

Permanent Anterior Teeth Fractures and its Impact on Oral Health-Related Quality of Life among 8–15-Year-Old Schoolchildren of Chennai City – A Cross-Sectional Survey

Abstract

Background: Tooth fracture is not only a distressing experience on the physical level of a child, but it may also have an effect on emotional and psychological levels. This study aims to assess the permanent anterior teeth fractures and their impact on Oral Health-Related Quality of Life (OHRQoL) among 8–15-year-old schoolchildren of Chennai city. **Materials and Methods:** Thirty schools were randomly selected by stratified random sampling. All school-going children aged 8–15 years were invited to participate. A total of 7247 children were screened and 628 children with permanent anterior teeth fractures were included. Data were collected using Child Oral Health Impact Profile questionnaire. In addition, questionnaire addressing sociodemographic data and factors influencing permanent anterior teeth fractures were recorded. Descriptive statistics was performed to characterize the sample. One-way analysis of variance and Tukey's honestly significant difference *post hoc* tests was applied for multiple pair-wise comparisons. **Results:** The prevalence of permanent anterior teeth fracture was found to be 8.7%. The type of school had highly significant ($P < 0.001$) influence on the impact of permanent anterior teeth fracture on OHRQoL with negative OHRQoL among the corporation schools. The study participants of corporation schools had negative OHRQoL with significant difference in oral health well-being ($P < 0.001$) and self-image ($P = 0.014$). **Conclusion:** All the children reporting with tooth fractures had negative OHRQoL. The study stresses the importance of promoting good oral health-care practices to prevent oral disease in children and to meet children's unmet oral health-care needs.

Keywords: Oral health, quality of life, school children, tooth fractures

Introduction

According to Sheiham, “the compartmentalization involved in viewing the mouth separately from the rest of the body must cease because oral health affects general health by causing considerable pain and suffering and by changing what people eat, their speech and their quality of life (QoL) and well-being.”^[1] One such condition is the tooth fracture altering the dentofacial esthetics, which is an important determinant of overall physical esthetics. From the standpoint of child psychology, a healthy smile is conducive to how children start building up interpersonal relationships and self-esteem.^[2,3] Disturbances in dental and facial features provoke psychological problems that may affect children, further impairing speech and trouble in eating. Thus influenced, children do not smile as often as they would like to.^[2]

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Oral Health-Related QoL (OHRQoL), a multidimensional paradigm that blows an individual's well-being, is increasingly being recognized as an integral part of general health. The need to determine the impact of oral health problems on people's QoL led to the development of various instruments for assessing the OHRQoL and also aid in clinical decision-making and monitor a patient's condition. Thus, incorporating OHRQoL instruments in clinical practice and research can have important benefits for individual patients, community-based dental practices, clinical research, and potentially public health policy. OHRQoL of children remained underexplored and therefore formed the objective for several researchers to develop tools for the comprehensive measure of children's QoL. Child Oral Health Impact Profile (COHIP) developed by Broder *et al.* is one of the modern instruments

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K Priya Deepa Lakshmi, MB Aswath Narayanan¹, SG Ramesh Kumar¹, A Leena Selvamary¹, A Sujatha¹

Department of Public Health Dentistry, Vinayaka Mission Sankaracharyar Dental College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, ¹Department of Public Health Dentistry, Tamil Nadu Government Dental College and Hospital, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India

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Address for correspondence:

Dr. K Priya Deepa Lakshmi,
No: 7/256, Muniappan Kovil
Backside, Kondappanaickenpatti,
Salem - 636 008, Tamil Nadu,
India.
E-mail: karan.priya21@yahoo.com

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for assessing QoL in school-aged children and is the first children's OHRQoL measure to incorporate positive and negative health impacts.^[4]

Acquaintance of the impact of anterior teeth fracture on children's QoL is scarce.^[5] The psychosocial impact caused by permanent anterior teeth fracture among school-going children remains unexplored in South India. Hence, a survey was planned among the 8–15-year-old schoolchildren of the Chennai metropolitan city to assess the psychosocial impact of permanent anterior teeth fractures using the COHIP, thereby interpreting its effects on OHRQoL.

Materials and Methods

This cross-sectional survey was conducted among 8–15-year-old schoolchildren from December 2015 to November 2016. Ethical clearance was obtained from the Institutional Review Board of Tamil Nadu Government Dental College and Hospital, Chennai. Permission was obtained from the Deputy Commissioner of Education Board and the Chief Educational Officer, Chennai, to conduct the survey in the schools. Written informed consent was obtained from both the parents/guardians and the participating schoolchildren and the information sheet regarding the survey was given to all parents. The study was presented following the STROBE guidelines.^[6]

The Chennai Municipal Corporation has been divided into ten zones. According to the source of information collected from the Corporation office and Directorate of Public Instruction, there were 27 Government schools, 298 Corporation schools, 351 Government-aided schools, and 361 Private schools in Chennai city. As the study intends to assess the permanent anterior teeth fracture among urban schoolchildren, government schools and the schools in the city outskirts were not included, and hence, a total of 1010 schools were considered for sampling.

Thirty schools were randomly selected by stratified random sampling with proportionate selection of one corporation, one government aided, and one private school from each of the ten zones of Chennai Corporation. Prior notification of the survey of the selected schools was done in person by the chief investigator and the feasible date was fixed for screening and for participant recruitment.

All schoolchildren of mentioned age group (8–15 years) of the 30 selected schools were examined. The inclusion criteria were children with permanent anterior teeth fractures and children who were present on the day of examination. Children with known systemic diseases and physically and mentally challenged were excluded. The sample size was calculated with power of study as 90% and alpha error at 5%. The minimum sample estimated by the prevalence of permanent anterior tooth fracture from previous studies^[7] was calculated to be 138.

Oral examination was done by Type III examination. Sociodemographic data including age, gender, religion, and socioeconomic status;^[8] factors influencing tooth fractures; type of fracture;^[9] oral health status;^[10] and impact on OHRQoL of each study participant were recorded. Intraexaminer variability of the chief investigator for assessment of tooth fractures was done on a sample of fifty children with various types of tooth fracture (Kappa coefficient is 0.99).

The original COHIP is a structured pretested questionnaire consisting of 34 items, forming five conceptually distinct subscales: oral health well-being, functional well-being, social-emotional well-being, school environment, and self-image. From these, four questions were removed and customized such that the questionnaire could be used to assess OHRQoL of tooth fractures and cannot be applied to other oral diseases. A five-point Likert scale was used with the following options: never = 0, almost never = 1, sometimes = 2, fairly often = 3, and almost all of the time = 4.

A translation of the questionnaire was done in the local language (Tamil) and was validated by bilingual scholars and to check the validity of the questionnaire and operational feasibility of the study a pilot study was conducted among 50 schoolchildren. The intraexaminer reliability of the questionnaire was assessed using Cronbach's alpha. The questionnaire was given to the schoolchildren for analysis of difficulty in understanding, interpreting, and answering without any difficulty. The same set of questionnaire was given to the same schoolchildren 15 days after the administration of the first set of questionnaire. These two sets of questionnaire were used to calculate the Cronbach's alpha coefficient for internal consistency, which was found to be 0.84. No adjustments were found to be required.

Among the 30-item questionnaire, 24 items were negatively and 6 items were positively worded. Scoring of the negatively worded items of the questions in the domains of oral health well-being, functional well-being, social-emotional well-being, and school environment were reversed, while scoring of the positively worded items in self-image were not. The sum of individual item scores for each of the subscales was obtained followed by a grand total of the scores for assessment of OHRQoL. The total score for OHRQoL may range from 0 to 120. Higher COHIP scores reflect positive OHRQoL and lower scores reflect negative OHRQoL.

Data analysis

The data tabulated in Microsoft Office Excel 2013 were analyzed using the IBM Statistical Package for the Social Sciences version 22 (SPSS Inc, Chicago, IL, USA). Descriptive statistics were performed to characterize the sample and demonstrate the distribution of COHIP items. To compare the mean values between school types,

one-way analysis of variance was applied, followed by Tukey's honestly significant difference *post hoc* tests for multiple pair-wise comparisons. Variables that do not follow a normal distribution, Kruskal–Wallis test was used followed by Bonferroni-adjusted Mann–Whitney test for multiple pair-wise comparison. The significance level was fixed at 5% ($\alpha = 0.05$).

Results

A total of 7247 schoolchildren were screened for the prevalence of permanent anterior teeth fractures. Among them, 62.5% were boys ($n = 4527$) and 37.5% were girls ($n = 2720$). Six hundred and twenty-eight ($n = 628$) children with permanent anterior teeth fracture constituted the study participants.

The prevalence of tooth fractures was found to be 8.7%, among which boys were 3.5 times more likely to experience anterior teeth fractures than girls. The mean age was 12.32 ± 1.8 years, with the predominant age being 14 years (21.2%). Hinduism prevailed more (78.7%) when compared to other ethnic groups. The socioeconomic status identified the majority of individuals (78.7%) from the upper-lower class. The prevalence of tooth fractures was comparatively higher among the Corporation school with 41.2% of children affected [Table 1].

Majority of tooth fracture had occurred due to tripping or slipping (62.4%). On investigating the specific reason for occurrence of tooth fracture, collision against object was the most frequent cause followed by fall from stairs or from bicycle. Forty-two percent of the fracture had occurred in school followed by street, park, or playground. Only 2.2% had undergone treatment for anterior tooth fracture with significantly higher ($P = 0.008$) number of treated individuals reporting from private schools.

A total of 784 teeth were fractured among 628 schoolchildren. The maxillary left central incisor (47.2%) was the most probable tooth involved with trauma. Ellis Class I, II, IV, V, VII, and VIII fractures were reported, and enamel fracture (86.4%) was the predominant among them all. There were no Class III tooth fractures reported among the study population. There was no significant difference among the class of fracture in respect to the type of tooth or type of school. Single tooth fractures were (78.7%) more common than multiple tooth fractures. The mean Decayed, Missing, and Filled Teeth was 1.44 ± 2.01 with significantly higher scores among the corporation schools ($P < 0.001$). On assessment of malocclusion through the components of Dental Aesthetic Index revealed a significant influence of diastema (mean = 0.53 mm) and anterior maxillary overjet (mean = 4.2 mm) with tooth fractures ($P < 0.001$) [Table 2].

The mean score of COHIP was 85.82 with a median of 96. Forty-six percent of children with anterior teeth fractures had positive OHRQoL and 54.3% had negative

Table 1: Distribution of the study participants according to sociodemographic characteristics (n=628)

Demographic data	Study participant, n (%)
Gender	
Boys	490 (78)
Girls	138 (22)
Age (years), mean±SD	12.32±1.8
8	17 (2.7)
9	33 (5.3)
10	68 (10.8)
11	94 (15)
12	93 (14.8)
13	119 (18.9)
14	133 (21.2)
15	71 (11.3)
Religion	
Hindu	494 (78.7)
Muslim	107 (17)
Christian	27 (4.3)
Socioeconomic status: Modified Kuppaswamy's socioeconomic status scale (updated income parameter April 2016)	
Upper	1 (0.2)
Upper middle	15 (2.4)
lower middle	70 (11.1)
Upper lower	494 (78.7)
Lower	48 (7.6)
Type of school	
Corporation	259 (41.2)
Government aided	229 (36.5)
Private	140 (22.3)

SD: Standard deviation

OHRQoL. All the study participants (100%) had negative functional well-being, social-emotional well-being, and school environment. Fifty-three percent of individuals had negative oral health well-being and 52.1% had negative self-image [Table 3].

Age showed a significant ($P = 0.031$) influence on the impact of anterior tooth fracture on OHRQoL with higher negative OHRQoL reported among 13 years of age (63%) followed by 14 years (60.9%). Socioeconomic status showed a significant ($P = 0.011$) influence on the impact of anterior tooth fracture on OHRQoL with negative OHRQoL among the lower class (64.6%) and upper lower class (56.1%). Religion also showed a statistically significant ($P = 0.047$) influence on the impact of anterior tooth fracture on OHRQoL with the negative OHRQoL among the Christians (70.4%).

The type of school had highly significant ($P < 0.001$) influence on the impact of anterior tooth fracture in permanent tooth on OHRQoL with negative OHRQoL among the corporation schools. In general, the study participants from corporation schools had negative

OHRQoL with significant difference in oral health well-being ($P < 0.001$) and self-image ($P = 0.014$). Functional well-being, socioemotional well-being, and school environment showed no significant difference between the schools. In multiple pair-wise comparison, age, oral health well-being, functional well-being,

social/emotional well-being, and total COHIP scores showed significant between the school types ($P < 0.001$) [Table 4].

Table 2: Comparison of variables of tooth fracture between school types using Kruskal-Wallis test

Variables	Type of school	Mean±SD	χ^2	P
DMFT	Corporation	1.88±2.2	42.614	<0.001*
	Government aided	1.45±2.1		
	Private	0.61±1.1		
Diastema (mm)	Corporation	0.822±1.09	27.922	<0.001*
	Government aided	0.415±0.87		
	Private	0.4±0.85		
Anterior maxillary irregularity (mm)	Corporation	1.58±1.30	10.335	0.006
	Government aided	1.45±1.32		
	Private	1.2±1.51		
Anterior mandibular irregularity (mm)	Corporation	1.67±1.56	4.407	0.110
	Government aided	1.56±1.43		
	Private	1.44±1.81		
Anterior maxillary overjet (mm)	Corporation	3.876±1.87	16.657	<0.001*
	Government aided	4.21±2.00		
	Private	4.47±1.62		
Anterior mandibular overjet (mm)	Corporation	0.01±0.24	1.454	0.483
	Government aided	0±0		
	Private	0.02±0.25		
Vertical anterior open bite (mm)	Corporation	0.03±0.36	1.173	0.556
	Government aided	0.03±0.38		
	Private	0±0		

* $P < 0.001$ highly significant. SD: Standard deviation; DMFT: Decayed, Missing, and Filled Teeth

Discussion

Oral health problems such as dental caries,^[2] periodontal disease,^[11,12] dental fluorosis,^[13] malocclusion,^[14,15] and cleft lip and palate^[16] are important factors in predicting the daily performance and QoL, thereby having impact how people grow, enjoy life, speak, chew, taste food, and socialize.

The prevalence of tooth fractures (8.7%) in the current study is similar to the studies by Patel and Sujan,^[17] Govindarajan *et al.*,^[7] Kalaskar *et al.*,^[18] Adekoya-Sofowora *et al.*,^[19] and Chen *et al.*^[20] also had a prevalence within the range of 6%–40% which is in accordance with data from the WHO. The prevalence of dental trauma in these epidemiological studies has been found to fluctuate within the acceptable range, and the discrepancy might be due to the influence of factors such as the classification of fracture used, type of dentition assessed, geographical, and behavioral differences between locations and countries.

Trauma to the teeth with its associated symptoms affects a child's well-being, and in this, 54% had negative OHRQoL which was similar to studies by Traebert *et al.*,^[5] Freire-Maia *et al.*,^[21] and comparatively higher than studies by Siqueira *et al.*,^[22] and Viegas *et al.*^[23] A similar study by Bagchi *et al.*,^[24] assessed OHRQoL using CPQ11–14 short form of Jokovic *et al.*^[25] has reported OHRQoL and its domains were associated with tooth fractures.

The prevalence of tooth fracture and its impact on OHRQoL was higher between 13 and 14 years of age which are

Table 3: Influence of tooth fracture between school types with overall child oral health impact profile scores and its domain

Variables	Corp, n (%)	Government aided, n (%)	Private, n (%)	Total, n (%)	χ^2 (Pearson χ^2)	P
OHRQoL well-being						
Positive	83 (32)	116 (50.7)	88 (62.9)	287 (45.7)	38.33	<0.001**
Negative	176 (68)	113 (49.3)	52 (37.1)	341 (54.3)		
Oral health well-being						
Positive	82 (31.7)	119 (52)	93 (66.4)	294 (46.8)	47.96	<0.001**
Negative	177 (68.3)	110 (48)	47 (33.6)	334 (53.2)		
Functional well-being						
Positive	0	0	0	0	-	-
Negative	259 (100)	229 (100)	140 (100)	628 (100)		
Social/emotional well-being						
Positive	0	0	0	0	-	-
Negative	259 (100)	229 (100)	140 (100)	628 (100)		
School environment						
Positive	0	0	0	0	-	-
Negative	259 (100)	229 (100)	140 (100)	628 (100)		
Self-image						
Positive	113 (43.6)	106 (46.3)	82 (58.6)	301 (47.9)	8.519	0.014*
Negative	146 (56.4)	123 (53.7)	58 (41.4)	327 (52.1)		

* $P < 0.05$; ** $P < 0.001$ highly significant. OHRQoL: Oral Health-Related Quality of Life

Table 4: Analysis of comparison of age, oral health well-being, functional well-being, social/emotional well-being, and total Child Oral Health Impact Profile scores by analysis of variances test and multiple pair-wise comparison

Dependent variable	ANOVA (P)	Multiple pair-wise comparison by Tukey HSD <i>post hoc</i> test		P
		Type of school	Mean difference	
Age (years)	<0.001**	Corporation		
		Government aided	0.017	0.994
		Private	0.806*	<0.001**
Oral health well-being	<0.001**	Government aided		
		Private	0.789*	<0.001**
		Corporation		
Functional well-bein	<0.001**	Government aided	-0.927*	<0.001**
		Private	-1.432*	<0.001**
		Government aided		
Social/emotional well-being	0.049*	Private	-0.506*	0.045*
		Corporation		
		Government aided		
COHIP score	<0.001**	Government aided	-1.793*	0.027*
		Private	-3.782*	<0.001**
		Government aided		
		Private	-1.989*	0.042*
		Corporation		
		Government aided		
		Government aided	-1.129	0.594
		Private	-3.295*	0.038*
		Government aided		
		Private	-2.165	0.256
		Corporation		
		Government aided		
		Government aided	-3.942	0.071
		Private	-8.928*	<0.001**
		Government aided		
		Private	-4.985*	0.049*
		Corporation		
		Government aided		

*The mean difference is significant at the 0.05 level; ** $P \leq 0.001$ highly significant. ANOVA: Analysis of variance; COHIP: Child Oral Health Impact Profile; HSD: Honestly significant difference

in line with the findings of Lam *et al.*^[26] who concluded that the majority of tooth fracture occurs in 0–4, 5–9, and 10–14 year age groups. Age is a determinant which influences the impact on OHRQoL, and it has been proven that there is an inception of abstract thinking and building of one's self-image and children start comparing their physical characteristics and personality traits with those of other children after 6 years of age. The idea of esthetics linked to health now begins to be incorporated into the mind of the child, interfering with his/her concept of self-esteem.^[2] The age selected for this study was 8–15 years so as to satisfy the above cause. During this period, there is the maximum physiologic growth and development and also children actively involve themselves in a lot of outdoor activities.

Boys were 3.5 times more susceptible for tooth fracture than girls which also corroborates the findings of Patel and Sujjan,^[17] Dua and Sharma,^[27] and Prasad *et al.*^[28] The higher percentage of tooth fracture among boys than girls could be attributed to the fact that boys engage in outdoor leisure activities of a generally more aggressive nature, and furthermore, boys tending to be more energetic as compared to girls.^[17,24,28] Even though the prevalence was higher among the boys, there was no significant difference

between boys and girls in impact of tooth fracture on OHRQoL and negative OHRQoL was more reported among the Christians (70.4%) the reason remains unexplained. No previous studies have compared religion as a factor influencing the impact of tooth fracture on OHRQoL.

The prevalence of permanent anterior tooth fracture was more among lower socioeconomic status (78.7%) with negative OHRQoL among lower and upper lower class similar to study by Ain *et al.*^[29] The negative OHRQoL among the lower strata could be influenced by the affordability, acceptability, and the awareness of the child's parent.

The prevalence of tooth fracture was higher among the corporation schools (41.2%) similar to that reported by Ain *et al.*^[29] and in contrary to the study by Ahlawat *et al.*^[30] Most of the children in the lower socioeconomic strata tend to be in corporation schools and those from the higher strata in the private schools. Hence, the prevalence of tooth fractures being more in corporation schools. On the contrary, more fractures are reported in private schools by Ahlawat *et al.* could be attributed to the fact that the students from the private schools have more sports facilities such as swimming pools, skates and skids, and other different types of contact sports, and thus, they are more prone to tooth fractures.^[29]

The most common type of tooth fracture was a Class I fracture involving enamel only similar to previous studies reported by Piovesan *et al.*,^[31] Traebert *et al.*,^[5] and Prasad *et al.*^[28] A total of 784 teeth were fractured among 628 schoolchildren with only 21.3% having multiple tooth fractures similar to study by Govindarajan *et al.*^[7] The maxillary central incisors were the most commonly affected tooth similar to previous studies Govindarajan *et al.*,^[7] Bagchi *et al.*,^[24] and Ahlawat *et al.*^[30] These findings probably relate to the vulnerable position of the maxillary central incisors, the first front teeth often to be exposed to the outer environment, hence most commonly affected by any kind of injury.^[24] Further, the force with which a trauma occurs also determines the type and the multiplicity of the fracture.

The presence of anterior maxillary overjet of 4.2 mm or more influenced the occurrence of tooth fracture in the current study, whereas a similar study by Ain *et al.*^[29] and Patel and Sujan^[17] reports maxillary overjet of 3 mm or more and 5.5 mm or more respectively are associated with tooth fractures. Hence, the maxillary overjet of 4 mm or more substantiates the increase in the prevalence of tooth fractures and thereby its impact on OHRQoL.

Limitation

This study does not take into consideration the assessment of OHRQoL before and after the treatment of fractured teeth. The study sample is limited to urban school children and does not take into consideration the schools of periurban and rural regions.

Recommendation

Preventive oral health educational program targeting the parents and school teachers should be conducted at regular intervals to inform them about the identification of tooth fracture and its modes of management. Health promotion and safety policies and closer supervision of children to avoid indulgence in fights and other aggressive activities must be adopted. Usage of intraoral and extraoral devices such as mouthguards during sports must be promoted. Periodic continuing dental education programs about the latest technologies in the management of traumatized teeth could be organized for the dental and medical practitioners.

Conclusion

Facial appearance and Oral Health-Related problems can affect psychological and social well-being. All the children reporting with tooth fractures had negative OHRQoL, especially in their functional well-being, socio-emotional well-being, and in school environment domains. The planners need to plan for tooth fractures also on a priority along with other oral diseases.

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Conflicts of interest

There are no conflicts of interest.

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