score levels 3 and 4 appeared mostly on the cervical and occlusal/inisal surfaces. In another study, among 14-year-old School children in Liverpool, it was also found that all the children exhibited some degree of tooth wear. From this particular study, 30% and 7.6% of the subject had exposed dentine (score 2 and 3) on the incisal and occlusal surfaces respectively [27]. Bartlett

et al. 1998 in their study among 11 to 14-year-old school children revealed 57% of subjects had tooth wear on more than ten teeth with 2% or less surfaces having exposed dentine [15]. In a more recent study by Bardsley *et al.* 2004 among 14-year-old children comparing tooth wear in fluoridated and non-fluoridated areas, it was found that 53% of subjects in their study had exposed dentine. In fluoridated areas, significantly fewer children had exposed dentine on the labial and palatal surfaces but no difference was found for incisal and occlusal surfaces [28]. In the present study the proportion of subjects having exposed dentine was considered low compared to other studies[29]**.**

It is important to consider the limitations of the study. The very first one is related to the tooth wear index. Most early tooth wear indices were developed in an attempt to match treatment need to severity and as such, are biased toward the more severe levels. The Smith and Knight index has 5 levels, from 0 to 4, with wear on enamel denoted by level 1 and early dentin being exposed denoted by level 2. Therefore, the Smith and Knight index is biased toward moderate (level 3) and severe (level 4) levels of tooth wear. The comparison of data between studies was possible at levels 3 and 4 but not possible at those that were less severe. This index does not indicate the whether the tooth wear lesion is due to attrition or abrasion or erosion.

Recommendations and future studies
• A main perspective for future work is the initiation of a consensus process in the scientific community, aimed at avoiding the further proliferation of indices. This process should lead to the development of an internationally accepted, standardized and validated index. A reasonable appraisal of the various forms of tooth wear as oral disease is needed to avoid overestimating its importance for oral health. We support the idea of adopting a widely held and used tooth wear index. It is unlikely that a single index will ever be fully adopted by all researchers, but it might be possible to use a skeleton index which can be adaptable to others, both in collection and presentation of data.
• A further topic for the research agenda is the initiation of data collection on the prevalence of tooth wear on a population based level, preferably integrated in caries prevalence surveys when applicable. For improving the validity of diagnostic criteria and to facilitate the differential diagnosis of subforms of tooth wear, a database providing clinical photos may help with training sessions and calibration.
• Considering analytical epidemiological studies, for instance identifying risk factors from life style and diet, or general health conditions, the development of a validated questionnaire needs to be initiated. In addition, future research into the roles of saliva and medical conditions in the pathogenesis of the tooth

wear lesions may help further the understanding of this complex condition.

- The management of TW is a major challenge to the dental profession. Improved measures of prevention and therapy of tooth wear lesions still need to be determined. Failure to eliminate the cause may compromise the long-term survival of restorations and further deterioration of the dentition.

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