

PREVALENCE OF TRAUMATIC DENTAL INJURIES TO MAXILLARY ANTERIOR TEETH, ASSOCIATED RISK FACTORS AND ITS INFLUENCE ON QUALITY OF LIFE AMONG ADOLESCENTS IN KERALA

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ABSTRACT:

Context: Traumatic Dental Injuries are of concern in many developed countries. Increased overjet and inadequate soft-tissue coverage are the common risk factors. Quality of life affection due to dental injury has not been studied much in India.

Aims: To estimate the prevalence of traumatic dental injuries and study risk factors associated with it and its influence in oral health related quality of life among adolescents aged between 15- 18 years in Kerala.

Settings and design: A descriptive cross sectional study with a stratified cluster sampling among higher secondary schools in 5 districts of Kerala.

Methods: Traumatic dental injury was registered using WHO criteria. Risk factors, normative malocclusion features, Dental Aesthetic Index and Quality of Life were assessed by calibrated examiners.

Statistical analysis: Descriptive statistics included means, standard deviations and proportions. Independent t test and Chi-square test was used to test the significance at $P < 0.05$.

Results: The overall prevalence of traumatic dental injury was 5.2%. Out of this 52.1% had Enamel and 25% had Enamel and Dentine fracture. Maxillary incisor was affected in 81.2% of cases and most frequent place of trauma was at home (50%). Children with increased overjet (>6 mm) had significantly more dental injuries than those with lesser overjet ($P < 0.05$). Quality of Life was negatively affected in subjects with incisor fracture.

Conclusions – Prevalence of traumatic dental injury in Kerala among young adolescents was low. Injury occurred more frequently at home than in school and quality of life was negatively affected in children with traumatic dental injuries.

Key words: Traumatic Dental Injury, Oral health related quality of life, Incisor fracture.

INTRODUCTION:

Incisors are very important for esthetics, speech and other functional activities. The four permanent maxillary incisors normally overlap the four mandibular incisors with an over jet of 1-3 mm and an over bite of up to incisal one-third of lower incisors. The morphology of these teeth and its



location makes them susceptible to Traumatic Dental Injuries (TDI's). The extent of injury can vary from an enamel crack or fracture to tooth luxation and avulsion.

The reported prevalence of TDI ranges from 4.1% to 58.6%.^[1] Most studies have stated that permanent maxillary central incisor is the most frequently affected

tooth.^[2-6] TDI is more prevalent in males than in females,^[3,4,7] although a statistically significant sexual dimorphism could not be observed in some studies.^[1] There is a general tendency towards an increase in incisor trauma until 10 to 12 years. A seasonal variation in rate of injury has also been reported.^[8]

Severity and frequency of TDI is associated with an increase in overjet, incompetent upper lip, and inadequate soft tissue coverage.^[2,9-11] Nguyen et al,^[12] suggested the inclusion of overjet as a malocclusion item into orthodontic treatment indexes because of its potential relation with TDI. In a Cochrane systematic review evaluating the effectiveness of one phase treatment and two phase treatment for class II malocclusion, the authors concluded that two phase treatment is indicated in individuals with large overjet to prevent traumatic injuries.^[13]

Most governments are now focusing on prevention of TDI because of the irreversible nature of the injury and its potential effect on Quality of Life (QOL).^[6-14] According to Artun et al,^[9] risk of TDI increases by 14.3% for every millimeter increase in overjet. Collisions, falls, sports, and traffic accidents are the main cause for dental injuries. Age, sex, socioeconomic status and behavioral problems have an influence in the frequency TDI's.^[7,9,12]

In India the reported prevalence of TDI varies between 6-23%. There are only very few studies available that have estimated the prevalence and risk factors associated with TDI in Kerala population.^[15] Kerala ranks first among all states in India in terms

of Literacy and other health Indicators.^[16] The reported prevalence of TDI by David J et al^[15] was only 6% which is better than most developed countries. This study aimed to estimate the Prevalence of TDI, associated risk factors and Quality of life among adolescents aged between 15 and 18 years of Kerala, South India.

MATERIALS AND METHODS:

Institutional ethics committee approval was obtained prior to the conduct of study from Government Dental College, Kottayam (IEC/M/02/2011/DCK/1). At all stages of examination and data collection permissions from school authorities and informed consent from participants and parents were obtained.

This cross sectional study was part of a larger survey designed to estimate the prevalence of malocclusion, orthodontic treatment needs and malocclusion related quality of life among adolescents aged between 15 and 18 years. The estimated sample size with an assumed prevalence of TDI not more than 8%^[15] with a precision of $\pm 5\%$ and type I error of 5% and a design effect of 1.5 due to cluster sampling was 883. However 930 subjects were included for data analysis after eliminating incomplete data.

A multistage sampling strategy was adopted. The state of Kerala located at the southern tip of peninsular India with 14 districts can be divided based on two criteria. First, according to the agro-climatic conditions, and adopted by the Registrar General of India into 3 homologous areas namely coastal

midland, mid land and high land.^[17] Each districts belonging to this method were enumerated. The second division was based on the geographic location as southern, central and northern Kerala. Since the regions overlap and to reduce cost, 5 districts were randomly selected which fulfills both criteria. The selected districts were, Kollam, Kottayam, Thrissur, Wayanad and Kannur.

In the second stage, from each district, one urban and one rural area according to The Kerala Municipality Act 1994, was randomly selected. For each area a complete list of government and private schools were prepared separately in alphabetical order. Two government and two private schools from each urban and rural area were randomly selected from the school list. A single class of higher secondary students (35-40 students per class) aged between 15 and 18 formed one cluster. After one school the study proceeded to the next until the required number for the district was met ensuring almost equal representation from government and Private schools. The overall rural to urban population ratio in Kerala is approximately 50% according to the 2011 census. Those children who were not willing to participate, those with cleft lip/ palate, tooth agenesis and those with supernumerary teeth were excluded.

Normative malocclusion features were recorded according to Ackerman-Proffit classification. TDI was registered using the WHO criteria.^[18] The criteria were as follows;

0- No sign of injury

- 1- Treated injury
- 2- Enamel fracture only
- 3- Enamel and dentine fracture
- 4- Pulp involvement
- 5- Missing teeth due to trauma
- 6- Other damage
- 7- Nonvital tooth
- 8- Displacement of the tooth without the fracture of crown or root
- 9- Excluded tooth

Orthodontic treatment need was assessed using Dental Aesthetic Index (DAI) developed by cons and Jenny^[19] and accepted by WHO as a cross cultural Index. Other information like place of fracture, reason for injury, type of treatment, duration since injury, and socioeconomic status (APL – Above Poverty Line and BPL – Below Poverty Line) were also recorded. To assess the Quality of life affection due to TDI, a psychometric tool (Malocclusion Related Quality of Life Questionnaire, MRQoLQ) developed and validated according to the criteria described^[20] was used. There were 20 questions arranged in Psychological (6 items), socioeconomic (2 items), orthodontic self-confidence (5 items), social impact (3 items) and functional limitation (4 items) domains. The response was registered using a five point Likert scale. The response options were; 1=not at all, 2=no, 3=occasionally, 4=yes, 5=definitely yes.

All examinations were performed by trained and calibrated examiners (kappa for inter rater reliability 0.82 to 0.96) adhering to a WHO criteria (supervised by EP and BRM). A CPITN probe and mouth mirror using natural light was used to register TDI and other features ensuring strict infection control protocol.

Statistical analysis – Data was entered in Microsoft Excel spread sheet (version 2010, Microsoft Corp, Washington) and imported to Statistical Package for Social Sciences (SPSS for Windows, version 16.0, SPSS Inc., Chicago, IL, USA) for analysis. Descriptive statistics including proportions, means and standard deviations were estimated. Chi-square test and Independent sample t test with significance level kept at $P < 0.05$ was performed to compare the proportions and means respectively. Pearson correlations between Quality of life score and sub domains in children with and without TDI were done.

RESULTS:

This cross sectional study surveyed 930 higher secondary students (boys – 366, 39.4% and girls – 564, 60.6%) aged between 15 and 18 years (mean age -16.2) from Kerala, South India. Overall prevalence of Traumatic Dental Injury (TDI) to upper anterior teeth was 5.2% (48 subjects). Out of this 52.1% (25 subjects) had enamel fracture, 25% (12 subjects) had enamel and dentine fracture. Only 6.2% (3 subjects) had pulpal involvement and 14.6% (7 subjects) had undergone restorative treatment. Most TDI involved single incisor (39 teeth, 81.2%) and most

common place of occurrence of fracture was at home (24 subjects, 50%) followed by school (20 subjects, 41.7%). Most TDI's happened before 3 years from the date of examination (33 subjects 68.8%) and was due to fall (in 44 subjects, 91.7%).

However females (26 subjects with fracture, 54.2%) had more TDI compared to males (22 subjects with fracture, 45.8%) but this sexual dimorphism was not statistically significant ($P > 0.05$). Also there was no significant difference ($P > 0.05$) between the economic status (APL or BPL), place of residence (urban or rural) and school types (Government or Private) when compared with those with and without TDI. A summary of result is presented in table 1.

Of the risk factors studied, overjet, lip competency and orthodontic treatment need assessed using DAI showed a significant influence on TDI (table – 2). There was a statistically significant ($P < 0.05$) difference in the proportion of TDI between those with overjet more than 6 mm and those with overjet less than 6 mm (OR – 3.24, 95% CI – 1.59-6.62). Similarly DAI categorized in to those with little or no need for treatment and those with definite or mandatory need showed statistically significant difference in TDI (OR – 2.11, 95% CI – 1.18-3.8). Competent and incompetent lip groups also showed similar difference. Even though the proportion of TDI in class II division 1 (8.0%) was more than the proportion in class I malocclusion (5.2%), the difference was not statistically significant ($P > 0.05$).

An independent t test comparing the mean scores of QoL with TDI (mean 45.98, SD 12.69) and without TDI (mean 50.75, SD 16.34) was significant ($P < 0.05$) suggestive of a possible QoL affection in those subjects with incisor fracture. The overall QoL scores of subjects with TDI showed statistically significant positive correlation with psychological, socioeconomic and functional domains (table 2). The mean scores of these domains were significantly different between subjects with and without TDI.

DISCUSSION:

Numerous studies have been conducted so far to study the prevalence and risk factors associated with TDI in children.^[2,4,9,12,15,21,22] Most of the findings in the present study were consistent with previous studies while some were not. The reported prevalence of TDI shows wide variations due to the difference in registration methods, racial, sexual and personality traits.^[23] No reported studies on TDI from this part of the country have attempted such a wide geographical coverage. TDI being irreversible and having a potential to affect QOL^[6,7,14] should undergo periodic assessment enabling a responsible government for planning policies to prevent it.

The over-all prevalence of 5.2% was similar to that reported by David J et al,^[15] who reported 6% in 2009 for South Indian population. However a higher rate was reported by Garg et al,^[2] in 2017 for North Indian children. The reason for a lower prevalence in this study may be due to the selected age group of the participants.

Young adolescents of 15 to 18 years selected for study has not been subjected to much studies previously. This period is critical in any individual's life as self-esteem is rapidly taking its shape and peer influence is very high. Hence the possibility of QOL affection is at its peak.

Most fractures registered were of enamel fracture (52.1%), followed by enamel and dentine (25%) and least possibility was for pulpal involvement (6.2%) and tooth avulsion. This is in tune with other reported studies^[1,22,24] suggesting that most TDI are mild or mild to moderate in nature. Another noteworthy finding was the place of occurrence of fracture. Many studies reported TDI occurs commonly at school^[2,25,26] than at home. However, in this study the rate of occurrence of TDI at home (50%) was significantly higher than that at school (41.7%, $P < 0.05$).

The peak age of occurrence of TDI in permanent dentition is between 9-13 years.^[9] Findings of the present study also supported this because most fractures (68.8%) occurred at a date 3 years prior to the date of examination. Although some studies have observed a sexual dimorphism in TDI, present study could not identify such a difference ($P > 0.05$). This is according to Glendor et al^[1] who also found no relation between gender and TDI. Socioeconomic status, place of residence and type of school failed to show a statistically significant difference with the rate of injury^[27] possibly suggesting that these factors have no role in TDI in this population.

One of the major risk factor identified for TDI was increased overjet.^[3,10,12] An overjet more than 6 mm was associated with and increased rate of TDI. Usually such overjet is a feature of class II division 1 malocclusion. However a sizable proportions of Class I malocclusions also had TDI compared to Class II malocclusions in the current study. This may be because Class I bi-maxillary proclination is the most prevalent form of malocclusion in South India.^[21] Lip incompetency was also a major risk factor identified for TDI. Baldava et al,^[10] and Nguyen et al,^[12] also reported similar findings.

DAI is now universally accepted as a cross cultural index after it is adopted by WHO for epidemiological surveys^[18] to estimate orthodontic treatment needs. It has been found to be valid for Indian population also^[28] Subjects with higher DAI grades have more severe orthodontic problems making the treatment need mandatory^[19] A statistically significant difference observed between the proportions of DAI and TDI is logic because overjet having a higher weightage in DAI score might have contributed to an increased prevalence of TDI in mandatory treatment need group.

Very few studies have probed the potential effect of TDI on individual's QoL.^[6,14,27] This study used a previously described and validated Psychometric QoL tool and found a significant negative effect on QoL in subjects with TDI. The impact was more in Psychological (Pearson $r = 0.905$, $P < 0.001$) than in physical domain ($r = 0.608$, $P < 0.001$) unlike reported in many studies.^[6,27] This is because most TDI had occurred more than 3 years before the date of examination,

hence pain and discomfort following TDI was no more of concern for the subjects.

However the study is not without limitations. No attempt to estimate the prevalence of TDI during its peak susceptible period in permanent dentition was undertaken. This is because the study was part of a larger study with broader objectives. Another limitation is a possible independent association between QoL and malocclusion making the TDI – QoL link erroneous.

CONCLUSION:

The prevalence of traumatic dental injury among older adolescents in Kerala, South India is only 5.2% which is another positive health Indicator. There is no significant difference between gender and socioeconomic status for TDI. Most commonly affected teeth are maxillary central incisors and the place where TDI frequently occurred was at home. Quality of life, especially in psychological domain is significantly affected with TDI. However this study emphasizes the need for early orthodontic treatment in children with increased overjet to prevent incisor fracture. Converting home and schools to be more children friendly to prevent TDI cannot be overlooked.

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TABLES:

Table -1 Comparison of TDI with demographic variables and risk factors

Variables	TDI n (%)		TOTAL	P value	OR (95% CI)
	Absent n (%)	Present n (%)			
Gender					
Boys	344 (94.0)	22 (6.0)	366	0.345*	
Girls	538 (95.4)	26 (4.6)	564		
School type					
Government	498 (95.2)	25 (4.8)	523	0.551*	
Private	384 (94.3)	23 (5.7)	407		
Economic status					
Below Poverty Line (BPL)	395 (95.6)	18 (4.4)	413	0.323*	
Above Poverty line(APL)	487 (94.2)	30 (5.8)	517		
Place of residence					
Urban	457 (94.2)	28 (5.2)	485	0.379*	
Rural	425 (95.5)	20 (4.5)	445		
Type of MO					
Class I	707 (94.9)	38 (5.1)	745	0.189*	
Class II div 1	115 (92.0)	10 (8.0)	125		
Overjet					
Less than 6 mm	808 (95.6)	37 (4.4)	845	0.001**	3.24 (1.59-6.62)
More than 6 mm	74 (87.1)	11 (12.9)	85		
DAI					
Little or no need	615 (96.1)	25 (3.9)	640	0.010**	2.11 (1.18–3.80)
Definite and mandatory need	267(92.1)	23 (7.9)	290		
Lip Incompetence					
Competent	747 (96.1)	30 (3.9)	777	0.000**	1.86 (1.04-3.66)
Incompetent	135 (88.2)	18 (11.8)	153		

Chi-square - * not significant, ** significant.

Table 2: Comparison of Quality of Life sub scales between groups & Correlation with overall QoL scale.

Sub scale	Comparison with TDI status			Correlation with QoL Scale total (MRQoL)	
	TDI Present (Mean \pm SD)	TDI Absent (Mean \pm SD)	P value	Pearson's r	P value
Psychological	15.12 \pm 5.97	13.54 \pm 5.01	0.035*	0.940**	<0.001
Socioeconomic	5.73 \pm 2.20	4.75 \pm 2.07	0.002*	0.826**	<0.001
Orthodontic-self confidence	16.38 \pm 4.78	15.31 \pm 4.29	0.095	0.890**	<0.001
Social impact	5.62 \pm 3.09	5.40 \pm 2.30	0.525	0.834**	<0.001
Functional impairment	7.90 \pm 3.37	6.98 \pm 2.53	0.017*	0.610**	<0.001
Scale total score	50.75 \pm 16.34	45.98 \pm 12.69	0.013*		

*Statistically significant - independent t test

** Statistically significant – Karl Pearson's correlation