Dental Traumatology 2008; **24**: 309–313; doi: 10.1111/j.1600-9657.2007.00547.x

Impact of treated and untreated dental injuries on the quality of life of Ontario school children

Kausar Sadia Fakhruddin[1], Herenia P Lawrence[1], David J Kenny[1,2], David Locker[1]

[1]Faculty of Dentistry, University of Toronto, [2]Department of Dentistry, The Hospital for Sick Children, Toronto, ON, Canada

Correspondence to: Herenia P Lawrence, Associate Professor, Department of Biological and Diagnostic Sciences/ Community Dentistry, Faculty of Dentistry. 124 Edward Street, Rm 515D, Toronto, ON, Canada M5G 1G6
Tel.:+1 416 979 4908 ext. 4492
Fax:+1 416 979 4936
e-mail: herenia.lawrence@utoronto.ca

Accepted 22 June, 2006

Abstract – A population-based, matched case–comparison study was undertaken in 30 schools in two Ontario communities to measure the impact of dental trauma on quality of life (QoL) in Canadian school children. Dental hygienists screened 2422 children aged 12–14 years using the dental trauma index, the decayed, missing and filled teeth index (DMFT) and the aesthetic component of the index of orthodontic treatment needs (AC-IOTN). Cases ($n = 135$) were children with evidence of previous dental trauma. Controls ($n = 135$) were classmates matched for age and gender. Oral-health-related QoL was assessed using mailed Child Perception Questionnaires (CPQ_{11-14}) completed by all children. Data were analyzed using simple and multiple conditional logistic regressions after adjusting for DMFT and AC-IOTN, CPQ_{11-14}, overall impact and item-specific impacts. Approximately 64% of injuries were untreated enamel fractures and just over 30% were previously injured restored teeth. Untreated children experienced more chewing difficulties ($P = 0.026$), avoided smiling ($P = 0.029$) and experienced affected social interactions ($P = 0.032$) compared with their non-injured peers. When treated and non-injured groups were compared, the only statistically significant effect was difficulty in chewing ($P = 0.038$). Injured children who were untreated experienced more social impact than their non-injured peers. Restoration of injured teeth improved aesthetics and social interactions but functional deficiencies persisted as a result of periodontal or pulpal pain.

Introduction

Quality of life (QoL) includes perceived physical, psychological and social functions as well as a sense of well being (1). It has been shown that the appearance and position of the anterior teeth have psychological and social impacts on children (2). Consequently, injuries produced by dental trauma can produce significant emotional and social costs for children and their families (3). When injuries to incisor(s) produce pain, disfigurement, poor aesthetics or other psychological effects (4), children may avoid laughing or smiling, and this can affect their social relationships (5). Cortes et al. (3) reported that children with fractured teeth reported a greater negative impact on eating and enjoying food, cleaning teeth, smiling, laughing and showing teeth without embarrassment, maintaining their usual emotional state and enjoying contact with people than children without injury.

Previous studies assessed the impact of the mouth and teeth on QoL of adults and elderly populations (6, 7), while others reported the impact of oral health on children (3, 8). A recent Canadian study reported a prevalence of 18.5% for dental injuries to permanent incisors of 14-year-old school children in six Ontario communities (9). One in eight children had one or more incisors with unrestored enamel fractures and 6% had one or more teeth with damage sufficiently severe to warrant treatment (approximately 20% of this population in need of treatment were untreated).

This study was designed to assess the social impact of dental trauma on the QoL of Canadian school children. Specifically, to assess whether or not untreated dental injuries had an impact on the QoL compared with non-injured controls and to assess the consequences of treated and untreated dental injuries on the QoL of children.

Materials and methods

This population-based, case–comparison study was conducted in schools in the communities served by two Ontario public health departments: York Region and Brant County. Grade 6 and grade 8 children, $n = 2422$ (range 12–14 years), with and without clinical evidence of dental injury were identified during mandatory screening at these health units. Any child with a dental trauma index (10) code 1 (untreated enamel fracture) through 5 (restored fracture) for at least one anterior tooth was designated as a case. Each case was then matched with a comparison subject of the same age and gender who had taken part in the clinical screening component of the study and had no evidence of previous trauma. After clinical examination, the health department staff sent questionnaires along with a letter that explained the aims and objectives of the study including

an information sheet and a consent and assent form, to the home addresses of the sample population ($n = 810$). The Research Ethics Board of the University of Toronto approved this project.

The child questionnaire consisted of 10 items designed to measure the impact of oral disorders in terms of symptoms, oral function, emotional and social well-being (schooling, peer relationships and leisure activities). It was an abbreviated version of a previously validated instrument, the Child Perception Questionnaire (CPQ_{11-14}) (11). Information regarding socio-economic status of the children in the injured and non-injured groups was recorded using a parental questionnaire. Non-responders were issued two reminder notes and a second questionnaire.

Sample size calculations were possible using estimates of the proportion of 11 to 14-year-old children reporting one or two impacts on the oral-health-related QoL before undergoing orthodontic treatment (12). It was assumed that a similar proportion of children among controls would report such impacts in the present study, *i.e.* 36.6%, and it was further assumed that the difference in proportions would be one-third between cases and controls – 0.122, with alpha equals 0.05 (two-tailed test) and 80% power. A sample size of matched pairs was estimated *a priori* 105.

A total of 270 of 810 eligible 12 to 14-year-old children agreed to participate in the study (33.3%). The sample included 152 boys (56.3%) and 118 girls (43.7%). Amongst those with clinical evidence of dental injury (135), over half of the subjects, 92 presented with untreated dental injuries and 43 subjects had restored teeth.

Based on skewness of the CPQ_{11-14} scores, measurement of impacts were dichotomized (0 = never vs 1 = once or twice/sometimes,often/almost every day) and this identified a high proportion of children who reported no impact because of their injury. Conditional logistic regression for multivariate analysis was conducted after controlling for the confounding effects of other factors such as arrangement and appearance of teeth and dental status, as measured by the aesthetic component of the index of orthodontic treatment needs (AC-IOTN) (13) and the DMFT index, respectively. The variables were added into the regression model independent of whether they were statistically significantly related to the outcome. Statistical tests were two-tailed and interpreted at the 5% significance level.

Results

Amongst subjects with clinical evidence of dental injury, over 30% had received restorative treatment for fractured tooth crowns, while over 65% presented with untreated dental injuries. Approximately 30% had more than one injured tooth. The only significant difference ($P < 0.02$) with respect to socio-economic characteristics and oral health status indicators between case and control groups was whether the child had visited a dentist in the past year (Table 1). A higher percentage of children without dental injury had visited the dentist within the last year compared with those who had been injured.

Table 1. Comparison of demographics and socioeconomic characteristics and oral health status indicators

Variables	Case ($n = 135$) *n* (%)	Control ($n = 135$) *n* (%)	*P*-value*
Gender			
Female	59 (43.7)	59 (43.7)	1.00
Male	76 (56.3)	76 (56.3)	
Birthplace			
Born in Canada	106 (78.5)	113 (83.7)	0.35
Born outside Canada	29 (21.5)	22 (16.3)	
Mother's level of education			
Up to high school	58 (43.0)	51 (37.8)	0.39
More than high school	76 (56.3)	84 (62.2)	
Family income			
Less than $30 000	34 (25.2)	30 (22.2)	0.45
More than $30 000	97 (71.9)	105 (77.8)	
Family size			
Up to 4 people	94 (69.6)	96 (71.1)	0.79
5 or more people	41 (30.4)	39 (28.9)	
Ontario family support			
Yes	5 (3.7)	7 (5.2)	0.77
No	130 (96.3)	128 (94.8)	
Family dental insurance			
Yes	81 (60.0)	79 (58.5)	0.89
No	54 (40.0)	56 (41.5)	
Child's dental health			
Excellent/good	109 (80.7)	111 (82.2)	0.79
Fair/poor	26 (19.3)	24 (17.8)	
Family dentist			
Yes	114 (84.4)	116 (85.9)	0.86
No	21 (15.6)	19 (14.1)	
Dental visit within 1 year			
Yes	80 (59.3)	99 (73.3)	0.02*
No	55 (40.7)	36 (26.7)	

*Obtained using McNemar's test.

When the DMFT and AC-IOTN scores were compared between both groups (with and without dental injury), children with dental injuries demonstrated a significantly higher DMFT (1.09 ± 1.55) and AC-IOTN (3.34 ± 2.52) than controls (DMFT = 0.50 ± 1.43, $P < 0.001$; AC-IOTN = 3.79 ± 2.18, $P = 0.027$) using the Wilcoxon Signed-rank test.

The most prevalent CPQ_{11-14} impact was dental pain experienced during the last 3 months which, although not statistically significant ($P = 0.412$) was reported by children with untreated dental injuries (41.3%) and their uninjured peers (35.9%) (Table 2). For both subject groups, the second most prevalent impact was difficulty chewing, the proportion being significantly higher for injured untreated (35.9%) than for uninjured (23.9%). Despite the low prevalence of CPQ_{11-14} functional impacts, dental trauma significantly affected emotional well-being. A higher proportion of injured untreated cases reported social interaction problems such as being concerned with what others think (31.5%) than their uninjured controls (17.4%) ($P = 0.03$). Significant differences between injured untreated and uninjured controls were also found for items in the social well-being dimensions; avoid smiling and laughing ($P = 0.02$) and did not want to talk to other children ($P = 0.03$). The remaining three items in the social well-being dimension

Table 2. Frequency distribution of each $CPQ_{11–14}$ item and overall $CPQ_{11–14}$ for children with untreated dental injury and age- and gender-matched children without dental injury

Dimensions and items	Case (n = 92) (Untreated dental injury) n (%)	Control (n = 92) (No dental injury) n (%)	Unadjusted odds ratio** (95% CI)	Adjusted odds ratio** (95% CI)[a]
Oral symptoms				
Pain				
CPQ_{11-14} = 0	54 (58.7)	59 (64.1)	1.31 (0.68–2.52)	1.54 (0.71–3.36)
CPQ_{11-14} = 1	38 (41.3)	33 (35.9)		
Functional limitations				
Sleep disturbance				
CPQ_{11-14} = 0	86 (93.5)	84 (91.3)	0.75 (0.26–2.16)	1.29 (0.39–4.16)
CPQ_{11-14} = 1	6 (6.5)	8 (8.7)		
Chewing difficulty				
CPQ_{11-14} = 0	59 (64.1)	70 (76.1)	2.00 (0.97–4.12)	2.86 (1.13–7.26)*
CPQ_{11-14} = 1	33 (35.9)	22 (23.9)		
Emotional well-being				
Shy or embarrassed				
CPQ_{11-14} = 0	72 (78.3)	76 (82.6)	1.27 (0.64–2.49)	1.71 (0.78–3.75)
CPQ_{11-14} = 1	20 (21.7)	16 (17.4)		
Concerned with what others think				
CPQ_{11-14} = 0	63 (68.5)	76 (82.6)	2.00 (1.03–3.89)*	2.07 (0.96–4.47)
CPQ_{11-14} = 1	29 (31.5)	16 (17.4)		
Social well-being				
Low concentration in school				
CPQ_{11-14} = 0	79 (85.9)	82 (90.1)	1.50 (0.61–3.67)	1.80 (0.67–4.87)
CPQ_{11-14} = 1	13 (14.1)	9 (9.9)		
Avoid smiling/laughing				
$CPQ_{11-14)}$ = 0	72 (78.3)	83 (90.2)	2.38 (1.04–5.43)*	3.09 (1.12–8.50)*
CPQ_{11-14} = 1	20 (21.7)	9 (9.8)		
Did not want to talk to other children				
CPQ_{11-14} = 0	79 (85.9)	88 (95.7)	3.25 (1.06–9.97)*	3.84 (1.12–13.18)*
CPQ_{11-14} = 1	13 (14.1)	4 (4.3)		
Did not want to spend time with other children				
CPQ_{11-14} = 0	85 (92.4)	90 (97.8)	3.50 (0.73–16.84)	5.12 (0.85–30.76)
CPQ_{11-14} = 1	7 (7.6)	2 (2.2)		
Teased by other children				
CPQ_{11-14} = 0	79 (85.9)	85 (92.4)	1.86 (0.74–4.65)	2.19 (0.78–6.18)
CPQ_{11-14} = 1	13 (14.1)	7 (7.6)		
Overall CPQ_{11-14}				
CPQ_{11-14} = 0	33 (35.9)	44 (47.8)	1.58 (0.89–2.81)	1.80 (0.93–3.48)
CPQ_{11-14} 1	59 (64.1)	48 (52.2)		

*P < 0.05, **Obtained using conditional logistic regression, and [a]Adjusted for the aesthetic component of the IOTN and DMFT. IOTN, index of orthodontic treatment needs.

were: being teased by other children, low concentration in school and not wanting to spend time with other children. The differences between the impacts reported for these items were not statistically significant although injured untreated children experienced increased impacts in this component of QoL. Except for the item, sleep disturbance, in the functional limitations dimension, all other impacts such as chewing difficulty, shy or embarrassed, were more common in children with untreated dental injury than for their uninjured peers (Table 2).

A multiple conditional logistic regression was performed to assess the relationship between untreated dental fracture and the CPQ_{11-14} items, controlling for the potential confounding effects of the arrangement and appearance of teeth and dental status (Table 2). A statistically significant difference in difficulty chewing was observed between children with untreated injuries and their uninjured peers after taking into account AC-IOTN and DMFT scores (P = 0.026). Children with untreated dental injuries were approximately three times more likely to report difficulty chewing than those without injury. The item, concerned with what other people think, did not reach statistical significance for children with untreated crown fractures after adjusting for the AC-IOTN and DMFT scores (P = 0.062). The adjusted odds ratio (OR) was 2.07 (95% CI = 0.96–4.46). However, subjects with untreated dental trauma were approximately three times more likely to avoid smiling or laughing (95% CI = 1.12–8.50) and four times more likely to report not wanting to talk to other children (95% CI = 1.12–13.18) compared with uninjured controls. Despite the low prevalence of CPQ_{11-14} impacts, overall CPQ_{11-14} scores demonstrated that children with untreated fractured incisors were approximately twice (Adjusted OR = 1.80; 95% CI = 0.93–3.48) as likely to report effects on their daily living than uninjured children (Table 2).

When the sample of children with treated injuries was compared with uninjured controls, the most prevalent CPQ_{11-14} impact reported by both groups was pain,

Table 3. Frequency distribution of each CPQ_{11-14} item and overall CPQ_{11-14} for children with restored dental injuries and age- and gender-matched children without dental injury

Dimensions and items	Case (n = 43) (Restored injury) n (%)	Control (n = 43) (No dental injury) n (%)	Unadjusted odds ratio** (95% CI)	Adjusted odds ratio** (95% CI)[a]
Oral symptoms				
Pain				
CPQ_{11-14} = 0	24 (55.8)	24 (55.8)	1.00 (0.42–2.40)	1.17 (0.40–3.43)
CPQ_{11-14} = 1	19 (44.2)	19 (44.2)		
Functional limitations				
Sleep disturbance				
CPQ_{11-14} = 0	41 (95.3)	37 (86.0)	0.33 (0.07–1.65)	0.16 (0.02–1.32)
CPQ_{11-14} = 1	2 (4.7)	6 (14.0)		
Chewing difficulty				
CPQ_{11-14} = 0	27 (62.8)	35 (81.4)	2.60 (0.93–7.29)	4.16 (1.08–16.12)*
CPQ_{11-14} = 1	16 (37.2)	8 (18.6)		
Emotional well-being				
Shy or embarrassed				
CPQ_{11-14} = 0	31 (72.1)	35 (81.4)	2.33 (0.60–9.02)	2.14 (0.37–12.31)
CPQ_{11-14} = 1	12 (27.9)	8 (18.6)		
Concerned with what others think				
CPQ_{11-14} = 0	32 (74.4)	34 (79.1)	1.40 (0.44–4.41)	2.01 (0.39–10.29)
CPQ_{11-14} = 1	11 (25.6)	9 (20.9)		
Social well-being				
Low concentration in school				
CPQ_{11-14} = 0	39 (90.7)	40 (95.2)	2.00 (0.37–10.91)	1.81 (0.23–14.15)
CPQ_{11-14} = 1	4 (9.3)	2 (4.8)		
Avoid smiling/laughing				
CPQ_{11-14} = 0	36 (83.7)	39 (90.7)	2.00 (0.50–7.99)	1.67 (0.26–10.82)
CPQ_{11-14} = 1	7 (16.3)	4 (9.3)		
Did not want to talk to other children				
CPQ_{11-14} = 0	38 (88.4)	41 (95.3)	2.50 (0.49–12.89)	1.16 (0.13–10.75)
CPQ_{11-14} = 1	5 (11.6)	2 (4.7)		
Did not want to spend time with other children				
CPQ_{11-14} = 0	38 (88.4)	41 (95.3)	2.50 (0.49–12.89)	0.74 (0.09–5.49)
CPQ_{11-14} = 1	5 (11.6)	2 (4.7)		
Teased by other children				
CPQ_{11-14} = 0	38 (88.4)	39 (90.7)	1.33 (0.29–5.96)	2.54 (0.29–22.33)
CPQ_{11-14} = 1	5 (11.6)	4 (9.3)		
Overall CPQ_{11-14}				
CPQ_{11-14} = 0	16 (37.2)	18 (41.9)	1.20 (0.52–2.78)	1.43 (0.52–3.88)
CPQ_{11-14} = 1	27 (62.8)	25 (58.1)		

*$P < 0.05$, **Obtained using conditional logistic regression, [a]Adjusted for the Aesthetic Component of the IOTN and DMFT. IOTN, index of orthodontic treatment needs.

followed by problems with chewing and feeling shy or embarrassed. However, the results were not statistically significant for any of the CPQ_{11-14} items using simple conditional logistic regression (Table 3).

A multiple conditional logistic regression was performed to assess the relationship between subjects with restored incisors and their controls for the CPQ_{11-14}. All CPQ_{11-14} items separately and the overall CPQ_{11-14} were adjusted by the AC-IOTN index and DMFT scores. No significant association was found between the two groups except for the item reporting effects on chewing. Difficulty chewing was statistically significantly associated with children with restored fractured teeth ($P = 0.038$). The OR was 4.16 (95% CI = 1.07–16.12). Subjects with their injured teeth restored had more problems chewing than those with uninjured incisors (Table 3).

Discussion

The impact of dental trauma to upper incisors on social well-being was greater than on functional and psychological well-being in this sample of 12–14 year old school children. Those with untreated dental injuries experienced a higher risk of negative social impact on their daily living than those without injury. This dissatisfaction with the appearance of untreated fractured incisors reduced smiling, laughing and socializing with others. This corroborates findings of Cortes et al. (3), who reported that aesthetics rather than function were major concerns for children with fractured teeth.

As expected, the children with untreated dental injuries had physical limitations related to chewing as reported in this and previous studies (3, 8). Children with restored incisors still had some of the same functional limitations with respect to chewing as those with untreated crown fractures. The findings that both treated and untreated tooth injuries affected chewing suggest that a restored crown is only part of the injury and pulpal pain and periodontal ligament damage may have long-term effects on chewing. This study shows that children with restored teeth gained improvement in aesthetics and social interactions following crown restoration.

Despite the fact that both injured and uninjured groups were similar in terms of mother's educational level, family income and parents' dental insurance, fewer injured than uninjured children visited the dentist in the last year and approximately 70% of injured children presented with untreated dental fractures. This may be because the majority of dental injuries were uncomplicated fractures that parents or caregivers did not consider serious enough to warrant treatment or that access to dental care was limited. However, in some cases, the outcomes of uncomplicated crown fractures may take up to 2 years to manifest (14). This highlights the need to raise awareness about timely and appropriate use of dental services.

Dental appearance and dental health-related problems can affect psychological and social well-being, leading to harmful complications to a child's well-being that diminishes their QoL. This study showed that untreated dental injuries were more likely to have an impact on the children's daily living than restored injuries. While restoration of fractured crowns appears to improve social aspects of the QoL of school children, functional limitations may continue because of the pulpal and periodontal effects of the injury.

Acknowledgements

This study was supported by a grant from the Ontario Ministry of Health and was conducted with the assistance of the dental staff of the two Public Health Units who participated in the study. In particular, we would like to acknowledge the contribution of Dr. David Wiebe, Dr. Joyce Sinton and Heather Murray.

References

1. de Oliveira CM, Sheiham A. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. J Orthod 2004;31:20–7.
2. Helm S, Kreiborg S, Solow B. Psychosocial implications of malocclusion: a 15-year follow-up study in 30-year-old Danes. Am J Orthod 1985;87:110–8.
3. Cortes MIS, Marcenes W, Sheiham A. Impact of traumatic injuries to the permanent teeth on the oral health-related quality of life in 12–14-year-old-children. Community Dent Oral Epidemiol 2002;30:193–8.
4. Alonge OK, Narendran S, Williamson DD. Prevalence of fractured incisal teeth among children in Harris County, Texas. Dent Traumatol 2001;17:218–21.
5. Marcenes W. Prevalence and impact of Traumatic Dental Injury and Quality of Life, 2005. Available at: http://www.ucl.ac.uk/dph/festschrift/powerpoint/Wagner%20Marcenes.pdf
6. Wong MC, McMillan AS. Tooth loss, denture wearing and oral health-related quality of life in elderly Chinese people. Community Dent Health 2005;22:156–61.
7. Veyrune JL, Tubert-Jeannin S, Dutheil C, Riordan PJ. Impact of new prostheses on the oral health related quality of life of edentulous patients. Gerodontology 2005;22:3–9.
8. Marcenes W, Murray S. Impact of untreated traumatic dental injuries on daily life. J Dent Res 2003;82(Spec issue B): abstract no. 1243.
9. Locker D. Prevalence of traumatic dental injury in grade 8 children in six Ontario communities. Can J Public Health 2005;96:73–6.
10. O'Brien M. Childrens Dental Health in the United Kingdom 1993. Office of Population Censuses and Surveys. London: HMSO; 1994.
11. Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Validity and reliability of a questionnaire for measuring child oral health-related quality of life. J Dent Res 2002;81:459–63.
12. Jokovic A, Maggirias J, Locker D, Tompson B. Gender and age differences in health-related quality of life in orthodontic patients aged 11–14 years. J Dent Res 2003; 82 (Spec. issue B): abstract no. 1564.
13. Brook PH, Shaw WC. The development of an index of orthodontic treatment priority. Eur J Orthod 1989;11:309–20.
14. Zadik D, Chosack A, Eidelman E. The prognosis of traumatized permanent anterior teeth with fracture of the enamel and dentine. Oral Surg Oral Med Oral Pathol 1979;47:173–5.