Dental Traumatology

Dental Traumatology 2009; **25**: 462–469; doi: 10.1111/j.1600-9657.2009.00809.x

Effects of severe dentoalveolar trauma on the quality-of-life of children and parents

Teresa D. Berger[2], David J. Kenny[1,2], Michael J. Casas[1,2], Edward J. Barrett[1,2], Herenia P. Lawrence[2]

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

Correspondence to: David J. Kenny, Professor of Dentistry, The Hospital for Sick Children, 555 University Avenue, Toronto, ON, Canada M5G 1X8
Tel.: +1 416 813 8220
Fax: +1 416 813 6375
e-mail: david.kenny@sickkids.ca

Accepted 8 May, 2009

Abstract – *Background/Aim*: This investigation assessed the effects of dental trauma on the perception of pain and quality of life (QoL) of patient-parent pairs for a year following severe injuries. *Sample*: A visual analogue scale (VAS) was used to assess the pain of injury and treatment for 27 individuals 8–20 years and their parents. The Child Oral Health Quality of Life (COHQoL) survey was used to assess the effects of dental injuries on the QoL of 23 children aged 8–14 and their parents. *Results*: Mean VAS scores revealed that all patients and parents perceived the pain of initial injury to be significantly greater than pain of splint removal ($P \leq 0.05$) and that pain decreased in a stepwise manner from injury through emergency treatment to splint removal. The COHQoL questionnaire demonstrated a profound and continuing effect on children and their parent's QoL following severe dental injury. The initial parental COHQoL score was significantly greater than the 12-month score ($P \leq 0.05$) in both 8–10 and 11-14- year-olds. The COHQoL results indicated a measurable reduction in the QoL of patients and parents was still present 12-months after the injuries. At the end of one-year children were still affected by the social and well-being aspects of the injury yet parents exclusively reported that one-year effects were limited to their children's oral symptoms and functional limitations. *Conclusions*: Severe dental injuries produce initial and ongoing pain. Detrimental effects on the QoL of both children and parents are still present at one-year and these long-term effects are different for children and parents.

Facial differences and dental malocclusion affect the self-esteem of children and young adults (1–4). Likewise, dental caries and facial clefts negatively affect oral function and development as well as emotional and social well-being (5). Severe dental injuries, unlike these chronic conditions, cause immediate unexpected pain and disfigurement. In addition to the economic consequences of dental injuries (6–8), trauma produces acute and chronic pain as well as a range of socioeconomic effects that include quality-of-life insults that can lead to time off school and work, lost sleep and commuting for treatment. Moreover, children may experience anxiety produced by the unwanted attention of their peers and the inability to take part in school activities such as sports and music.

The objectives of this investigation were to quantify the perception of pain produced by dental injuries and their treatment by visual analogue scale (VAS) testing of both the patient and parent and to assess the effects of severe dental injury on the oral-health-related quality-of-life of children, adolescents and their families using the Child Oral Health Quality-of-Life (COHQoL) questionnaire (9–15). The patient–parent pair design was chosen to determine differences in perception of, pain and quality-of-life of the patient, the most-affected parent and the extended family. This study was designed to test the hypothesis that there would be differences in coping ability of children and parents, longevity of effects and quality-of-life on patients and parents. Results were compared with previously reported COHQoL scores of children with oral-facial anomalies, orthodontic needs and dental caries (5).

Sample

Inclusion and exclusion criteria

Individuals between the ages of 8–20 who presented for emergency dental treatment at this hospital from May 2006 until November 2007 and their parents were eligible for (VAS) testing based on previous validation studies (16–18). Children and adolescents between the ages of 8–14 and their parents were eligible for the Child Oral Health Quality of Life (COHQoL) portion of this investigation based on previous validation studies (9–15). Patients whose injuries required intra-oral splinting and one of their parents were invited to participate. Those who were unable to understand the written questionnaire, cooperate for treatment, or who did not speak and read English were excluded. Patient and parent both had to agree to participate in order to be enrolled or to continue as a patient–parent pair.

Sample

There are no published standards against which to assess change in any of the four COHQoL measures (oral

symptoms, functional limitations, emotional well-being and social well-being) that represent clinically significant outcomes. However, any dental injury severe enough to require intraoral splinting will have a clinically significant effect on the child and parent.

Patients and their parents were invited to participate in the study by the clinician who treated the dental injury and informed consent was obtained at the emergency appointment. An age-appropriate VAS modified from Shields et al. 2003 (16, 17) was completed separately by the patient and parent to assess their perceptions of both the pain caused by the injury and pain due to treatment at the time of the emergency visit. The VAS employed a horizontal line exactly 100 mm in length. The left anchor point read 'No pain' and the right anchor read 'Very much pain'. Data regarding patient and parent perception of pain experienced by the patient were gathered using a VAS at the initial visit and the time of splint removal. VAS scores were obtained by measuring the distance from the left anchor ('No pain') to the pain marking indicated by the patient or parent. Scripted instructions were used when administering the VAS for verbal consistency. Scores were tabulated for each patient and parent and mean VAS scores for each category were calculated (patient age 8–10 & parent; patient age 11–20 & parent). Mean VAS scores were compared across age and category (patient age 8–10 vs. patient age 11–20; parent of child age 8–10 vs. parent of child age 11–20; patient age 8–10 vs. parent of child age 8–10; patient age 11–20 vs. parent of child age 11–20) using repeated measures ANOVA. Scores were adjusted for baseline levels of pain using the analysis of covariance and least square means. The Tukey adjustment was used to account for significance due to chance. Statistical tests were two-tailed and interpreted at the 5% significance level (SAS Institute, North Carolina, USA).

Data collection (COHQoL)

The COHQoL questionnaire measures oral health-related quality of life (OHRQoL) in four domains: oral symptoms, functional limitations, emotional well-being and social well-being. Data from each component of the COHQoL questionnaire [Child Perception Questionnaire (CPQ), Parental Perception Questionnaire (PPQ) and Family Impact Scale, (FIS)] were collected for children and adolescents between the ages of 8–10 and 11–14 ($CPQ_{8–10}$, $CPQ_{11–14}$ respectively) and their parents PPQ and FIS (9). The questionnaires varied for the children and youth depending upon their age group. The parent questionnaires, PPQ and FIS, were the same regardless of their child's age. Study questionnaires were completed at < 1 month for a baseline assessment, at 6 months and 12 months to identify if there was a change in scores over time.

At the time of enrolment in the study (emergency treatment) parents and patients signed a consent/assent form after explanation of the investigation by the clinician. The Research Ethics Board of this hospital approved all aspects of both the VAS and COHQoL portions of the study (REB file # 1000009071).

Data analysis (COHQoL)

$CPQ_{8–10}$, $CPQ_{11–14}$, PPQ and FIS scores were tabulated by assigning numerical values to each response code and data were summed to produce a Likert-type frequency scale. Responses of 'everyday or almost everyday' were scored as four, 'often' as three, 'sometimes' as two, 'once or twice' as one and 'never' as zero. Questions were written so that no effect on CPQ, PPQ or FIS would score zero. For example, the patient was asked 'since the accident how often have you had pain in your mouth'? The responses were 'never', 'once or twice', 'sometimes', 'often' or 'everyday or almost everyday'. The $CPQ_{8–10}$ and the $CPQ_{11–14}$ each have different total values [100, 148] due to a differing number of questions. They were not numerically equivalent but were identical for all aspects of the study. Overall scores were calculated by adding the individual responses for each questionnaire item. Once a total score was available for each participant, mean scores were calculated for each time period (initial/baseline, 6 and 12 months) and each subgroup (children, parents 8–10; children and adolescents, parents 11–14). The parental questionnaires, PPQ and FIS, were identical in numerical total value [188] for all aspects of the study.

The goal was to compare all groups to assess changes over time ($COHQoL_{8–10}$ initial, 6 and 12 months). Changes in mean scores over 12 months were tested using repeated measures ANOVA. The distribution of responses 'sometimes' and 'often/everyday' were tabulated for the FIS and social and emotional well-being subscales of the CPQ to display differences between the two age groups of children/adolescents to determine if there was a family, social or emotional impact on QoL due to the dental injury. One-year trends in both the CPQ and PPQ were analysed by tabulating the number of participants that responded 'sometimes' or 'often/everyday' to questionnaire items after one-year. Scores were adjusted for baseline COHQoL scores using the analysis of covariance and least square means. The Tukey adjustment was used to account for significance due to chance. Statistical tests were two-tailed and interpreted at the 5 per cent significance level. Group results were compared with data from previous studies of children with severe dental caries, undergoing orthodontic treatment, and with cleft lip and palate and their parents (5, 19–21).

Results

Patient information

Data collection began in May 2006 and ended November 2007. Forty individuals presented with dental injuries that required intraoral splinting. Of these patients, two were from overseas and returned home, four were developmentally delayed and could not cooperate, one presented with dental injuries and a broken femur, one parent did not consent to participate and five patients had their splints removed by community dentists and did not return. Distribution of patient–parent pairs enrolled in the VAS were eleven 8–10-year-olds (3 male, 8 female,

median 9 years) sixteen 11–20-year-olds (12 male, 4 female, median 13 years) for a total of 27 pairs. Patient–parent pairs enrolled in the COHRQoL component were eleven 8–10-year-olds (3 male, 8 female, median 9 years) twelve 11–14-year-olds (9 male, 3 female, median 12.5 years) for a total of 23 pairs. Four patients were older than 14 years and not eligible for the COHQoL component.

Patient injury data

Most individuals suffered multiple tooth injuries. Twenty-one incisors sustained lateral luxations, 19 were extruded, 2 were intruded and 13 were avulsed. Of the avulsed incisors, 7 were not replanted (remaining injured teeth were splinted) and 6 were replanted. Twenty-three teeth required root canal treatment within the year following injury. Fifty-six per cent of the cases occurred in the summer (June–August). The activities that lead to the injuries included accidental falls and tripping (41%), sports (48%) and acts of violence (11%). The sports activities included bicycle riding, roller-skating, softball, weight training, tennis, skate boarding, basketball, football and gymnastics.

Visual analogue scale

Based on a 100-point scale, where a greater number indicated more pain, the mean VAS values of 8–10 year old children ($n = 11$) were 88.5 (SD = 16.8) for pain of initial injury, 35.8 (SD = 33.8) for emergency treatment (includes splint placement) and 27.1 (SD = 37.2) for splint removal. Corresponding parental values were 78.8 (SD = 28.7) for pain of initial injury, 49.0 (SD = 39.1) for emergency treatment and 18.5 (SD = 23.7) for splint removal.

The mean VAS scores for 11–20-year-olds ($n = 16$) were 47.0 (SD = 36.4) for pain of initial injury, 38.8 (SD = 32.0) for emergency treatment and 10.9 (SD = 7.9) for splint removal. Corresponding parental values were 66.8 (SD = 27.2) for pain of initial injury, 43.8 (SD = 20.8) for emergency treatment and 23.4 (SD = 19.1) for splint removal.

Mean VAS results were adjusted according to baseline levels using an analysis of covariance (ANCOVA) and least square means, adjustments for chance were made using the Tukey adjustment and patterns in mean VAS results were analysed using repeated measures ANOVA. No significant differences in mean VAS scores were found between patients and their parents for pain at times of injury, emergency treatment or splint removal regardless of age group ($P > 0.05$). The 8–10-year-olds and their parents perceived the initial injury as significantly more painful than splint placement and removal ($P < 0.05$). The difference between the pain of splint placement and removal was not significant ($P > 0.05$).

The 11–20-year-olds also indicated that the injury was significantly more painful than splint removal ($P > 0.05$). Parents of the 11–20-year-olds also perceived the initial injury to be significantly more painful than subsequent treatment ($P > 0.05$). Despite numerically higher scores for pain of initial injury between groups (8–10, 88.5, SD = 16.8; 11–20, 47, SD = 36.4), these values were not significantly different ($P = 0.3$).

Child oral health quality-of-life

A cross-sectional view of the entire data set of mean values for the CPQ, PPQ, and FIS scores for each age group can be found in Table 1. Longitudinal mean scores of patient/parent pairs that completed either the 6 or 12-month recall are listed in Tables 2 and 3. Longitudinal results were adjusted for baseline COHQoL scores.

Social and emotional well-being domains

The CPQ and PPQ components of the total COHQoL scores contain four matching domains: oral symptoms, functional limitations, social well-being and emotional well-being. The social well-being subscale contained a number of questions about missed schooling and since 55% of the patients in this study were enrolled during the summer when school is in recess, associated questions did not apply. Analysis of the distribution of responses to the emotional well-being subscale that had responses of 'sometimes', 'often', or 'everyday or almost everyday' were counted. When scores were tabulated in this manner, 55% of the children in the younger group reported feeling upset, 45% reported feeling shy or embarrassed, and 64% of the children were concerned about what others thought about their mouth. The strongest feelings reported in the older age group were those of being irritable, frustrated (17%) or concerned about what other people thought of their teeth, mouth, lips or jaws (17%). The 12-month positive responses to the individual CPQ domains for 8–10-year-olds are illustrated in Fig. 1 and and for 11–14-year-olds in Fig. 2.

The PPQ measures the parents' perceptions of their child's oral health-related quality-of-life. The mean raw PPQ scores were greater for the 11–14 year group compared with the 8–10-year-olds across all time periods (Table 1) but the differences were not statistically significant ($P > 0.05$).

The PPQ was analysed according to the distribution of responses of 'sometimes' or 'often/everyday' for both the parental age groups. The residual 12-month positive responses to the PPQ domains are shown in Figs 3 and 4.

Table 1. Cross-sectional view of the mean COHQoL scores (± standard deviations) in children in 8–10, 11–14-year-olds and their parents

	n	$CPQ_{8–10}$	$PPQ_{8–10}$	FIS
Initial	11	31.2 (13.3)	34.8 (18.6)	13.1 (6.4)
6 months	10	20.6 (14.8)	20.6 (21.8)	9.7 (8.2)
12 months	8	17.5 (12.3)	15.9 (12.0)	7.6 (6.1)
	n	$CPQ_{11–14}$	$PPQ_{11–14}$	FIS
Initial	12	29.3 (10.9)	38.8 (22.6)	9.8 (6.9)
6 months	11	19.8 (12.2)	28.0 (17.7)	7.6 (5.6)
12 months	9	16.7 (9.3)	27.4 (18.3)	7.2 (6.0)

Table 2. Mean COHQoL scores of patient/parent pairs who completed the 6-month survey (n = 21)

	Baseline COHQoL Mean (95% CI)	6-month COHQoL Mean (95% CI)	Adjusted Difference Mean (95% CI) *
COHQoL Child			
$COHQoL_{8–10}$	31.6 (21.7, 41.5)	20.8 (10.3, 31.3)	−10.6 (−18.1, -3.2)
$COHQoL_{11–14}$	30.7 (23.8, 37.6)	20.2 (11.8, 28.2)	−10.9 (−18.0, -3.8)
P-value			N/A***
COHQoL Parent			
$COHQoL_{8–10}$	47.4 (29.2, 65.6)	31.4 (10.5, 52.3)	−16.4 (−29.8, −3.0)
$COHQoL_{11–14}$	49.2 (29.2, 69.2)	35.6 (20.4, 51.0)	−13.2 (−26.0, −0.5)
P-value			0.725 **

*Adjusted for baseline COHQoL scores.
** ANCOVA.
***Cannot compare scores between children of different ages because of different surveys.

Table 3. Mean COHQoL scores of patient/parents pairs who completed the 12-month survey (n = 17)

	Baseline COHQoL Mean (95% CI)	6-month COHQoL Mean (95% CI)	12-month COHQoL Mean (95% CI)	Adjusted Difference Mean (95% CI) *
COHQoL Child				
$COHQoL_{8-10}$	31.1 (18.3, 43.9)	21.3 (11.9, 30.7)	17.5 (7.25, 27.8)	−13.5 (−21.2, −5.9)
$COHQoL_{11-14}$	30.9 (22.1, 39.7)	21.2 (8.6, 29.8)	16.7 (9.3, 24.0)	−14.3 (−21.5, −7.0)
P-value				N/A***
COHQoL Parent				
$COHQoL_{8–10}$	46.9 (24.4, 69.4)	24.0 (13.1, 34.9)	23.5 (10.2, 36.8)	−24.5 (−36.9, −12.1)
$COHQoL_{11–14}$	50.7 (26.0, 75.4)	38.2 (22.5, 43.9)	34.6 (16.5, 52.6)	−15.1 (−26.8, −3.4)
P-value	0.7****	0.13****	0.24****	0.256**

*Adjusted for baseline COHQoL scores.
** ANCOVA.
***Cannot compare scores between children of different ages because of different surveys.
****Repeated measures ANOVA.

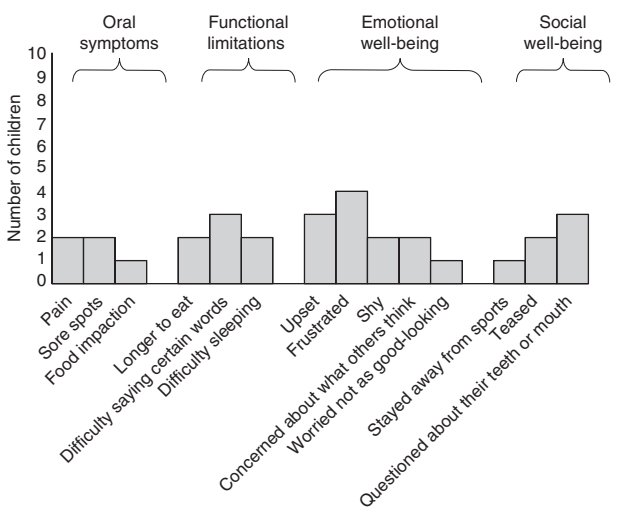

Fig. 1. Twelve-month responses in the $CPQ_{8–10}$ according to domain (n = 8). An affect was scored as remaining if the responses of 'sometimes', 'often' or 'everyday' were given when completing the questionnaire.

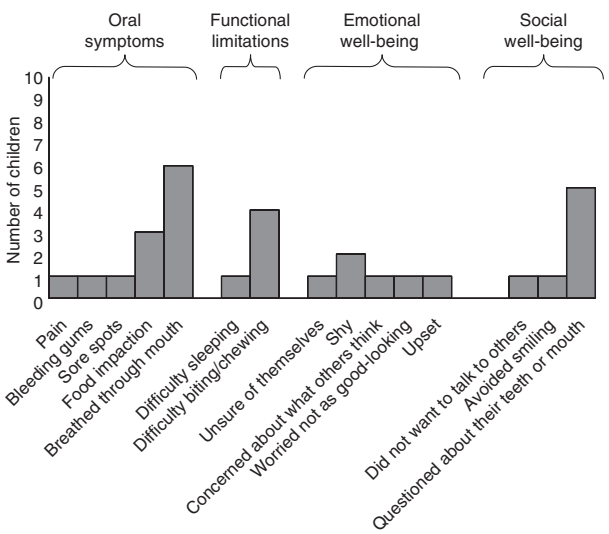

Fig. 2. Twelve-month responses in the $CPQ_{11–14}$ according to domain (n = 9). An affect was scored as remaining if the responses of 'sometimes', 'often' or 'everyday' were given when completing the questionnaire.

Both age groups of children/adolescents reported lasting effects in each of the four CPQ domains at 12 months but their parents only perceived lasting effects in two domains (oral symptoms and functional limitations) and did not offer a single response in the domains of emotional and social well-being for either age group.

Family impact scale

The FIS measures the effects of the child's condition on family finances, interactions within and outside the family and the personal burden on the primary caregiver. No significant differences were found between the mean

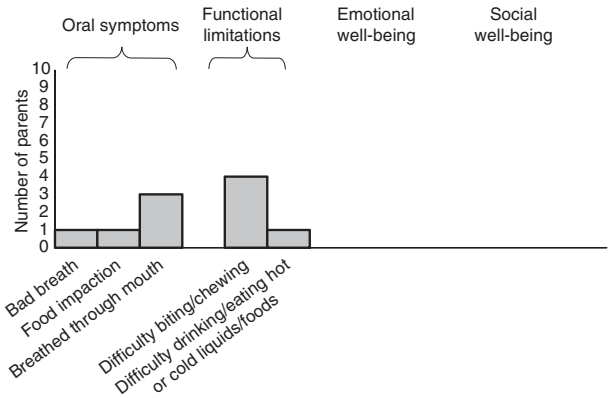

Fig. 3. Twelve-month responses in the PPQ of parents of the 8–10-year-old children according to domain (n = 8). An affect was scored as remaining if the responses of 'sometimes', 'often' or 'everyday' were given when completing the questionnaire.

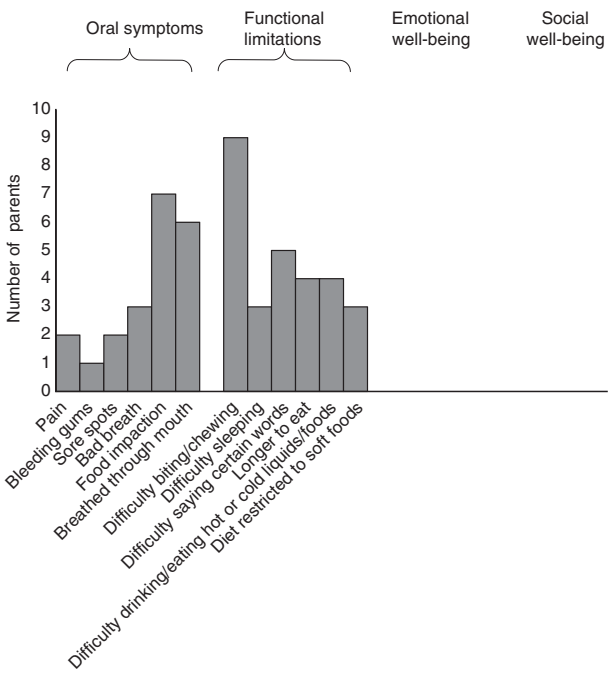

Fig. 4. Twelve-month responses in the PPQ of parents of the 11–14-year-old children according to domain (n = 9). An affect was scored as remaining if the responses of 'sometimes', 'often' or 'everyday' were given when completing the questionnaire.

FIS scores for the two age groups across all time periods Fig. 5.

The results were analysed using the percentage responding 'sometimes' and 'often/everyday' as an indicator. For the younger age group, more items received a response of 'sometimes' or 'often/everyday'. In the initial questionnaire, 73% of parents reported feeling upset, 55% had to take time off work, 54% claimed finances were a cause of stress, 45% felt guilty, and 45% of parents felt that their child required more attention from them. At the 6-month mark, 50% of parents had to take

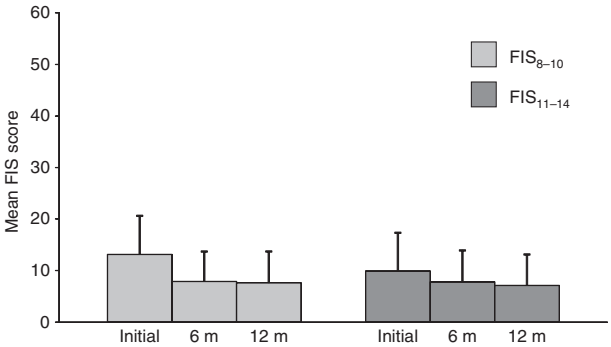

Fig. 5. Comparison of mean FIS scores over time in parents who completed the 12-month recall (mean FIS scores in parents of children 8–10 (n = 8) and 11–14 years (n = 9), maximum value 56).

time off work, 60% had reported being upset, and 30% had undergone a financial burden. One year after the incident, 50% of parents still claimed to have been upset, 12% felt guilty, 24% had to take time off work, 12% stated that their child required more attention, had their sleep interrupted and had less time for themselves. Twenty-five per cent of parents claimed that their child was still argumentative, 25% thought their child's condition caused family conflict, 38% were worried that their child would have fewer life opportunities and 25% were concerned with finances.

For the older age group, at the initial appointment 50% of parents reported taking time off work, 33% reported family activities being interrupted, 33% felt that their child's condition caused financial difficulties for their family, 33% stated that their child required more attention and 33% of the parents were upset. At 6 months, 37% of the parents had to take time off work, 28% reported family activities being interrupted, 36% stated that their child's condition caused financial difficulties for the family and 64% reported feeling upset. At one year, 44% of parents stated that they still had to take time off work due to their child's condition, 33% thought their child required more attention, 11% claimed that they had less time for themselves, 22% had their sleep interrupted, 11% had family activities interrupted, 33% were still upset, 22% felt guilty and 44% claimed that the condition had caused financial difficulties**.** The highest individual recorded COHQoL scores are listed in Table 4. There were no participants with either floor effects (zero score) or ceiling effects (maximum score) in either age category.

Score changes over time

Twenty-one patient/parent pairs (8–10, n = 10; 11–14, n = 11) were followed for 6 months and their COHQoL scores were analysed according to changes over time with respect to baseline and 6-month COHQoL scores. The scores were adjusted to baseline using an analysis of covariance and least square means. The 6-month parental COHQoL scores were dependent upon the initial COHQoL scores (P = 0.03, ANCOVA), however, the

Table 4. Maximum scores for the COHQoL questionnaire according to age group

	Highest initial score	Highest 6-m score	Highest 12-m score	Highest possible score
$CPQ_{8–10}$	45	36	30	100
$PPQ_{8–10}$	69	74	38	132
$FIS_{8–10}$	24	28	11	56
$CPQ_{11–14}$	43	50	30	148
$PPQ_{11–14}$	88	37	32	132
$FIS_{11–14}$	25	16	6	56

6-month scores of patient were not dependent upon the initial score ($P = 0.12$, ANCOVA).

Seventeen patient/parent pairs (8–10, $n = 8$; 11–14, $n = 9$) were followed for 12 months and their scores were analysed for changes over time with respect to baseline, 6- and 12-month COHQoL scores. The COHQoL scores were adjusted to baseline using an analysis of covariance and least square means to determine if the initial COHQoL scores had an effect on subsequent results. The parental 12-month results indicate that scores were dependent upon the initial scores ($P = 0.001$, ANCOVA). The child 12-month results ($CPQ_{8–10}$, $CPQ_{11–14}$) were also dependent upon the baseline COHQoL scores ($P = 0.005$, ANCOVA).

For the group followed 1 year beyond the accident, there were no significant differences among the mean initial, 6- and 12-month $CPQ_{8–10}$ scores. The mean $CPQ_{8–10}$ score of 17.5 at 12 months is approximately half of the mean initial score of 31.1 and much greater than the floor value of zero. The initial mean $CPQ_{11–14}$ score of 30.9 was significantly greater than the 12-month score of 16.7 ($P < 0.05$). There was no significant difference between the mean initial and 6-month $CPQ_{11–14}$ scores ($P > 0.05$).

The mean initial PPQ score for the younger group was significantly greater than both the 6-month ($P < 0.05$) and 12-month scores ($P < 0.05$). There was no significant difference between the 6- and 12-month PPQ scores ($P > 0.05$). The initial mean PPQ score for the older group was significantly greater than the mean 12-month score ($P < 0.05$). No difference was found between the 6- and 12-month results ($P > 0.05$) or the initial and 6-month scores ($P > 0.05$). This indicates that the parents of 11–14 year old patients experienced a significant ongoing effect on their personal QoL 1 year after the injury (mean PPQ = 27.4).

Discussion

Pain of injury and treatment

As children develop, they experience other injuries and possibly previous dental trauma. Older child may have broader experience with pain and seem better able manage it due to a larger assortment of coping strategies than younger children (22). Decreased experience and coping skills may explain the higher VAS values for pain of injury in younger (mean VAS = 88.5) children than older (mean VAS = 47.0) children. These values were not statistically different due to variance. All participants agreed that the injury was the most painful event, followed by emergency treatment and splint removal.

Two studies by Goodenough et al. investigated pain experienced by children during venipuncture and parental perception of their child's pain (23, 24). Values obtained in the current study largely exceeded the VAS pain perception scores reported for venipuncture (23, 24). The parents in both the venipuncture study and this study rated their children's pain higher than the children did. While younger children rated the pain of initial injury higher than the older children they reported decreased pain with each procedure similar to the older group and their parents. The pain aspects of the injury and treatment appear to diminish more rapidly than the effects on quality-of-life. Children and parent groups both appear to cope with the pain of injury and treatment consistently and equally well.

Quality-of-life

The COHQoL questionnaire used in this study was previously validated on groups of children with craniofacial anomalies, dental caries, and those undergoing orthodontic treatment (5, 10, 20). The COHQoL was modified for this study to address the acute nature of the injury compared with the chronic nature of craniofacial anomalies, orthodontic treatment or dental caries. The sole modification to the COHQoL was to re-phrase the modifier at the beginning of each section to state, 'since your accident, how often...' rather than, 'within the last 3 months, how often…'. The COHQoL questionnaire used in this investigation is the first quality-of-life measure designed specifically for children rather than modified from a scale used on adult populations (9).

The mean initial CPQ scores following severe dental injury were 31.2 for 8–10-year-olds and 29.3 for the 11–14-year-olds. The mean $CPQ_{11–14}$ scores for children with chronic conditions were the lowest ($CPQ_{11–14} = 23.3$), for dental caries, greater for those undergoing orthodontic treatment ($CPQ_{11–14} = 24.3$), and greatest for children with cleft lip and palate ($CPQ_{11–14} = 31.4$) (9). Scores obtained in this trauma study approximate values reported in children with cleft lip and palate, and exceed the values for children with dental caries or undergoing orthodontic treatment. Dental trauma CPQ scores that approach scores of children with cleft lip and palate is noteworthy. By 6 months, the mean CPQ trauma scores fell to 20.8 for the 8–10-year-olds and 20.2 for the 11–14-year-olds. This decrease in scores demonstrates the children's adaptation to their postinjury state at 6 months.

The high initial parental PPQ and FIS scores indicate a large effect on the parents' QoL following dental injury. Parents may feel guilty or may not have sufficient financial resources and this places stress on the family. Trauma is unexpected and occurs without warning. Parents are immediately thrown into a situation that involves multiple dental visits, time away from work, a financial burden, commuting, and seeing their child in pain.

Although COHQoL scores decreased for both the children and their parents at 6 months, parental scores

were still high (>60% of initial) which illustrates the persistent effects of the injury. The PPQ score for the parents of 11–14-year-olds at 6 months still approximates the reported value for parents of children with cleft lip and palate at 6 months. This comparison is most meaningful as by 6-months oral rehabilitation of severe dental injury is chronic and similar to repeated clinic visits for children with cleft lip and palate. Parents continue to feel the effects on their QoL and these effects are greater for the older age group.

Malden et al. (2008) investigated changes in parent-assessed QoL in children undergoing dental rehabilitation under general anaesthesia for severe dental caries using the COHQoL questionnaire. They reported a mean PPQ of 25.9 before treatment that dropped to 11.8 at 1–4 week follow up (19). The mean initial PPQ of both parent groups in the current study ($PPQ_{8–10}$ = 34.8 and $PPQ_{11–14}$ = 38.8) exceed the values reported by Malden et al. (19). Parents in the dental rehabilitation study reported an immediate reduction in the PPQ score that indicated the rapid improvement in their QoL after treatment. PPQ scores in this investigation remained elevated (>50% of initial) and above the postoperative scores of the Malden et al. sample 1 year after the injury.

Locker et al. (2002) reported mean FIS scores of 9.4 for the cleft lip and palate group, 7.3 for the dental caries group and 8.3 for the orthodontic group (20). In the current investigation, the mean FIS scores were 7.6 at 1 year for the younger children and 7.2 for the older group. The persistence of high mean FIS scores at 1 year indicates the impact on the family long after the accident.

Mean CPQ scores for both patient groups were similar across all time periods. This was not the case with the mean parental PPQ scores. Scores of parents of the older children indicated that they perceived a greater reduction in their QoL than the parents of the 8–10-year-old group. This greater impact on parents of the older children may be due to their children's growing independence suddenly being reversed by the need for parental intervention and supervision. Following severe dental injuries parents are again thrust back in their child's lives. Parents who are used to their child's independence now have to take them to appointments and tend to their acute needs.

The 6-month CPQ scores were not dependent upon the initial scores but 1 year scores were positively associated with initial scores. For instance, if the initial CPQ score was high, the 12-month score was also likely to be elevated. At 1 year the children were no longer as positive about their dental outcome. They may have realized by then that the lasting affects of the dental injury were complicated and would not disappear completely in the near future. For example, 1 year after the incident, some children were in pain, being teased and questioned about the effects of the injury.

The parental 6- and 12-month scores were both dependent on the initial scores. This may be because parents tend to be protective of their children and may be more anxious than their child with respect to ongoing treatment and the implications of the injury. If the initial parental score was high, it was likely that subsequent scores would also be elevated.

The one-year residual effects varied greatly between a child and parent. The children gave positive responses to items from all four domains (oral symptoms, functional limitations, emotional well-being and social well-being), but the majority of their concerns were confined to the emotional or social well-being categories. The parental responses suggest that they felt that their children were only affected in the domains of oral symptoms and functional limitations. The parents did not note any responses in either the emotional or social well-being domains. The parents' omission of these responses may be because children are better able to hide emotional or social difficulties from their families compared with physical symptoms. The children may choose not to admit to their parents that they are still bothered by the accident. This oversight of the lingering emotional/social impact may also exist because parents concentrate on the physical symptoms and are not in tune with the emotional aspects of the injury. Dentists who treat children who have suffered dental trauma have the opportunity to counsel parents with respect to these emotional aspects and facilitate discussions between child and parent. This difference in reporting symptoms supports the concept that parents should serve only as adjuncts when addressing their child's QoL, rather than the sole provider of information.

Inclusion criteria

The need for splinting was chosen as an eligibility criterion as it signals severe injury that damages both teeth and surrounding bone. The injuries represented in this sample ranged from severe luxation to avulsion. This mixed range of injuries was chosen because dental trauma is rare. A 2005 Canadian study revealed a prevalence of 18.5% for dental injuries to the permanent incisors in grade 8 school children in six Ontario communities (25). Only 6% of injured patients reported tooth damage severe enough to call for treatment, and only 80% of severely injured patients actually received care. Two recent studies measured the impact of the full range of dental trauma on the OHRQoL of Canadian school children and the aetiology of their injuries (26, 27). The incidence of dental trauma found in the sample of 2422 Canadian children aged 12–14 was 11.4%. Moreover, Fakhruddin et al. (2008) found that in subjects with evidence of previous dental injuries, over 65% of the injuries were untreated (26). Therefore, even though dental trauma is rare, treatment of these injuries is even rarer. For this reason, all dental luxations severe enough to require splinting of the maxillary anterior teeth as part of their emergency treatment were included.

Conclusions

Both age groups of children and their parents perceived the initial injury to be significantly more painful than the pain of splint removal. Patients and their parents agreed on ratings of the pain of initial injury, emergency treatment and splint removal regardless of age group, but in all cases, the pain of each subsequent procedures

was less. Parents of the older children perceived their child's pain as being greater than the pain reported by the patient, and younger children perceived the initial injury as more painful than the older group.

Children and adolescents who sustain a dental injury severe enough to warrant splinting of the maxillary anterior teeth suffer an immediate decrease in their QoL. Parents of these children also report an immediate negative effect on their QoL. This parental decrease in QoL is still present a year after the event. The 6-month mean PPQ value for the parents of 11–14-year-olds was similar to the value reported for children with cleft lip and palate (5, 20). This comparison of caregiver impact was chosen because both groups of parents and children make many more than the usual two visits a year to the dentist, Results indicate that at 1 year, children are affected mostly in the emotional or social well-being domains yet their parents exclusively reported one-year effects that were based on oral symptoms and functional limitations. This supports previous studies that state parents should not be used as proxies for children when reporting QoL, but should be used for complimentary information to the child's personal report. Results from the emotional well-being component of the COHQoL questionnaire indicate that dental trauma continues to cause emotional distress and financial difficulties for the injured child and their parent 1 year later.

Acknowledgement

SickKids Dental Trauma Research Group is supported by the Dentistry Clinical Research Fund: Rhani Ghar Grotto Endowment.

References

1. Shaw WC, Rees G, Dawe M, Charles CR. The influence of dentofacial appearance on the social attractiveness of young adults. Am J Orthod 1985;87:21–6.
2. Helm S, Krieborg 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. Patel RR, Tootla R, Inglehart MR. Does oral health affect self perceptions, parental ratings and video-based assessments of children's smiles? Community Dent Oral Epidemiol 2007;35: 44–52.
4. Lee S, McGrath C, Samman N. Quality of life in patients with dentofacial deformity: a comparison of measurement approaches. Int J Oral Maxillofac Surg 2007;36: 488–92.
5. Locker D, Jokovic A, Tompson B. Health-Related Quality of Life of Children Aged 11 to 14 Years With Orofacial Conditions. Cleft Palate Craniofac J 2005;42:260–6.
6. Nguyen P-MT, Kenny DJ, Barrett EJ. Socio-economic burden of permanent incisor replantation on children and parents. Dent Traumatol 2004;20:123–33.
7. Glendor U, Jonsson D, Halling A, Lindqvist K. Direct and indirect costs of dental trauma in Sweden: a 2-year prospective study of children and adolescents. Community Dent Oral Epidemiol 2001;29:150–60.
8. Wong FSL, Kolokotsa K. The cost of treating children and adolescents with injuries to their permanent incisors at a dental hospital in the United Kingdom. Dent Traumatol 2004;20: 327–33.
9. Jokovic A Development of an oral health outcome measure for children aged 6 to 14 years [Ph. D. dissertation]. Canada: University of Toronto (Canada); 2003. Available from: Dissertations & Theses @ University of Toronto. Accessed October 3, 2008, Publication Number: AAT NQ78338.
10. 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.
11. Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Measuring parental perceptions of child oral health-related quality of life. J Public Health Dent 2003;63:67–72.
12. Jokovic A, Locker D, Stephens M, Guyatt G. Agreement between mothers and children aged 11–14 years in rating child oral health-related quality of life. Community Dent Oral Epidemiol 2003;31:335–43.
13. Jokovic A, Locker D, Tompson B, Guyatt G. Questionnaire for measuring oral health-related quality of life in eight-to ten-year-old children. Pediatr Dent 2004;26:512–8.
14. Foster Page LA, Thomson WM, Jokovic A, Locker D. Validation of the child perceptions questionnaire (CPQ_{11-14}). J Dent Res 2005;84:649–52.
15. Jokovic A, Locker D, Guyatt G. How well do parents know their children? Implications for proxy reporting of child health-related quality of life Qual Life Res 2004;13:1297–307.
16. Shields BJ, Palermo TM, Powers JD, Grewe SD, Smith GA. Predictors of a child's ability to use a visual analogue scale. Child Care Health Dev 2003;29:281–90.
17. Shields BJ, Cohen DM, Harbeck-Weber C, Powers JD, Smith GA. Pediatric pain measurement using a visual analogue scale: a comparison of two teaching methods. Clin Pediatr 2003;42:227–34.
18. Stinson J, Kavanagh T, Yamada J, Gill N, Stevens B. Systematic review of the psychometric properties, interpretability and feasibility of self-report pain intensity measures for use in clinical trials in children and adolescents. Pain 2006;125:143–57.
19. Malden PE, Thomson WM, Jokovic A, Locker D. Changes in parent-assessed oral health-related quality of life among young children following dental treatment under general anaesthetic. Community Dent Oral Epidemiol 2008;36:108–17.
20. Locker D, Jokovic A, Stephens M, Kenny D, Tompson B, Guyatt G. Family impact of child oral and oro-facial conditions. Community Dent Oral Epidemiol 2002;30:438–48.
21. McGrath C, Pang HN, Lo ECM, King NM, Hagg U, Samman N. Translation and evaluation of a Chinese version of the Child Oral Health-related Quality of Life measure. Int J Paediat Dentistry 2008;18:267–74.
22. Versloot J, Verkamp JSJ, Hoogstraten J, Martens LC. Children's coping with pain during dental care. Community Dent Oral Epidemiol 2004;32:456–61.
23. Goodenough B, van Dongen K, Brouwer N, Abu-Saad HH, Champion GD. A comparison of the Faces Pain Scale and the Facial Attractiveness Scale for children's estimates of the intensity and unpleasantness of needle pain during blood sampling. European Journal of Pain 1999;3:301–15.
24. Goodenough B, Thomas W, Champion DG, Perrott D, Taplin JE, von Baeyer CL et al. Unraveling age effects of sex differences in needle pain: ratings of sensory intensity and unpleasantness of venipuncture pain by children and their parents. Pain 1999;80:179–90.
25. Locker D. Prevalence of traumatic dental injury in grade 8 children in six Ontario communities. Can J Public Health 2005;96:73–6.
26. Fakhruddin KS, Lawrence HP, Kenny DJ, Locker D. Impact of treated and untreated dental injuries on the quality of life of Ontario school children. Dent Traumatol 2008;24:309–13.
27. Fakhruddin KS, Lawrence HP, Kenny DJ, Locker D. Etiology and environment of dental injuries in 12- to 14-year-old Ontario schoolchildren. Dent Traumatol 2008;24:305–8.