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Evaluation of the predictors of oral health-related quality of life among 3–5-year-old children with dental trauma

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Abstract: This study evaluated the influence of socio-demographic, clinical, and parental psychological factors on oral health-related quality of life (OHRQoL) and determined their predictors in preschool-aged children with traumatic dental injury (TDI). The study sample consisted of 324 dyads of children and their parents attending the Clinics of Pediatric Dentistry at Istanbul University. After clinical examination, the Sense of Coherence (SOC), Generalized Self-Efficacy Scale, Early Childhood Oral Health Impact Scale, and Multidimensional Health Locus of Control Scale-MHLC questionnaires were administered to the parents. The statistical analyses included Spearman correlation coefficients, Mann–Whitney U tests, Kruskal–Wallis tests, multiple linear regression, and confirmatory factor analysis. Having mixed TDI, a non-nuclear family, fewer children, and weak parental SOC were important predictors of worse overall OHRQoL and its sections of child and family. Lower internal health locus of control and dental pain due to TDI were predictors of worse overall OHRQoL and child impact, respectively. Consideration of these predictors may help oral health professionals to develop prevention and treatment programs for TDI and oral health literacy programs for families.

Keywords: quality of life, oral health, preschool, dental trauma, socio-demographic

Introduction

Traumatic dental injuries (TDI) are an increasingly important public health issue.[1,2] A recent study on TDI global incidence rate and prevalence showed that children aged 1–6 years had at least one TDI to their primary teeth, corresponding to 22.7% of the world's population.[1] Recent systematic reviews and meta-analyses on quality of life in preschoolers and schoolchildren[2,3] reported the negative impact of TDIs on the oral health-related quality of life (OHRQoL) of preschool children and their families.

The identification of factors that affect parents' negative perceptions of their child's OHRQoL is important for assessing priorities. Moreover, the field of oral health must develop effective treatment strategies and

prevention programs for targeted age groups.[4,5] As a parental proxy report, the Early Childhood Oral Health Impact Scale (ECOHIS) is the most commonly used validated measure for evaluating OHRQoL in children aged 0–5 years with TDI and their families.[3,6]

Parental psychological factors such as sense of coherence (SOC) and self-efficacy affect preschoolers' use of dental services[7] and oral health outcomes.[8] Poor OHRQoL was associated with parents' perceptions of poor oral[9] and general[10] health, as well as preschool children's self-confidence;[11] however, children's OHRQoL was not associated with parental SOC and locus of control.[12]

In addition to TDI, few studies have simultaneously evaluated the impact of dental caries and malocclusion on OHRQoL in preschool children and their families. Only one study examined the impact of oral health conditions such as caries, malocclusion, and TDI on OHRQoL in a clinical sample of Turkish preschool-aged children and their parents. The study showed that TDI negatively affected the OHRQoL of this population, while dental caries and malocclusion negatively impacted the OHRQoL of their families but not the children.[13]

The identification of factors affecting children's OHRQoL may provide valuable information for oral health professionals developing and planning effective TDI prevention and treatment programs, as well as the preparation of anticipatory guidance. Thus, to determine OHRQoL predictors, the present study explored the impact of socio-demographic, clinical, and parental psychological factors and subjective parental ratings of their child's general and oral health on OHRQoL in a clinical-based sample of preschool-aged children with TDI.

Methodology

Study sample

The study sample comprised 324 dyads of children with TDI and their caregivers attending the Istanbul University Faculty of Dentistry, Clinics of Pedodontics between September 2013 and November 2017.

Daniel Soper's online statistical calculator for multiple regression analysis was used to determined a minimum required sample of 220 based on a moderate effect size of 0.15, 28 predictors, α level of 0.05, and statistical power level of 0.90.[14]

The inclusion criteria were children (of both sexes and with full primary dentition) aged 3–5 years with TDI whose parents/caregivers signed an informed consent form. The exclusion criteria were any systemic and/or neurological disease, history of any TDI treatment except for oral examinations and medications, dental pain due to dental caries, lack of cooperation during the clinical examination, and missing maxillary incisors due to caries or physiological exfoliation.

This study was conducted according to the principles of the Declaration of Helsinki and was approved by the Research Ethics Committee of the Istanbul University Faculty of Dentistry (Protocol nos: 2009/5:4 and 2014/2084-32). All parents/ caregivers received information regarding the study purpose and benefits. The study's design followed the guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[15]

Dental examinations

Three pediatric dentists (DT, DOY, and YK), who underwent training and calibration exercises lasting 5 h at each phase, performed the children's oral examinations. The calibration process was performed in a pilot study involving 30 children (who were not included in the main study) aged 3–5 years who underwent two clinical examinations. Intra-rater and inter-rater agreements were assessed using the kappa statistic (K), in which values > 0.81 indicated perfect agreement.[16] Inter-examiner agreement between the pediatric dentists and the experienced dental epidemiologist (KP) was measured in the first examination (K = 0.93–1.00 for caries, 0.80–0.87 for TDI, and 0.80–0.93 for malocclusion). After 2 weeks, the same children were re-examined for the calculation of intra-examiner agreement (K = 1.00 for caries, 0.87 for TDI, and 0.93 for malocclusion).

This study applied the World Health Organization (WHO) dental trauma classification modified by Andreasen et al.[17] Glendor et al.[189] and Neves et al.[19] classified TDI severity as uncomplicated, complicated, or mixed (both uncomplicated and complicated). Dental fractures, including pulp, periodontal tissue

injuries (luxation, subluxation, lateral luxation, extrusion, and intrusion), and avulsions were defined as complicated, whereas enamel and dentine fractures were considered uncomplicated injuries.

Malocclusion was assessed according to the criteria proposed by Foster and Hamilton: increased overbite (> 2 mm), increased overjet (> 2 mm), anterior open bite, anterior crossbite, and posterior crossbite.[20] Children with at least one of these criteria were classified as having malocclusion.

The caries status of the primary dentition was assessed using the Decayed, Missing due to caries, and Filled Teeth (DMFT) index according to criteria recommended by the WHO.[21] Dental caries was dichotomized as absent (DMFT = 0) or present (DMFT ≥ 1).

Instruments and settings

After the children underwent the oral examination, their parents completed a questionnaire in the clinic waiting room that included the socio-demographic characteristics of parents (sex, age, educational status, monthly income, number of children, and family structure) and children (age, sex, and educational status); parent-reported dental trauma (trauma duration, search for dental care following trauma, and patient referral status); parental subjective measures (ECOHIS, Generalized Self-Efficacy Scale, SOC, Multidimensional Health Locus of Control [MHLC], and parental ratings of their child's general and oral health).

Both the self-rated general health and oral health statuses were assessed using a single question on a five-point Likert scale (1 = excellent, 2 = very good, 3 = good, 4 = fair, and 5 = poor). To assess the oral health-related impacts in children aged 0–6 years and their families, we used the Turkish version of the ECOHIS.[22] This scale comprises 13 questions with a five-point Likert scale (0 = never, 1 = hardly ever, 2 = occasionally, 3 = often, 4 = very often, and 5 = do not know) and two sub-sections; the Child Impact Section (CIS; nine items) and the Family Impact Section (FIS; four items). The CIS consists of questions regarding the child's symptom(s) (one item), function (four items), psychological state (two items), and self-image/social interactions (two items), while the FIS has two domains: parent distress (two items) and family function (two items). The alpha coefficient In this sample was 0.74. The total scores ranged from 0 to 52, with higher scores indicating a more negative impact of oral health problems on the quality of life. In this study, the Cronbach's α values for the overall ECOHIS, CIS, and FIS were 0.82, 0.85, and 0.79, respectively.

The Turkish version of the 13-item SOC scale was used to assess mothers' global orientation to view the world as comprehensible, manageable, and meaningful. Items were rated on a seven-point Likert-like scale. After reversing negatively worded items, the total sum score ranged from 13 to 91, with higher scores reflecting a strong SOC.[23] The Cronbach's α value in this study, was 0.71.

The Turkish version of the Generalized Self-Efficacy Scale was used to assess mothers' general sense of perceived self-efficacy and optimistic beliefs.[24] This scale contains 10 items with a four-point Likert scale ranging from not at all true (1) to completely true (4). The alpha coefficient in this study was 0.78.

The Turkish version of Form A of the MHLC scale was used to evaluate the mothers' beliefs about self-control over health. This scale consists of 18 items with a six-point Likert response scale ranging from 'strongly disagree = 1' to 'strongly agree = 6' and three subscales: Internal-IHLC, Chance-CHLC, and Powerful others-PHLC. The Cronbach's α values in this study ranged from 0.72 to 0.84.[25]

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, EUA). Kolmogorov–Smirnov tests were used to assess data normality. Data were analyzed using descriptive statistics, Mann–Whitney U tests, and Kruskal–Wallis tests, followed by Dunn's multiple comparisons tests, Spearman's correlation coefficients, and multiple linear regression. The Spearman correlation coefficients were interpreted as follows: $r \leq 0.49$ = weak relationship, $0.50 \leq r \leq 0.74$ = moderate relationship and $r \geq 0.75$ = strong relationship.[26] The Cronbach's α value was used to assess the internal consistency of all study measures, with a value >0.70 considered acceptable.[27] Three

separate multiple regression analyses using the backward stepwise method were used to identify predictors independently associated with the scores of total ECOHIS and its sections (CIS and FIS). All variables with $p < 0.10$ in the univariate analysis were entered into multiple linear regression analysis. In each regression model, the dependent variables were the overall OHRQoL and its section scores. The R^2 statistic was used to determine the proportion of the variance explained by the predictors. Standardized β coefficients were calculated for all variables. The tolerance and variance inflation factors (VIF) were used to detect multicollinearity among the variables, in which tolerance < 0.10 and/or VIF > 10 indicated the presence of multicollinearity.[26] Confirmatory factor analyses (CFAs) were performed to test the construct validity of both the two-section structure of the ECOHIS and the three-factor structure of the MHLC scales using AMOS software version 26 (IBM Corp., Armonk, USA). As suggested by Kline,[28] four model fit statistics were used to evaluate the model fit: the ratio of chi-square to the degree of freedom (CMIN/df), the root mean squared error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). The acceptable values were CMIN/df ≤ 3,[28] RMSEA < 0.08,[29] CFI > 0.9,[30] and SRMR < 0.08.[30] The sample size of this study (n = 324) was considered adequate according to the recommendation for at least 200 participants to test the theoretical model.[31]

Results

This study selected a total of 365 child-parent pairs. Forty-one children were excluded owing to missing data in the studied scales, resulting in 324 dyads of children and their caregivers available for this study (Response rate = 89%).

Table 1 shows the sociodemographic and clinical characteristics of the parents and children included in this study. All trauma cases examined in this study were in the anterior region of both the maxilla and mandible. The most affected teeth were the right upper central incisors (42%), followed by the upper left central (36.1%), upper left lateral (11.1%), and the right upper central (42%) incisors. The least affected teeth were the canines of the maxilla and mandible. Among the children with TDI, 59% had enamel fractures, 17.6% had enamel and dentin fractures without pulp involvement, 23.1% had enamel and dentin fractures with pulp involvement, 5.9% had avulsions, and 19.8% had periodontal tissue injuries.

Table 2 shows the results of the bivariate analysis of the sociodemographic variables associated with the total, sections, and all domains of the ECOHIS. Parent age was negatively correlated with CIS scores ($r = -0.113$, $p < 0.05$) and the child function domain ($r = -0.127$, $p < 0.05$), while the scores for the total ECOHIS ($r = -0.139$, $p < 0.05$), CIS ($r = -0.164$, $p < 0.01$), its domains child function ($r = -0.176$, $p < 0.01$) and "child image" ($r=-0.124$, $p < 0.05$) were correlated with child age. Non–educated parents reported higher oral impact in the total ECOHIS ($p = 0.010$), CIS ($p = 0.008$), and child image domains ($p = 0.004$) compared to parents with higher education, whereas parents with primary ($p = 0.033$) and secondary education ($p = 0.017$) reported lower oral impact in the child image domain compared to those in parents with no education. Children living in nuclear families had lower ECOHIS scores ($p > 0.05$) except for the child symptom domain. The number of living children was negatively correlated with the scores for FIS ($r =-0.118$, $p < 0.05$) and its family function domain ($r = -0.134$, $p < 0.05$), as well as child symptoms ($r = -0.162$, $p < 0.05$) and function domains of CIS ($r = -0.111$, $p < 0.05$).

As shown in Table 3, the ECOHIS scores were significantly correlated with total ECOHIS score and self-rated oral health ($r = 0.218$; $p < 0.01$), SOC ($r = -0.324$; $p < 0.01$), IHLC ($r =-0.161$, $p < 0.05$), PHLC ($r = -0.118$; $p < 0.05$), and CHLC ($r = 0.266$; $p < 0.01$). The correlations between CIS and its domains, such as child function, child psychology, and child self-image/social interaction with parental SOC ($r = -0.299$; $p < 0.01$, $r = -0.183$; $p < 0.01$, $r =-0.163$; $p < 0.01$, $r = -0.302$; $p < 0.01$, respectively) and CHLC ($r = 0.242$; $p < 0.01$, $r = 0.125$; $p < 0.05$, $r = 0.139$; $p < 0.05$, $r = 0.277$; $p < 0.01$) were also significant. FIS and its domains, such as family stress and family function were significantly correlated with parental SOC ($r = -0.230$; $p < 0.01$, $r = -0.131$, $p < 0.05$,

Table 1. Description of study participants according to study variables.

Variable	Descriptive statistics
Parent sex (n, %)	
Female	148 (45.7)
Male	176 (54.3)
Parent age (Mean ± SD)	30.42±6.46
Parent education level (n, %)	
Non-educated	27 (8.3)
Primary education	171 (52.8)
Secondary education	102 (31.5)
Higher education	24 (7.4)
Monthly household income (n, %)	
<minimum wage	109 (33.6)
≥minimum wage	215 (66.4)
Household composition (n, %)	
Nuclear family	204 (63)
Non-nuclear family	120 (37)
Child sex (n, %)	
Female	119 (36.7)
Male	205 (63.3)
Child age (mean ± SD)	3.55±0.75
Number of children (mean ± SD)	2.72±1.24
Child's attendance at primary school (n, %)	
No	126 (38.9)
Yes	198 (61.1)
Trauma classification (n, %)	
Non-complicated	171 (52.8)
Complicated	85 (26.2)
Mixed	68 (21)
Trauma region (n, %)	
Maxilla	243 (75)
Mandible	28 (8.6)
Maxilla + mandible	53 (16.4)
Number of injured teeth in the maxilla (mean ± SD)	1.33±0.83
Number of injured teeth in the mandible (mean ± SD)	0.29±0.56
Total number of injured teeth (mean ± SD)	1.62±1.12
Trauma duration (mean ± SD)	12.04±4.65
History of dental pain (n, %)	
Yes	220 (67.9)
No	104 (32.1)
Dental caries (n, %)	
Presence	282 (87)
Absence	42 (13)

Continue

Continuation	
Malocclusion (n, %)	
Absence	141 (43.5)
Presence	183 (56.5)
Search for dental care following trauma (n, %)	
Yes	254 (78.4)
No	70 (21.6)
Patient referral status (n, %)	
Yes	206 (63.6)
No	118 (36.4)
Self-rated general health (mean ± SD)	2.48±0.88
Self-rated oral health (mean ± SD)	2.74±1.11
ECOHIS (Mean ± SD)	20.49±7.52
SOC (mean ± SD)	54.48±9.90
Generalized Self-Efficacy Scale (mean ± SD)	23.85±5.94
IHLC (mean ± SD)	16.24±4.72
PHLC (mean ± SD)	16.34±4.28
CHLC (mean ± SD)	17.52±5.29

SD: standard deviation; SOC: sense of coherence; IHLC: Internal Health Locus of Control; PHLC: powerful others' health locus of control. During the study period, the monthly minimum wage in Turkey ranged from TRY 773,01 (406 US dollars in 2013) to TRY 2.020,90 (554 US dollars in 2017).

r = -0.229; p < 0.01) and CHLC (r = 0.207; p < 0.01, 0.157; p < 0.01, r = 0.167; p < 0.01).

As shown in Table 4, separate linear regression analyses revealed that the most significant predictors of the total ECOHIS (explaining 27% of the variance), CIS (explaining 24% of the variance), and FIS (explaining 12% of the variance) were mixed dental injuries (β = 0.244, p < 0.001, β = 0.191, p = 0.001, β = 0.118, p = 0.028, respectively), being in a non-nuclear family (β = 0.250, p < 0.001, β = 0.241, p < 0.001, β = 0.151, p = 0.005, respectively), lower parental SOC (β = −0.343, p < 0.001, β = −0.309, p < 0.001, β = -0.261, p = 0.001, respectively), and lower numbers of children (β = -0.120, p = 0.013, β = -0.100, p = 0.042, β = -0.120, p = 0.023, respectively).

The CFA results supported the two-section structure of the ECOHIS and the three-factor structure of the MHLC scales. All items of the ECOHIS confirmed the latent variables in the CIS and the FIS. The CFA results for ECOHIS showed that three model fit indices were acceptable (CMIN/df = 1.717, RMSEA = 0.047, SRMR = 0.079); however, the CFI value was close to 0.9, indicating a marginal fit (CFI = 0.888). As the RMSEA is more appropriate in confirmatory contexts than CFI, the two-section structure of the ECOHIS appeared to be an acceptable fit in this study.[32] In addition, the CFA showed an acceptable fit to the three-factor structure of the MHLC scale: Form A (CMIN/df = 1.684, RMSEA = 0.052, CFI = 0.90, SRMR = 0.054) (Table 5).

Discussion

Previous studies using the ECOHIS reported the negative effects of dental trauma on OHRQoL in preschool children in both clinical[6,9] and population-based samples.[3,10,11,13,19] Only one study examined the psychometric properties of the ECOHIS and TDI on OHRQoL in preschool-aged children attending a dental trauma care program.[7]

Compared to clinical-based studies using the ECOHIS among preschool-aged children with TDI, Turkish children showed a higher impact of TDI on overall OHRQoL, CIS, and FIS.[7,9,13] Consistent with previous studies,[9,13] Turkish parents were more negatively affected by their children's OHRQoL than

Table 2. Socio-demographic factors associated with total, sections, all domains of the ECOHIS.

Variable	Total ECOHIS	CIS	Child symptom	Child function	Child psychology	Child image	FIS	Family stress	Family function
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Parent sex									
Female (n= 148)	20.56 ± 7.39	13.99 ± 5.59	1.62 ± 1.15	6.10 ± 3.11	3.20 ± 1.95	3.00 ± 1.94	6.57 ± 2.97	3.09 ± 1.87	3.47 ± 1.92
Male (n=176)	20.43 ± 7.64	13.70 ± 6.04	1.68 ± 1.08	6.15 ± 3.62	2.99 ± 1.84	2.86 ± 2.05	6.73 ± 2.92	3.38 ± 1.92	3.35 ± 1.83
p value	0.922	0.790	0.594	0.896	0.246	0.462	0.826	0.227	0.464
Parent age[b]	-0.079	-0.113*	-0.056	-0.127*	-0.036	-0.090	0.024	0.011	0.024
Parents' education level[c]									
Non-educated (n= 27) (A)	23.07±6.15	16.37±5.24	1.88±1.05	7.48±3.15	3.48±1.52	3.51±1.69	6.70±2.67	3.55±2.00	3.14±1.58
Primary education (n= 171) (B)	20.44±6.55	13.63±5.14	1.59±1.10	5.95±3.23	3.15±1.82	2.92±2.00	6.80±2.74	3.38±1.84	3.42±1.80
Secondary education (n= 102) (C)	20.91±8.68	14.17±6.74	1.66±1.17	6.31±3.63	3.12±2.09	3.06±2.08	6.73±3.14	3.08±1.96	3.64±1.97
Higher education (n= 24) (D)	16.20±8.65	10.95±5.91	1.75±1.03	5.08±3.46	2.41±1.83	1.70±1.48	5.25±3.54	2.66±1.94	2.58±2.04
p value	0.014	0.008	0.534	0.083	0.170	0.005	0.131	0.212	0.102
Group comparison (*p* value)	A and D (0.010)	A and D (0.008)				A and D (0.004) A and C (0.017) A and B (0.033)			
Monthly household income[a]									
<minimum wage (n=109)	19.95±7.39	13.42±5.88	1.50±1.13	5.91±3.45	3.13±1.96	2.86±2.19	6.53±2.81	3.31±1.92	3.22±1.82
≥minimum wage (n=215)	20.77±7.58	14.04±5.81	1.73±1.09	6.24±3.37	3.11±1.87	2.96±1.89	6.72±3.01	3.21±1.90	3.50±1.89
p value	0.431	0.431	0.092	0.457	0.816	0.457	0.742	0.804	0.212
Household composition[a]									
Nuclear family (n=204)	19.04±8.24	12.75±6.21	1.58±1.12	5.64±3.44	2.91±1.94	2.60±2.00	6.28±3.15	3.07±1.97	3.21±1.92
Non-nuclear family (n=120)	22.96±5.26	15.67±4.61	1.76±1.09	6.96±3.15	3.46±1.78	3.47±1.87	7.29±2.42	3.55±1.74	3.74±1.74
p value	<0.001	<0.001	0.129	<0.001	0.015	<0.001	0.003	0.020	0.017
Child sex[a]									
Female (n= 119)	20.78 ± 7.24	14.18 ± 5.85	1.68 ± 1.14	6.26 ± 3.45	3.29 ± 1.88	2.94 ± 1.86	6.60 ± 2.86	3.11 ± 1.85	3.48 ± 1.82
Male (n=205)	20.32 ± 7.69	13.63 ± 5.83	1.63 ± 1.09	6.05 ± 3.37	3.01 ± 1.90	2.92 ± 2.08	6.69 ± 2.99	3.32 ± 1.93	3.36 ± 1.90
p value	0.874	0.562	0.505	0.708	0.205	0.832	0.705	0.296	0.545
Child age[b]	-0.139*	-0.164**	0.054	-0.176**	-0.108	-0.124*	-0.037	0.011	-0.048
Number of children[b]	-0.105	-0.099	-0.162*	-0.111*	-0.036	-0.070	-0.118*	-0.079	-0.134*
Child's attendance at primary school[a]									
No (n= 126)	19.85 ± 8.15	13.40 ± 6.49	1.64 ± 1.16	5.84 ± 3.66	3.08 ± 2.09	2.82 ± 2.02	6.45 ± 3.05	3.22 ± 1.93	3.23 ± 1.97
Yes (n= 198)	20.90 ± 7.08	14.11 ± 5.37	1.66 ± 1.08	6.31 ± 3.21	3.14 ± 1.76	2.99 ± 1.99	6.79 ± 2.87	3.26 ± 1.89	3.52 ± 1.80
p value	0.138	0.138	0.745	0.164	0.556	0.448	0.223	0.751	0.195

ECOHIS: Early Childhood Oral Health Impact Scale, SD: standard deviation. [a]Statistical evaluation by Mann–Whitney U test; [b]Statistical evaluation by Spearman's correlation coefficient; [c] Kruskal–Wallis test followed by Dunn's multiple comparisons test. CIS: Child Impact section; FIS: Family Impact Section.

Table 3. Clinical, psychological, and health care-related factors associated with total, sections, and all domains of the ECOHIS.

Variable	Total ECOHIS	CIS	Child symptom	Child function	Child psychology	Child image	FIS	Family stress	Family function
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Trauma classification[c]									
Non-complicated (n = 171) (A)	18.91±8.01	12.68±6.13	1.64±1.14	5.52±3.39	2.92±1.86	2.58±1.98	6.22±3.11	3.16±2.01	3.06±1.84
Complicated (n = 85)(B)	23.97±6.56	16.58±4.88	1.78±1.08	7.80±3.08	3.42±1.87	3.57±1.89	7.38±2.79	3.55±1.80	3.83±1.95
Mixed (n= 68) (C)	20.13±5.82	13.29±5.06	1.50±1.07	5.58±3.12	3.22±1.97	2.98±1.98	6.83±2.49	3.08±1.74	3.75±1.70
p-value	0.000	0.000	0.361	0.000	0.220	0.001	0.018	0.438	0.003
Group comparison (p-value)	A and C (<0.001)	A and C (<0.001)		A and C (<0.001)		A and C (0.001)	A and C (0.016)		A and B (0.009)
	B and C (0.002)	B and C (0.001)		B and C (<0.001)					A and C (0.007)
Trauma region[c]									
Maxilla (n = 243)	20.93±7.43	14.23±5.71	1.67±1.11	6.25±3.41	3.25±1.88	3.05±2.04	6.69±2.95	3.27±1.92	3.42±1.84
Mandible (n = 28)	20.03±5.29	13.03±5.00	1.53±1.10	5.92±3.25	2.67±1.82	2.89±1.64	7.00±1.98	3.25±1.75	3.75±1.73
Maxilla + mandible (n = 53)	18.73±8.68	12.43±6.61	1.64±1.12	5.67±3.40	2.73±1.96	2.37±1.89	6.30±3.32	3.15±1.94	3.15±2.06
p value	0.209	0.121	0.880	0.642	0.087	0.091	0.630	0.986	0.294
Number of injured teeth in the maxilla[b]	-0.056	-0.025	0.001	-0.016	-0.017	-0.109	-0.102	-0.039	-0.118*
Number of injured teeth in the mandible[b]	-0.095	-0.107	-0.023	-0.047	-0.111*	-0.097	-0.034	-0.004	-0.029
Total number of injured teeth[b]	-0.096	-0.079	-0.007	-0.036	-0.079	-0.148**	-0.101	-0.033	-0.114*
Trauma duration [b]	-0.063	-0.058	-0.053	-0.018	-0.070	-0.064	-0.086	-0.017	-0.161*
History of dental pain[a]									
Yes (n = 220)	21.01 ± 7.58	14.37 ± 5.88	1.73 ± 1.15	6.47 ± 3.41	3.13 ± 1.89	3.03 ± 2.03	6.70 ± 3.09	3.39 ± 2.03	3.45 ± 1.86
No (n = 104)	19.40 ± 7.30	12.70 ± 5.60	1.49 ± 1.01	5.41 ±3.25	3.08 ±1.91	2.71 ±1.92	6.64 ±2.87	3.18 ±1.84	3.30 ±1.90
p-value	0.092	0.018	0.087	0.011	0.801	0.200	0.683	0.501	0.477
Dental caries[a]									
Presence(n = 282)	21.16 ± 7.26	14.29 ± 5.71	1.63 ± 1.13	6.35 ± 3.35	3.19 ± 1.91	3.10 ± 1.95	6.87 ± 2.85	3.31 ± 1.89	3.56 ± 1.82
Absence (n = 42)	16.00 ± 7.77	10.78 ± 5.82	1.78 ± 0.97	4.61 ±3.35	2.61 ±1.75	1.76 ±1.94	5.21 ±3.17	2.80 ±1.92	2.40 ±1.90
p-value	0.000	0.000	0.446	0.003	0.094	0.000	0.001	0.115	0.000
Malocclusion[a]									
Absence(n = 141)	20.12 ± 7.92	13.55 ± 6.11	1.66 ± 1.10	5.81± 3.38	3.14± 1.95	2.92± 2.14	6.56± 2.90	3.23± 1.83	3.33± 1.86
Presence(n = 183)	20.78 ± 7.20	14.05 ± 5.62	1.64 ± 1.12	6.37 ± 3.39	3.09 ± 1.86	2.93 ± 1.88	6.73 ± 2.98	3.26 ± 1.96	3.46 ± 1.88
p-value	0.347	0.482	0.928	0.207	0.836	0.782	0.505	0.993	0.503

Continue

Continuation

Search for dental care following trauma[a]									
Yes (n = 254)	20.64 ± 7.42	13.87 ± 5.81	1.68 ± 1.10	6.12 ± 3.43	3.18 ± 1.90	2.87 ± 1.99	6.67 ± 2.89	3.27 ± 1.87	3.48 ± 1.87
No (n = 70)	19.95 ± 7.89	13.68 ± 5.95	1.52 ± 1.13	6.15 ± 3.28	2.88 ± 1.86	3.11 ± 2.03	6.27 ± 3.10	3.14 ± 2.01	3.12 ± 1.86
p-value	0.677	0.876	0.233	0.953	0.263	0.390	0.234	0.553	0.165
Patient referral status[a]									
Yes (n = 206)	20.44 ± 7.48	13.72 ± 5.84	1.69 ± 1.11	6.18 ± 3.49	3.01 ± 1.82	2.82 ± 1.93	6.71 ± 2.90	3.35 ± 1.87	3.35 ± 1.75
No (n = 118)	20.58 ± 7.61	14.02 ± 5.84	1.57 ± 1.12	6.03 ± 3.22	3.30 ± 2.01	3.11 ± 2.11	6.55 ± 3.02	3.05 ± 1.94	3.50 ± 2.07
p-value	0.678	0.430	0.364	0.928	0.251	0.333	0.480	0.179	0.666
Self-rated general health [b]	0.058	0.028	-0.046	0.028	0.008	0.095	0.094	-0.004	0.156*
Self-rated oral health[b]	0.218**	0.204**	0.025	0.216**	0.047	0.165**	0.137*	0.010	0.185**
Self-efficacy[b]	-0.013	-0.022	0.043	-0.062	0.045	-0.008	-0.003	-0.003	0.032
SOC[b]	-0324**	-0.299**	-0.084	-0.183**	-0.163**	-0.302**	-0.230**	-0.131*	-0.229**
IHLC[b]	-0.161*	-0.140*	-0.012	-0.107	-0.096	-0.178**	-0.158**	-0.097	-0.160**
PHLC[b]	-0.118*	-0.113*	-0.047	-0.057	-0.071	-0.147**	-0.097	-0.036	-0.115*
CHLC[b]	0.266**	0.242**	0.038	0.125*	0.139*	0.277**	0.207**	0.157**	0.167**

SD: standard deviation. [a]Statistical evaluation by Mann–Whitney U test; [b]Statistical evaluation by Spearman's correlation coefficient; [c] Kruskal–Wallis test followed by Dunn's multiple comparisons test was used. CIS, child impact section; FIS, family impact section; SOC, sense of coherence; IHLC, internal health locus of control; PHLC, powerful others' health locus of control.

Table 4. Separate multiple linear regression analyses: ECOHIS, CIS and FIC as dependent variables.

Variable	B	SE	β	p-value
ECOHIS				
Low SOC[a]	-0.256	0.052	-0.343	< 0.001
Having a low IHLC[a]	-0.381	0.188	-0.243	0.044
Mixed dental injuries[b]	4.087	0.818	0.244	< 0.001
Non-nuclear family[b]	3.816	0.739	0.250	< 0.001
Lower numbers of children[a]	-0.714	0.287	-0.120	0.013
CIS				
Having a low SOC[a]	-0.179	0.041	-0.309	< 0.001
Having mixed dental injuries[b]	2.485	0.726	0.191	0.001
Non-nuclear family[b]	2.859	0.585	0.241	< 0.001
Lower numbers of children[a]	-0.463	0.227	-0.100	0.042
History of dental pain caused by TDIs [b]	-1.297	0.647	-0.105	0.046
FIS				
Low SOC[a]	-0.077	0.023	-0.261	0.001
Mixed dental injuries [b]	0.780	0.354	0.118	0.028
Non-nuclear family [b]	0.914	0.320	0.151	0.005
Lower numbers of children[a]	-0.283	0.124	-0.120	0.023

B: non-standardized regression coefficient; SE: standard error; β: standardized regression coefficient; TDIs: traumatic dental injuries; ECOHIS: Early Childhood Oral Health Impact Scale; CIS: child impact section; FIS: family impact section; SOC: sense of coherence; IHLC: internal health locus of control.
[a]Continuous variables: SOC, IHLC, and number of children. [b]Dichotomized variables: mixed *dental injuries* (1 = yes vs. 0 = no), a non-nuclear family (1 = yes vs. 0 = no), history of dental pain caused by TDIs (0 = yes vs. 1= no).

Table 5. Goodness of fit indices from confirmatory factor analyses of ECOHIS and MHLC scale-A form (n = 324).

Goodness of fit statistic	Acceptable fit	ECOHIS value	MHLC scale - A form value
CMIN/df	≤ 3	1.717	1.684
RMSEA	< 0.08	0.047	0.052
CFI	> 0.9	0.888	0.90
SRMR	< 0.08	0.079	0.054

CMIN/df: ratio of chi-square to the degree of freedom; RMSEA: root mean squared error of approximation; CFI: comparative fit index; SRMR: standardized root mean square residual; ECOHIS: Early Childhood Oral Health Impact Scale.

the children and items related to pain, frustration, eating, sleeping, and drinking. However, contrary to previous studies, FIS domains were mostly affected by the 'impact on financial situation of the family' and 'taking time off from work'. In our clinic, parents paid out-of-pocket for dental treatments not covered by universal health insurance. More appointments and longer waiting times may lead to problems in the parents' work and lives.

This is the first study to evaluate the effect of TDI on the OHRQoL of preschool-aged children and their parents' perceptions, which were measured using large parental psychological factors (*e.g.*, SOC, MHLC, and self-efficacy). In this study, parents with higher SOC, IHLC, and PHLC scores reported less oral impact on the overall OHRQoL and its child and family sections, whereas those with higher CHLC scores felt more impact. This result is not surprising because parental SOC, IHLC, and PHLC, which are considered protective factors, affect both the child's oral behavior and clinical status.[7,33]

The Cronbach's α values for all measures used in this study, > 0.70, indicated good internal reliability. The factor structure of the health locus of control and health-related quality of life measures was affected by some socio-demographic characteristics of the study sample (*e.g.*, age, education level), life experiences, and cultural beliefs.[34,35] Thus, CFA to test whether the MHLC scale–A form and ECOHIS were replicated in this study sample and fit the theoretical structure of these scales[35] showed that the two-section structure of the ECOHIS and the three-factor structure of the MHLC scale-A form were replicated in the study sample of 324 parents.

The results of the multivariate analysis showed that mixed dental injuries, living in a non-nuclear family, lower numbers of children, and weak parental SOC were predictors of a significant effect on the overall OHRQoL and its child and family sections. Moreover, lower IHLC and history of dental pain caused by TDI were predictors of worse overall OHRQoL and its child impact section, respectively. Higher SOC and IHLC were protective factors for better OHRQoL; thus, they should be considered when assessing the educational and motivational requirements of parents in developing anticipatory guidance brochures and practices.[36,37]

The last national survey on children's oral health conditions reported a high caries prevalence in Turkish children with TDI.[38] Children with TDI and caries experienced more oral effects due to limited oral function, self-image, and family functions. However, after controlling for the effect of possible confounding factors, dental caries was not predictive of OHRQoL in children with TDI. Moreover, the presence of malocclusion was not predictive of OHRQoL in children. Dental caries was associated with worse OHRQoL,[5,9,10,13] whereas malocclusion was not.[5,13]

Studies applying the ECOHIS in preschool-aged children with TDI reported that the results could be explained by the level of dental injuries. Complicated TDIs tend to more negatively impact the OHRQoL of preschoolers due to the life-limiting constraints imposed by such injuries.[39-41] Children with mixed TDI showed a more negative impact on oral and family functioning of OHRQoL compared to those with non-complicated and complicated TDIs. In mixed TDI; that is, the presence of both complicated and uncomplicated dental trauma in the same mouth, injury to multiple teeth is likely. A larger number of injured teeth may indicate greater injury or greater negative aesthetic impact. Neves et al.[19] reported similar results in children; however, the number of traumatized teeth did not affect parental perceptions. In contrast, in the present study, mixed TDI was an important predictor of overall OHRQoL and in both CIS and FIS. In addition, the parents of children with non-complicated TDI had more positive feelings about their child's physical appearance and more social interactions compared to those with children with mixed TDI. This may be explained by low self-esteem and self-confidence in children with TDI and their parents owing to their aesthetic appearance and in42[44] the findings of the present study underscore the importance of factors related to the parental home environment on children's OHRQoL. Children from non-nuclear families had worse OHRQoL, which may be related to limited access and utilization of oral health services due to inadequate economic circumstances. Moreover, an increasing number of children in the family can reduce family time caring for children and parental ratings of their children's oral health.[43,44]

To our knowledge, few studies have investigated parents' qualifications, attitudes, knowledge, and beliefs.[45,46] Thus, evidence of the relationship between parental SOC and OHRQoL is limited. Individuals with a strong SOC may be more likely to lead a healthy lifestyle and respond to health-related advice compared to those with a weaker SOC. A 2014 study reported that mothers with strong SOCs were better able to cope with stressors directly related to their children's OHRQoL.[47] Other studies observed that a strong parental SOC was predictive of children's healthy oral habits, more frequent visits to the dentist, better oral condition, and lower levels of dental caries; thus, SOC also affects OHRQoL.[48-50] In our study, poor parental SOC was an important predictor of overall OHRQoL and had a large impact on child and family segments, contrary to the findings in other studies that parental SOC did not affect OHRQoL.[46]

This study had several limitations. Socio-cultural and socio-economic differences in cosmopolitan

cities limited the generalizability of the findings and conclusions. Thus, future multicenter studies are warranted to confirm our findings. The cross-sectional study design could not identify the causal relationships and modifications in the OHRQoL of children over time. Longitudinal studies are needed to determine these potential changes and the relationships between changes in OHRQoL, clinical status, and individual and contextual characteristics. The strengths of this study include its use of validated and reliable measures to assess the psychological aspects of parents. Despite the limitations, this study's findings may provide clinicians with beneficial information regarding the factors influencing OHRQoL in preschool-aged children with TDI to prepare anticipatory guidance regarding the prevention and treatment of dental trauma and developing oral health literacy programs for families.

Conclusions

In the present study, mixed TDI, non-nuclear family, fewer children, and weak parental SOC were important predictors of worse overall OHRQoL and its sections related to child and family. Moreover, lower internal health locus of control and dental pain caused by TDI were predictors of worse overall OHRQoL and child impact, respectively. These predictors may help oral health professionals to develop TDI prevention and treatment programs and oral health literacy programs for families.

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