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Evaluation of the effect of dental caries, oral hygiene, and treatment need on oral health-related quality of life among Turkish orphan children and adolescents

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Abstract

Background The oral and dental health and related quality of life of orphan children and adolescents—who are considered a vulnerable population—are critical for both individual and public health.

Objectives This study aimed to investigate the status of the dental caries, oral hygiene, and dental treatment needs among a group of Turkish male orphan children and adolescents, as well as their impact on oral health-related quality of life.

Methods A total of 112 orphan children and adolescents aged between 9 and 17 years living in a residential care facility in Istanbul, Türkiye, were involved in this cross-sectional study. A comprehensive examination was conducted on each individual, encompassing the assessment of dental caries using the decayed, missing, and filled teeth (DMFT/dft) index, oral hygiene using the debris (DI-S), calculus (CI-S), and simplified oral hygiene (OHI-S) indices, and dental treatment need using the treatment need index (TNI). Oral health-related quality of life was evaluated using the validated Turkish version of the Child Oral Health Impact Profile-Short Form (COHIP-SF-19). The relationship between oral health-related quality of life and explanatory variables was evaluated using a multivariable linear regression model.

Results The mean age of the participants was 12 ± 1.79 years. The mean DMFT score was 4.57 ± 3.42 , and the mean OHI-S score was 1.4 ± 0.52 . Participants had a mean COHIP-SF-19 score of 57.79 ± 14.11 , with 25% requiring at least one tooth to undergo radical treatment. Multivariable linear regression analysis indicated that the DMFT score ($p = 0.009$) and the need for radical treatment (TNI code 6) ($p < 0.001$) had a statistically significant impact on oral health-related quality of life among orphan children and adolescents aged 13–17.

Conclusions This study underscores that dental caries and the need for radical treatment significantly impact the oral health-related quality of life of orphan children and adolescents.

Keywords Children, Dental caries, OHRQoL, Oral health, Oral health-related quality of life, Oral hygiene, Orphan, Orphanage, QoL, Quality of life, Treatment need, Vulnerable population

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Background

The prevalence of orphan children and adolescents living in residential care facilities worldwide is estimated to be approximately 105 per 100,000, reflecting a significant demographic within global child welfare systems [1]. The integration of these populations, who are unable to reside with their biological families is paramount for societal well-being in the foreseeable future. Ensuring adequate care and support for these children is of the utmost importance [2, 3]. The responsibilities and approaches of countries in regulating the well-being of children living in residential care institutions generally stem from principles of child and human rights, and international standards. These institutions establish regulations to ensure the safety, health, education, and emotional well-being of the children. While some countries promote family-based care, others focus on improving and enhancing the quality of institutional care. National policies and programs are developed to protect children, meet their needs, and foster an inclusive environment for their upbringing [4, 5]. The regulation of children's welfare in Türkiye is governed by several legislative frameworks, including the International Convention on the Rights of the Child, Law No. 2828 on Social Services and Child Protection Institution, and Law No. 5395 on Child Protection [6, 7].

Children and adolescents living in residential care facilities face distinct challenges, notably barriers to accessing healthcare services, which may result in neglecting their fundamental health needs [8, 9]. Previous research indicates that children and adolescents placed in residential care or juvenile detention facilities, exhibit more severe health issues than their peers [10, 11]. Individuals with a history of living in residential care facilities are reported to be up to four times more likely to experience poor health outcomes in adulthood compared to those raised by their biological parents [10]. In addition, regardless of the reasons for residing in residential care facilities, orphan children and adolescents exhibit significantly higher rates of psychiatric or psychological problems and associated medication use compared to their non-orphan peers. The adverse impact of these issues on quality of life has been documented, with the quality of life of those affected being found to be lower [12]. The disparities extend to oral health for children and adolescents in residential care, who have poorer oral health compared to their peers [13]. This disparity can be attributed to various factors, including a history of neglect within their birth families, challenges in accessing healthcare services, and personal neglect of health [14]. Moreover, it is crucial to assess and enhance the physical and mental well-being as well as the personal care development of children within social services and child protection institutions [15, 16].

Oral health is of significant importance to an individual's overall well-being and quality of life, and affects various aspects, including physical health, social interactions, and self-assurance [17, 18]. Particularly among vulnerable children and adolescents residing in challenging conditions, dental issues can exacerbate psychological effects such as shame, social isolation, and diminished self-esteem [19]. Despite the critical insights provided by the Global Oral Health Status Report 2022, there is still a need to evaluate the oral health status and utilization of dental services among vulnerable populations [20, 21]. Oral diseases, as widespread noncommunicable conditions, impact nearly 45% of the global population throughout their life course, particularly affecting vulnerable and marginalized groups [21]. It is crucial to evaluate the oral health status and oral hygiene practices of children and adolescents in residential care, considering the profound and cumulative impact of oral health on their quality of life [22].

Oral and dental health of orphan children and adolescents is considered a global problem due to changes in various child protection policies across countries. Higher prevalence of dental caries and worse dental caries experience have been reported in orphan children compared to their parented peers [23]. Studies have also shown that oral mucosal lesions are more common in orphan children due to poorer oral hygiene practices [24]. Effective preventive and therapeutic oral health strategies should be developed and implemented to enhance the oral health and quality of life of orphan children and adolescents residing in residential care facilities [23–25].

Identifying the oral health needs of children and adolescents in residential care settings is crucial for improving their oral health outcomes [13]. These vulnerable populations often face unique challenges, and addressing their specific needs can lead to better overall health and well-being. Although studies exist in the literature that separately evaluate the oral health and quality of life of orphan children and adolescent living in residential care facilities, no study has comprehensively assessed their oral health and its relationship to oral health-related quality of life (OHRQoL). Therefore, this study aimed to evaluate the status of dental caries, oral hygiene, and treatment needs in orphan children and adolescents in a residential care facility in Istanbul, Türkiye, and assess the effect on OHRQoL. The null hypothesis of the study was that dental caries, oral hygiene, and treatment needs had no effect on OHRQoL in orphan children and adolescents.

Methods

Ethical approval and consent

This study was conducted following the principles outlined in the Helsinki Declaration and its subsequent

amendments. Ethical approval for the study was received from the Clinical Research Ethics Committee of the School of Dentistry, Marmara University, on 27.12.2023, with protocol number 08.12.2023.1763. All necessary written permissions regarding the study were obtained from the institution where the study was conducted and all related official authorities. Details about the study were explained to the participants verbally and in an appropriate language by the researchers. Subsequently, those who consented to participate in the study were requested to read and sign the consent forms, which provided detailed information about the study. In addition, consent for participation was obtained from the responsible legal guardians of orphan children and adolescents in the residential care facility.

Sample size calculation

The sample size was calculated using the G*Power statistical software (version 3.1.9.7, Universitat Kiel, Kiel, Germany). Based on the data reported by Khattab et al. [23], which demonstrated that the total DMFT scores were 0.75 ± 1.29 for non-orphan children compared to 1.80 ± 2.54 for institutionalized orphan children ($p=0.025$), a minimum total sample size of 108 was determined to be sufficient. This calculation was performed to achieve a statistical power of 85%, with a significance level (α) of 0.05 and an effect size of 0.5212443.

Study population

A total of 112 Turkish male orphan children and adolescents, aged between 9 and 17 years, living in the same and single residential care facility in Istanbul, Türkiye, affiliated with Ministry of Family and Social Services of Republic of Türkiye, were included in this cross-sectional study. Children and adolescents who did not provide informed consent to participate in the study or failed to cooperate during the intraoral examination were excluded from the study.

In Türkiye, the residential social service model is implemented within each province's social, cultural, and physical context, as well as in regions suitable for child-rearing, to ensure that children and adolescents under protection are cared for in smaller, more supportive units. The main aims of this model are to ensure that orphan children and adolescents under protection learn concepts such as friendship and neighborhood, understand the requirements of life in society, and become self-confident individuals who can look to the future with hope. Accordingly, children and adolescents who spend their lives as boarders in these institutions consume similar meals in the same institution. Educational processes are coordinated by various trainers and caregivers, with necessary support provided as needed. Institution officials coordinate with other authorities to meet

the psychological, physiological, and sociological needs of the children. Caregivers, nurses, and other staff are responsible for controlling and supporting children in matters such as brushing their teeth, determining their treatment needs, personal hygiene, and nutrition [26].

Data collection

After obtaining the necessary permissions, the residential care facility administration was informed about the date of the visit one week in advance. The facility administration provided preliminary information to orphan children and adolescents. On the day of the visit, all orphan children and adolescents living in the facility were invited to the institution's meeting hall. In this hall, the researchers provided information about the study to the participants with a visual presentation. During this presentation, explanations were made to the participants in a style appropriate to their ages and sociological conditions. Questions from the participants regarding the study were collected and answered. The children and adolescents who agreed to participate in the study were examined intraorally in a mobile examination section set up in a separate part of the meeting hall. The sociodemographic information of the participants and the findings from the intraoral examination were recorded on pre-designed forms. A validated questionnaire assessing OHRQoL was administered to participants following the completion of their intraoral examinations. After expressing gratitude to the participants, information regarding diagnosed systemic diseases and medications for the orphan children and adolescents was obtained from the responsible nurses and documented in the participant files.

Intraoral examination

Two pediatric dentists (N.A. and N.H.) conducted the intraoral examinations. Prior to the study, a calibration process was carried out to ensure consistency in diagnoses. Fifteen children and adolescents, who were not included in the study, were examined twice by both researchers under identical conditions, with a one-month interval between examinations. During the calibration, one of the researchers acted as the gold standard to provide a reference for consistency in diagnoses. Cohen's kappa statistics were calculated to assess inter- and intra-examiner reliability for dental caries diagnosis, oral hygiene assessment, and evaluation of treatment need. The results demonstrated strong agreement, with kappa values exceeding 0.8 for inter- and intra-examiner reliability.

A common flat-surface mouth mirror (#5) was used for visual diagnosis during intraoral examinations. Standard dental probe #PCP11 was used for tactile inspection, and standard periodontal probe #PCPUNC15 with

a millimeter scale was used for periodontal and gingival assessments.

Dental caries evaluation was conducted utilizing the decayed, missing, and filled teeth (DMFT/dft) index, with the dft index applied to primary dentition and the DMFT index to permanent dentition. Within these indices, a tooth is classified as carious (D/d component) if a cavity is visibly present, including untreated dental caries. The missing (M component) category encompasses teeth with extraction indications or those removed due to dental caries, while the filled (F/f component) category includes teeth restored due to dental caries. The DMFT/dft index is recommended by the World Health Organisation (WHO) and is widely used in population-based, cohort, and cross-sectional studies due to its simplicity, validity, reliability, ease of use, and statistical utility [27, 28]. Following the dental caries examination, a restorative care index and an unmet treatment needs index were calculated for each participant [23]. The Restorative Care Index was calculated using the formula $[F / (D + M + F)] \times 100$, representing the proportion of restored teeth relative to the total number of decayed, missing, and filled teeth. The Unmet Treatment Needs Index was calculated using the formula $[D / (D + F)] \times 100$, indicating the proportion of untreated decayed teeth relative to the total number of decayed and filled teeth.

Participants' oral hygiene was assessed using the Simplified Oral Hygiene Index (OHI-S), which is calculated by combining the Simplified Debris Index (DI-S) and the Simplified Calculus Index (CI-S). To determine the OHI-S, six surfaces were inspected, chosen from four posterior teeth and two anterior teeth (for primary dentition: buccal surfaces of teeth: #54, #61, and #64, lingual surfaces of teeth #82, #75, and #85; for permanent dentition: buccal surfaces of teeth #11, #16, #26, and #31, lingual surfaces of teeth #36 and #46). Score 0 means "no debris or stain present" for DI-S and "no calculus present" for CI-S. Score 1 means "soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered" for DI-S and "supragingival calculus covering not more than one-third of the exposed tooth" for CI-S. Score 2 means "soft debris covering more than one third, but no more than two third, of the exposed tooth surface" for DI-S and "supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth" for CI-S. And, score 3 means "soft debris covering more than two thirds of the exposed tooth surface" for DI-S and "supragingival calculus covering more than two-thirds of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth" for CI-S. The cumulative values

from the scoring of debris and calculus on the buccal and lingual/palatal surfaces of selected teeth are averaged by dividing by the total number of surfaces scored. This calculation gives the subject's DI-S and CI-S scores. Oral hygiene status is represented by the OHI-S score, calculated as summary of the DI-S and CI-S scores. A decrease in the OHI-S score indicates improved oral hygiene [29].

The Treatment Need Index (TNI), which identifies the realistic treatment requirements independent of the underlying cause (dental caries, trauma, and/or periodontal disease) was employed to evaluate dental treatment needs. TNI offers valuable insights that inform oral health planning. The index identifies seven fundamental levels of treatment. Code 0 means "no treatment needed", code 1 means "preventive treatment (topical fluoride applications etc.) needed", code 2 means "fissure sealants needed", code 3 means "initial conservative restorations (one-surface restorations, preventive resin restorations etc.) needed", code 4 means "moderate conservative restorations (one or two-surface restorations etc.) needed", code 5 means "advanced conservative restorations (three or more-surface restorations, stainless steel crowns etc.) needed", and code 6 means "radical treatment (endodontic, prosthetic, and/or surgical methods etc.) needed". In this index, the number and percentage of teeth in each category are recorded for each participant [30].

Measurement of oral health related quality of life

In the current study, the Child Oral Health Impact Profile-Short Form (COHIP-SF-19) questionnaire, comprising 19 questions, was employed to assess the OHRQoL of the orphan children and adolescents. The validity and reliability of the COHIP-SF-19 were assessed specifically for the age group of the study participants and adapted for the Turkish language [31].

The questionnaire efficiently assesses the child's overall OHRQoL across three domains: oral health, functional well-being, and socio-emotional well-being, school environment, and self image. Oral health domain is a section where various oral health symptoms (toothache, tooth discoloration, etc.) that are not necessarily related to each other are scored. Functional well-being domain includes items related to the child's ability to perform specific tasks and activities related to the mouth (speaking, chewing, etc.). Socio-emotional well-being, school environment, and self-image domain includes statements that evaluate the child's peer interactions, mood state, factors related to the school environment, and positive feelings about oneself [32]. Participants were asked to evaluate the items using a five-point Likert scale with numerical values: 0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = almost all the time. Negative questions (first 17 questions) are reverse scored: 0 to 4, 1 to 3, 2 to 2, 3 to 1, and 4 to 0. After re-coding, the maximum of

score is 76, indicating a higher quality of life in the context of oral health [32, 33].

Statistical analysis

The demographic, health-related, dental, and OHRQoL-related data collected from the participants were recorded in Microsoft Excel 2016 (Microsoft, Redmond, WA, USA). The statistical analysis of the data was conducted using the Statistical Package for the Social Sciences (SPSS Version 25.0, IBM Corp., Chicago, IL, USA). Normality of variables was assessed using the Shapiro-Wilk test and homogeneity of variance was assessed using the Levene test. Quantitative data are presented as mean \pm standard deviation, median, and minimum and maximum values. ANOVA (Analysis of Variance) test was used to compare three or more independent groups with normal distribution and Kruskal Wallis test was used for data without normal distribution. Post hoc Bonferroni tests, including the Bonferroni correction, were performed to identify the group or groups responsible for the differences. The relationships between variables

exhibiting non-normal distribution were assessed using the Spearman's rank correlation coefficient. Kendall's Tau Correlation was used to examine the relationships between ordinal and continuous measurements. For detailed analyses, participants were divided into two groups as 9–12 years old and 13–17 years old to define late mixed dentition and permanent dentition. A step-wise multivariate linear regression analysis was used to examine the impact of clinical characteristics of participants aged 13–17 on their total COHIP-SF-19 scores. $p < 0.05$ was considered statistically significant.

Results

Demographic and health-related data, and descriptive values of oral health parameters of the study population are presented in Table 1. A total of 112 male orphan children and adolescents, 52 between the ages of 9–12 (mean age: 11.01 ± 0.92) and 60 between the ages of 13–17 (mean age: 14.32 ± 1.21), were included in this cross-sectional study. The majority of participants (84.8%) did not have any systemic diseases, allergies, and/or systemic anomalies. While 58.9% of the participants were using medication for attention deficit and hyperactivity disorder, 21.4% were using antidepressant derivatives. No significant difference was observed in COHIP-SF-19 scores between individuals using and not using medications ($p > 0.05$). There were no statistically significant differences in medication usage and presence of systemic disease among different age groups ($p > 0.05$). For all participants, the mean DMFT score was 4.57 ± 3.42 , the mean dft score was 0.86 ± 1.9 , and the mean OHI-S score was 1.4 ± 0.52 . In the 9–12 age group, the mean dft score was 1.83 ± 2.49 , the mean DMFT score was 2.87 ± 1.98 , and the mean OHI-S score was 1.40 ± 0.58 . In the 13–17 age group, the mean DMFT score was 6.1 ± 3.8 , and the mean OHI-S score was 1.39 ± 0.47 . 25% of the all participants needed radical treatment, including pulp therapy, prosthetic restorations, and/or extractions (TNI Code 6).

In the 9–12 age group, the restorative care index for primary dentition was 5.24% and for permanent dentition was 8.94%. In the 13–17 age group, the restorative care index was 9.32%. In the 9–12 age group, the unmet restorative treatment index for primary dentition was 42.84% and for permanent dentition was 73.52%. In the 13–17 age group, the unmet restorative treatment index was 82.18%.

When the OHRQoL of the participants evaluated using COHIP-SF-19 was examined separately, the mean score of the all participants for the oral health subscale was 13.28 ± 4.49 . The mean score of the participants for the functional well-being subscale was 13.46 ± 2.78 , while it was 31.05 ± 8.44 for the socio-emotional well-being, school environment, and self-image subscale. The mean COHIP-SF-19 score of the population included in

Table 1 Demographic and health-related characteristics of study population

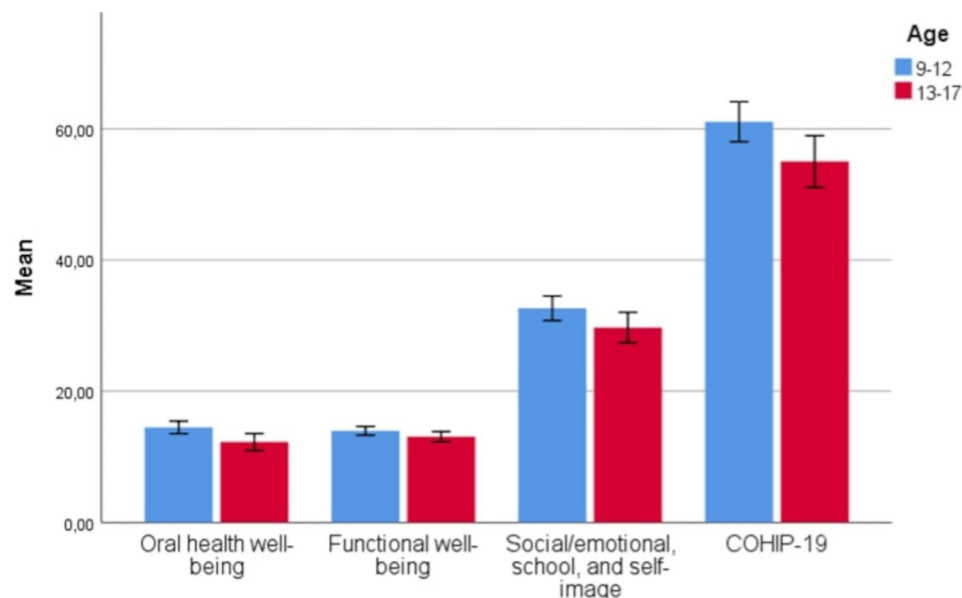
		Mean \pm SD (Min. – Max.)	N (%)
Age (years)		12 ± 1.79 (9–17)	112 (100)
DMFT		4.57 ± 3.42 (0–16)	
dft		0.86 ± 1.9 (0–9)	
OHI-S		1.4 ± 0.52 (0–2.8)	
TNI	TNI Code 1		5 (4.4)
	TNI Code 2		8 (7.1)
	TNI Code 3		24 (21.4)
	TNI Code 4		21 (18.7)
	TNI Code 5		26 (23.2)
	TNI Code 6		28 (25.0)
Systemic diseases	Rheumatologic diseases		1 (0.9)
	Hormonal diseases		1 (0.9)
	Cardiovascular diseases		6 (5.4)
	Respiratory diseases		1 (0.9)
	Neurological diseases		1 (0.9)
	Nocturnal enuresis		7 (6.3)
Medication	Anti-hypertensives		3 (2.7)
	Anticonvulsants		1 (0.9)
	Antiallergics		1 (0.9)
	Nocturnal enuresis medication		7 (6.3)
	Hormonal medication		1 (0.9)
	ADHD Medication		66 (58.9)
	Antidepressant Medication		24 (21.4)
	Antipsychotic Medication		13 (11.6)

SD: standard deviation; Min.: minimum; Max: maximum; N: number; DMFT: decayed-missing-filled-teeth index; dft: decayed-filled-teeth index; OHI-S: simplified oral hygiene index; TNI: treatment need index; ADHD: attention deficit hyperactivity disorder

Table 2 Child oral Health Impact Profile-Short Form (COHIP-SF-19), subscales, and summary scores of different age groups

Age Group	Subscales	Min.-Max.	Mean \pm SD (Median)	Cronbach Alpha
9–12	Oral health well-being	5–20	14.48 \pm 3.42 (15)	0.510
	Functional well-being	6–16	13.96 \pm 2.4 (15)	0.544
	Social/emotional, school, and self-image	10–40	32.63 \pm 6.73 (34.5)	0.756
	COHIP-SF-19	28–76	61.08 \pm 10.93 (64.5)	0.836
13–17	Oral health well-being	0–20	12.25 \pm 5.02 (13)	0.778
	Functional well-being	5–16	13.07 \pm 3.02 (14)	0.635
	Social/emotional, school, and self-image	9–40	29.7 \pm 8.97 (32)	0.884
	COHIP-SF-19	23–76	55.02 \pm 15.19 (58)	0.915

Min.: minimum; Max.: maximum; SD: standard deviation; COHIP-SF-19: Child Oral Health Impact Profile Short Form

**Fig. 1** Histogram graph of the distribution of Child Oral Health Impact Profile-Short Form (COHIP-SF-19) and its subscales in different age groups

this study was 57.79 ± 14.11 . Data for COHIP-SF-19 and its subscales for different age groups are presented in Table 2. A reliability analysis was conducted to test the consistency of COHIP-SF-19 and its subscales applied in the study based on the responses given by the participants. Accordingly, reliability was determined between low-adequate and high levels in the 9–12 age group (0.510–0.836), and between high-adequate and very high levels in the 13–17 age group (0.635–0.915). Figure 1 shows the histogram graph of the distribution of COHIP-SF-19 and its subscales in different age groups.

The comparison results of COHIP-SF-19 and its subscales according to TNI code groups in different age groups are presented in Table 3. While no statistically significant differences were observed between subscales in terms of treatment need in the 9–12 age group ($p > 0.05$), statistically significant differences were determined in all subscales and in total in the 13–17 age group ($p < 0.001$, $p < 0.001$, and $p < 0.001$, respectively). According to Bonferroni tests performed in the 13–17 group,

the scores of the TNI Code 6 group were significantly lower in all subscales and in total.

In 9–12 age group, there were statistically significant negative correlation between dft and OHI-S scores and oral health well-being subscale scores ($r = -0.320$, $p = 0.021$ and $r = -0.313$, $p = 0.024$, respectively). Statistically significant negative correlations were found between TNI codes and social/emotional, school, and self-image subscale scores and COHIP-SF-19 scores ($r = -0.239$, $p = 0.041$ and $r = -0.229$, $p = 0.048$, respectively). Statistically significant negative correlations were determined between DMFT scores and TNI groups and the COHIP-SF-19 scale and all its subscales in 13–17 age group ($r = -0.467$, $p < 0.001$; $r = -0.378$, $p = 0.003$; $r = -0.432$, $p = 0.001$; and $r = -0.483$, $p < 0.001$, respectively for DMFT scores. $r = -0.351$, $p = 0.001$; $r = -0.382$, $p = 0.001$; $r = -0.434$, $p < 0.001$; and $r = -0.441$, $p < 0.001$, respectively for TNI groups.). There were also statistically significant and negative correlations between OHI-S scores and oral health well-being, functional well-being subscales scores and COHIP-SF-19 scores ($r = -0.419$, $p = 0.001$; $r = -0.351$,

Table 3 Comparison of child oral Health Impact Profile-Short Form (COHIP-SF-19) scale and its subscales according to treatment need index (TNI) code groups for different age groups

Age Group	Subscales	TNI Code Group	Min.-Max.	Mean ± SD (Median)	Test Statistics	p
9–12	Oral health well-being	TNI 3	11–19	14.89 ± 2.93 (16)	1.346*	0.277
		TNI 4	12–19	15.58 ± 2.07 (16)		
		TNI 5	9–19	14.13 ± 3.87 (14)		
		TNI 6	5–20	13.06 ± 4.19 (13)		
	Functional well-being	TNI 3	9–16	13.89 ± 2.32 (14)	3.740 [†]	0.291
		TNI 4	14–16	15.17 ± 0.94 (15.5)		
		TNI 5	10–16	13.5 ± 2.07 (13)		
		TNI 6	6–16	12.81 ± 3.15 (13.5)		
	Social/emotional, school, and self-image	TNI 3	24–40	34.22 ± 5.93 (36)	5.287 [†]	0.152
		TNI 4	29–40	36.08 ± 3.26 (36.5)		
		TNI 5	21–40	31.38 ± 6.37 (32)		
		TNI 6	10–40	29.81 ± 8.66 (31)		
	COHIP-SF-19	TNI 3	44–74	63 ± 10.19 (65)	2.718*	0.057
		TNI 4	62–74	66.83 ± 3.81 (66)		
		TNI 5	44–73	59 ± 10.94 (59)		
		TNI 6	28–76	55.69 ± 13.71 (57)		
13–17	Oral health well-being	TNI 3	10–20	14.92 ± 3.25 (15)	8.506*	< 0.001
		TNI 4	4–16	11.58 ± 3.4 (12)		
		TNI 5	5–20	12.67 ± 4.26 (13)		
		TNI 6	0–18	6.64 ± 5.37 (5)		
	Functional well-being	TNI 3	8–16	14.62 ± 2.47 (16)	15.778 [†]	0.001
		TNI 4	8–16	13.25 ± 2.3 (13.5)		
		TNI 5	5–16	12.56 ± 2.87 (12)		
		TNI 6	5–16	10.55 ± 3.47 (11)		
	Social/emotional, school, and self-image	TNI 3	25–40	35.77 ± 5.25 (37)	19.698 [†]	< 0.001
		TNI 4	18–40	29.92 ± 6.52 (30)		
		TNI 5	12–40	28.28 ± 9.5 (31)		
		TNI 6	9–32	20.27 ± 6.99 (21)		
	COHIP-SF-19	TNI 3	46–75	65.31 ± 8.67 (67)	10.565*	< 0.001
		TNI 4	30–72	54.75 ± 11.18 (56)		
		TNI 5	23–73	53.5 ± 14.58 (58)		
		TNI 6	23–66	37.45 ± 12.09 (36)		

TNI: Treatment Need Index; Min.: minimum; Max.: maximum; SD: standard deviation; COHIP-SF-19: Child Oral Health Impact Profile Short Form. *ANOVA and [†] Kruskal Wallis test. Bold values mean statistically significance

$p = 0.001$; and $r = -0.356$, $p = 0.005$, respectively). The results of the correlation analysis between oral health parameters and COHIP-SF-19 total and subscale's scores are shown in Table 4.

According to multivariable linear regression analysis, the presence of dental caries and/or missing and/or filled teeth due to dental caries in the permanent dentition (DMFT) and the need for radical dental treatments (TNI Code 6) had a negative effect on OHRQoL in orphan children and adolescents between the ages of 13–17. The model was significant ($F = 15.654$, $R^2 = 0.380$; $p = 0.009$, $p < 0.001$, respectively). Table 5 summarizes the effects of DMFT and TNI Code 6, on predicting overall OHRQoL in 13–17 age group. A negative and statistically significant correlation was observed between COHIP-SF-19 scores and DMFT scores (Fig. 2). Furthermore, the results of the multivariable linear regression analysis

confirmed the presence of a negative and statistically significant association between COHIP-SF-19 scores and both DMFT scores and TNI Code 6 (Fig. 3).

Discussion

Children living in residential care often struggle to develop healthy personalities because of factors such as parental inadequacy, environmental deprivation, and emotional disturbances. As a result, they may encounter difficulties in forming healthy relationships, adapting to social norms, and achieving their academic or personal goals. It is crucial to provide support and intervention to help these children overcome these obstacles and thrive in their social and emotional development [16]. At this point, the levels of quality of life and OHRQoL are crucial for the healthy development of individuals. For children and adolescents living in residential care facilities,

Table 4 Correlation between the oral health variables and child oral Health Impact Profile Short Form (COHIP-SF-19) and subscales scores

9–12 Age Group		Oral health well-being subscale	Functional well-being subscale	Social/emotional, school, and self-image subscale	COHIP-SF-19 Total score
dft*	r	-0.320	-0.239	-0.187	-0.256
	p	0.021	0.088	0.185	0.066
DMFT*	r	-0.162	-0.214	-0.012	-0.074
	p	0.252	0.128	0.935	0.603
OHI-S*	r	-0.313	-0.198	-0.134	-0.244
	p	0.024	0.160	0.343	0.081
TNI†	r	-0.193	-0.176	-0.239	-0.229
	p	0.102	0.150	0.041	0.048
13–17 Age Group		Oral health well-being subscale	Functional well-being subscale	Social/emotional, school, and self-image subscale	COHIP-SF-19 Total score
DMFT*	r	-0.467	-0.378	-0.432	-0.483
	p	<0.001	0.003	0.001	<0.001
OHI-S*	r	-0.419	-0.351	-0.251	-0.356
	p	0.001	0.006	0.053	0.005
TNI†	r	-0.351	-0.382	-0.434	-0.441
	p	0.001	0.001	<0.001	<0.001

DMFT: decayed-missing-filled-teeth index; dft: decayed-filled-teeth index; OHI-S: simplified oral hygiene index; TNI: treatment need index; COHIP-SF-19: Child Oral Health Impact Profile Short Form. *Spearman correlation analysis and †Kendall's Tau correlation test. Bold values mean statistically significance

Table 5 Combined effects of factors on oral health-related quality of life (OHRQoL) explored through multivariable linear regression analysis in 13–17 age group

	Unstandardized Coefficients		Standardized Coefficients	t	p	VIF
	B	Std. Error	β			
Constant	65.681	3.553		18.485	<0.001	
DMFT	-1.326	0.487	-0.310	-2.719	0.009	1.070
TNI Code 6	-17.019	4.224	-0.459	-4.029	<0.001	1.070
R ²	0.380					
F	15.654					

Std: standard; DMFT: decayed-missing-filled-teeth index; TNI: treatment need index. B unstandardized regression coefficient, β standardized regression coefficient. Bold values mean statistically significance

the absence of parents and potential social living problems can significantly affect their quality of life. Lack of and incorrect knowledge and attitude about oral health can also cause changes in oral health-related behaviors. This cross-sectional study investigated the effects of dental caries, oral hygiene, and dental treatment needs on the OHRQoL of a group of orphan children and adolescents. It was concluded that various oral health parameters significantly impact their OHRQoL. Therefore, the null hypothesis of the study was rejected.

Dental caries is a prevalent global condition, particularly among children, and its high prevalence has a significant and adverse impact on the quality of life in various ways [34]. A recently published systematic review has revealed that children and adolescents who are orphaned are at a higher risk of developing dental caries than their counterparts who are not orphaned. Rural life, low grade of self-concept, changes in saliva properties, frequent sugar-containing diet, and increased plaque accumulation due to poor oral hygiene habits are the determinants of this increase [34]. In a study conducted by Xu

et al. [35] in China, caries experience in primary dentition was found to be 4.41 ± 2.6 in 78 orphan children aged 3–5 years, while in permanent dentition was found to be 1.28 ± 1.26 in 254 orphan children and adolescents aged 12–15 years. According to current study, the incidence of dental caries, related fillings, and missing teeth was much higher in the permanent dentition compared to the results of Xu et al. [35], and much lower in the primary dentition. In a study performed in India evaluating the effect of intelligence quotient on dental caries in orphan children, caries experience was reported as 1.54 ± 2.09 [36], while in another case-control study conducted in Iran, it was reported as 3.36 ± 1.86 [37]. In a study conducted in Egypt, caries experience in permanent dentition were found to be 1.86 ± 2.96 and 1.80 ± 2.54 in orphan children living in non-governmental and governmental institutions, respectively. These scores were statistically significantly higher than their parented peers, whose mean score was 0.75 ± 1.29 [23]. Considering the dental caries pattern, the varying levels of caries prevalence among orphan children and adolescents in different

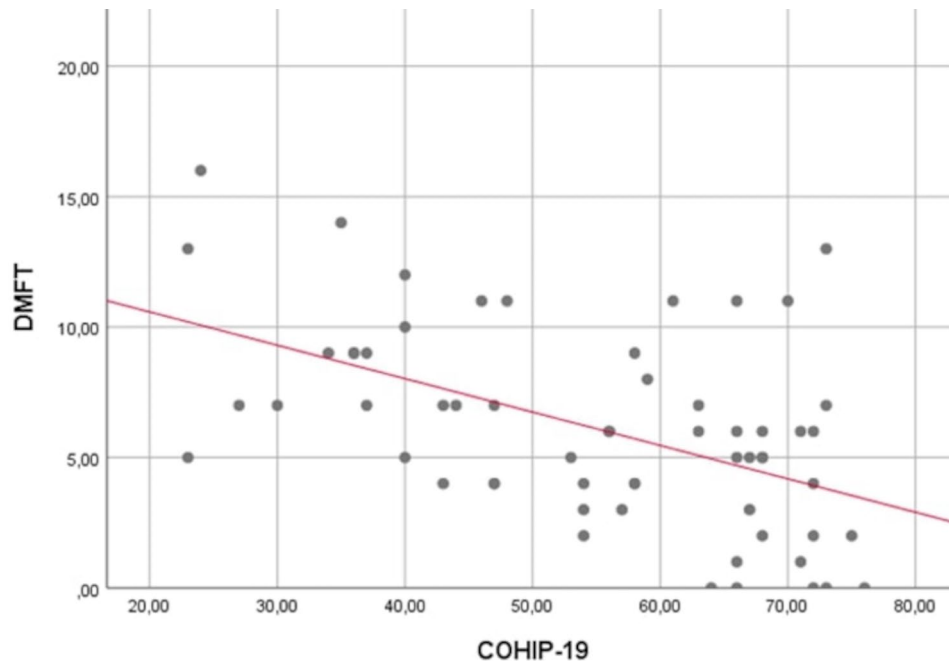


Fig. 2 Scatter plot graph of the relationship between the Child Oral Health Impact Profile-Short Form (COHIP-SF-19) scores and Decayed-Missing-Filled-Teeth Index (DMFT) scores of participants in 13–17 age group

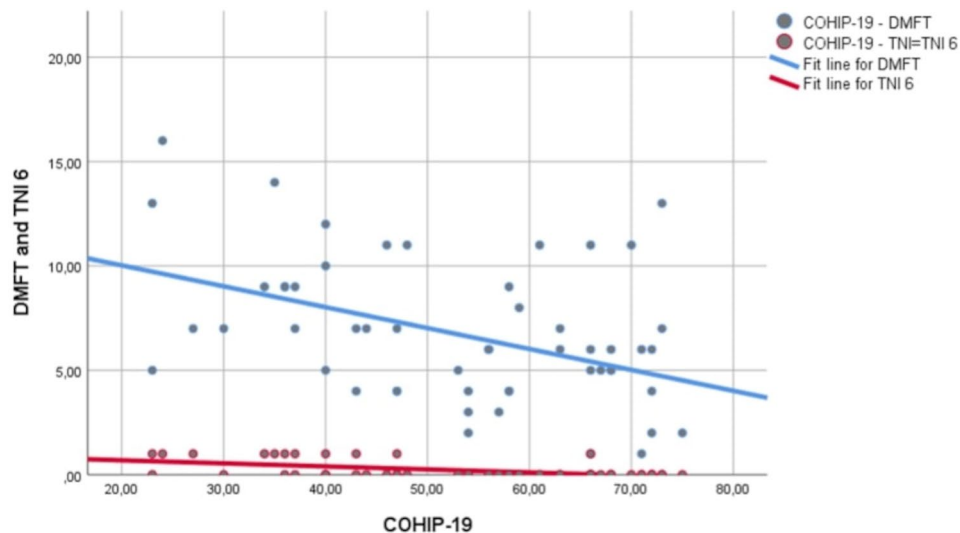


Fig. 3 Scatter plot graph of the relationship between the Child Oral Health Impact Profile-Short Form (COHIP-SF-19) scores and Decayed-Missing-Filled-Teeth Index (DMFT) and Treatment Need Index (TNI) Code 6 in 13–17 age group

populations and geographic regions can be attributed to factors such as the income and education levels of the societies where these studies are conducted, the level of access to dental services, differences in healthcare services and policies, cultural habits, genetic predisposition, the community's understanding and awareness of oral and dental health, in addition to their oral hygiene and dietary practices.

Oral hygiene is crucial for maintaining oral health and preventing periodontal diseases and dental caries.

Proper oral hygiene practices help reduce the accumulation of debris and calculus formation on teeth, which in turn controls the amount of bacteria in the mouth [38]. The buildup of debris and calculus can lead to gingivitis, which over time, can progress to severe periodontal disorders. Additionally, the bacteria in plaque produce acids that can damage tooth enamel, leading to dental caries. Untreated cavities can cause pain, infection, and tooth loss. Therefore, improvements in oral hygiene are crucial for preventing dental hard tissue diseases by

reducing plaque and debris accumulation [38]. Orphan children and adolescents often experience various psychological and sociological difficulties. Variations in their oral hygiene may be observed due to factors such as living conditions in residential care facilities, cultural differences, and nutrition and care conditions [39]. In a study in which the oral hygiene level of a group of orphan children and adolescents was evaluated with the OHI-S index, a mean score between 1.3 and 3.0 was classified as fair oral hygiene, and it was reported that 73.7% of the participants were in this group [39]. In another study [40], the oral hygiene of orphan adolescents aged 12–15 was evaluated with the same index, and it was found that their oral hygiene was at a good level. The mean OHI-S index score reported in the relevant study is similar to the score in our study and is 1.51 ± 1.30 . The results of Meshki et al.'s study [37], which is one of the studies reporting the highest mean OHI-S score in orphan children and adolescents in the literature, reported the mean score in these children as 2.30 ± 0.69 , statistically significantly higher than their non-orphan peers. It was stated that the oral hygiene status of only 11% of orphans was favorable. The presence of multifactorial factors, as in dental caries, underlies the differences in oral hygiene levels among different orphan populations living in various conditions.

It was observed that 23.2% of the orphan children and adolescents included in the study needed advanced restorations. Moreover, it was determined that one-in-four participants needed radical dental treatment. Although the number of studies evaluating the dental treatment needs of orphan children and adolescents in the literature is limited, in a study conducted on children and adolescents in 13 orphanages in India, reported that 18.3% of the participants needed two or more surface restorations, 19% needed endodontic treatment, and 11.1% needed extractions [41]. Considering the services provided by governments to children and adolescents living in orphanages, the knowledge and attitudes of caregivers and administrators about oral health, and individual risk factors, the importance of addressing dental treatment needs in these individuals should be taken into account.

The current study shows that, within the evaluated parameters, dental caries in the permanent dentition and associated missing and fillings, and the need for radical dental treatment significantly affect the OHRQoL of orphan children and adolescents. Many children living in orphanages face various health problems, often reflecting the neglect and abuse they have experienced. This isolated population, which deserves special attention, often suffers from a low quality of life due to factors such as lack of parents, deprivation of social environment, and psychological or psychiatric disorders. Additionally, the increased need for dental treatment and the

limited opportunities to seek dental care cause a decrease in the OHRQoL of these children and adolescents [42, 43]. Caries experience of orphan children between the ages of 7–18 have been reported to have a statistically significant effect on OHRQoL [42]. Similarly, it has been reported that dental caries in the permanent dentition, resulting tooth loss and the number of filled teeth, and the frequency of dentist visits, have a substantial effect on OHRQoL in orphan children and adolescents between the ages of 12–15. Moreover, these children's OHRQoL scores are significantly lower than those of their parented peers [43, 44]. Another study stated that the important factors determining the effect of oral diseases on daily activities in orphan children and adolescents are age, dental fluorosis, and decayed teeth. The study also reported that more than half of the participants complained of oral diseases that required treatment to improve their quality of life [45].

One of the limitations of the current cross-sectional study is that it only included male children and adolescents. Excluding females from the study population limits the generalizability of the findings and limits our understanding of oral health condition and hygiene routines among females living in similar social care homes. On the other hand, since the study is cross-sectional and aims to reflect the situation of children living in the relevant institution, it is natural that female adolescents cannot be included. In the current conjuncture, females and males cannot stay in the same social care facilities in Türkiye. Future research should aim to include a more diverse sample, encompassing both females and males, to provide a comprehensive assessment of oral health needs in residential care settings. Additionally, the homogeneous nature of the study population, consisting only of children from a single social care facility in Türkiye, may limit the generalizability of the findings to other residential care facilities or geographical regions. There might be an unlimited number of factors that affect individuals' OHRQoL. Only some of these factors were evaluated in this study. The cross-sectional design of present study precludes the possibility of determine the existence of causal links between the variables. Longitudinal research is necessary to explore the temporal relationships between oral health outcomes and hygiene practices in children and adolescents residing in care facilities. Despite these limitations, this study provides valuable information about the oral health status of orphan children and adolescents living in residential care facilities, highlighting the need for targeted interventions to improve oral health outcomes in this vulnerable population. In addition, it is the first study in the scientific literature to present a relationship between the need for dental treatment and OHRQoL in orphan children and adolescents. Other strengths of the study are the use of

indexes and questionnaires with validity and reliability and the presence of intra- and inter-observer agreement.

Conclusions

The findings of the current study indicate that dental caries in the permanent dentition, related tooth loss, and filled teeth, as well as the need for radical dental treatment, significantly reduce the oral health-related quality of life in orphan children and adolescents.

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Author contributions

E.A.Ş., B.S., and B.K. conceived the ideas; N.A. and N.H. collected the data; E.A.Ş. and B.S. analysed the data; E.A.Ş. and B.S. led figure/table development, E.A.Ş. and B.S. led the writing. All author reviewed the final submission.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author (B.S.) on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted following the principles outlined in the Helsinki Declaration and its subsequent amendments. Ethical approval for the study was received from the Clinical Research Ethics Committee of the School of Dentistry, Marmara University, on 27.12.2023, with protocol number 08.12.2023.1763. All legal permissions for the conduct of the study were obtained from relevant institutions and organizations. In addition, consent to participate was obtained from the responsible legal guardians of orphan children and adolescents within the residential care facility.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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