IMPACT OF DENTAL CARIES AND PAIN ON CHILDREN'S ORAL HEALTH-RELATED QUALITY OF LIFE: A PRELIMINARY STUDY

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Abstract
The Malay language Child Oral Health Impact Profile–Short Form 19 (ML COHIP-SF 19) is a validated self-administered questionnaire designed for a wide age range of children to measure the impact of clinical conditions on the children's oral health-related quality of life. This study aimed to compare the oral health-related quality of life (OHRQoL) between children with and without dental caries, and between children with and without dental pain among children aged 9-to-16-year-old using the newly validated Malay language COHIP-SF 19 (ML COHIP-SF 19) questionnaire. Children who aged 9-to-16-year-old, attended the Faculty of Dentistry, Universiti Teknologi MARA (UiTM) and Al Amin Tropicana School Sungai Buloh, Malaysia, who understood Malay language were invited to participate in this cross-sectional study. Those with low literacy in Malay language or presented with acute dental abscess and/or fistula, cognitively impaired, or had other chronic illnesses were excluded. After informed consent and assent were obtained, the children were invited to complete a questionnaire consisting of demographic details, ML COHIP-SF 19, and Faces Pain Scales-Revised. Subsequently, the children underwent dental examination. Dental caries were documented using the International Caries Detection and Assessment System (ICDAS). Data were statistically analysed using an independent t-test, Spearman's correlation test and multiple regression analysis. Although not statistically significant (p=0.34), children with dental caries were found to have a lower mean total ML COHIP-SF 19 score (52.83±8.74) compared to children without dental caries (55.11 ±11.10). The prevalence of pain experience among the children was 52.9%. Children with dental pain had a significantly (p<0.01) lower mean total ML COHIP-SF 19 score (50.57±9.40) compared to those without dental pain (57.79±9.33). Besides, males (β=-4.65, p=0.03), younger children (β=-1.26, p=0.02, those without previous pain experience (β=-4.64, p=0.03), and children who rated their oral health status more positively (β=4.46, p<0.01) had better OHRQoL. Children who had no previous dental pain demonstrated better OHRQoL compared to those with a history of dental pain. Besides, no significant differences in OHRQoL were observed between children with and without dental caries.

Keywords**:** Dental Caries, Dental Pain, Malay Language COHIP-SF 19 Questionnaire, Oral Health-Related Quality of Life

Introduction

One of the global oral health issues among children is dental caries. The National Health and Morbidity Survey (NHMS) has reported that three out of ten schoolchildren are affected by dental caries (1). However, the information on the impact of oral health problems on oral health-related quality of life (OHRQoL) among this population in Malaysia is

scarce. Dental caries is considered the main biological cause of dental pain in children, and pain is one of the most common reasons why patients seek dental treatment (2). It has been reported in a qualitative study that pain and aesthetic aspects are the main concerns of young patients (3).

Pain has been defined as "an unpleasant sensory and emotional experience associated with, or resembling, that associated with, actual or potential tissue damage" by The International Association for the Study of Pain (IASP) (4). The global prevalence of dental pain was estimated at 32.7% by a recent systematic review (5). Studies have reported that dental pain is associated with other oral conditions such as dental abscess (6), tooth eruption, exfoliation of primary teeth (7) and dentoalveolar trauma (8). It could impact one's daily life considerably in activities such as eating, sleeping, completing homework, paying attention in class, attending school, playing, and even resulting a low academic achievement (9, 10). Thus, poorer OHRQoL is expected in children experiencing dental pain than children who had not experienced dental pain (11). Furthermore, studies have recorded that parents of children with dental pain were associated with higher workplace absenteeism, increased expenditures, and feelings of guilt (12, 13).

There is a dearth of studies conducted in Malaysia that explore the association between dental caries, dental pain and OHRQoL among schoolchildren. The existing research in this context has predominantly centered around orthodontics-related issues. Nonetheless, it has been reported that only a quarter of the adolescents who had experienced dental pain visited a dentist and only a fifth of them used pain medication to control the pain (14). A study evaluating the caries experience and its relationship with OHRQoL among preschool children aged 5-to-6-year-old attending a private preschool in Kota Bharu, Kelantan revealed a significant association between the impact of caries experience on the family's OHRQoL ($p<0.01$), but not on the child's OHRQoL ($p=0.11$) (15). Meanwhile, another study assessed the oral health status, related behaviours, and oral health-related quality of life OHRQoL among Malaysian indigenous Orang Asli children in Cameron Highlands have identified that bleeding gum followed by toothache as the most prevalent oral conditions affecting the children's daily performances (16). To date, no published study has examined the impact of dental caries and dental pain on OHRQoL among children in Malaysia. Thus, this study aimed to compare the oral health-related quality of life (OHRQoL) between children with and without dental caries and children with and without dental pain among children aged 9-to-16-year-old in Malaysia by using the newly validated Malay language COHIP-SF 19 (ML COHIP-SF 19) questionnaire (17).

Materials and methods

The present study protocol was reviewed and approved by the Research Ethics Committee, Research Management Centre, Universiti Teknologi MARA (REC/07/2021 (FB/44)). All children assented to participate in the survey, and informed consent was obtained from their parents/caregiver during recruitment to participate in this study.

Sample collection

This cross-sectional study was conducted with a convenient sampling method at the Faculty of Dentistry, Universiti Teknologi MARA (UiTM) and Al Amin Tropicana School Sungai Buloh, Malaysia. A sample size of 70 participants was deemed necessary to attain 80% power and a 90% confidence interval, taking into account an effect size of 0.3 for a two-tailed analysis, along with consideration for a 10% dropout rate. (G*power version 3.1.9.4).

Children aged 9-to-16-year-old who understand the Malay language and had no cognitive impairment or other chronic illnesses were invited to participate in this study. However, those with low literacy in Malay language, or presented with acute dental abscess and/or fistula, cognitively impaired, or had other chronic illnesses were excluded. The children attended the Faculty of Dentistry, UiTM and children from Al Amin Tropicana School Sungai Buloh, Malaysia were invited to participate in this study. Informed consent from the parents/caregiver and assent from the children were obtained from all participants. All children with or without consent to participate in this study have received the same benefits in terms of dental examination, consultation and referral to the clinic based on their treatment needs without bias. All participants completed a set of ML COHIP-SF 19 questionnaires prior to the oral health examination. They have also rated their dental pain (if present) based on the Faces Pain Scales-Revised (18).

The COHIP-SF 19 is a self-reported OHRQoL measurement tool that contains three conceptual subscales: oral health (five items), functional well-being (four items) and socio-emotional well-being (ten items) (19). It also contains one global question on overall oral health perception (Q20). For each item, the children will respond according to the five-point Likert scale. The score of the 19 items will be summed up after reversing the scoring of the 17 negatively worded items. The total score ranged from 0 to 76, with a higher score indicating a better quality of life. The original English questionnaire was translated and validated into the Malay language (ML COHIP-SF 19) prior to the commencement of this study (17).

All clinical examinations were performed by a calibrated postgraduate student in paediatric dentistry (NR). The inter-examiner calibration was done in comparison with the National Benchmark Group (NBG) examiner for ICDAS. Meanwhile, to assess the intra-examiner reliability, visual examination of photographs and extracted permanent teeth (N=50) with different locations and stages of caries progression were done and repeated one week later (20). The participants' dental caries were recorded according to the ICDAS II diagnostic criteria which uses a two-digit coding method (21). The first digit (0 to 8) refers to the presence of restorations and/or sealants and the second digit (0 to 6) refers to the actual stage of the carious lesion. Dental caries were coded as ICDAS level 1 (first visual change in enamel seen after prolonged air drying) through 6 (distinct cavity with extensive visible dentin) (22). No dental radiographs were taken in this study.

The maximum ICDAS score for each participant was recorded. All participants were subsequently categorized into two categories based on the presence or absence of caries. Additionally, the participants were also categorized based on the presence or absence of dental pain. Among those with caries, the children were further categorized into two groups based on the severity of carious lesions using ICDAS II caries codes: non-cavitated enamel carious lesions at d/D1-2 level (codes 1 and 2) and cavitated carious lesions at d/D3-6 level (codes 3 to 6).

Data analysis

The inter- and intra-examiner reliability were tested with Cohen's Kappa. The independent t-test was used to determine differences between the mean total ML COHIP-SF 19 scores among children with or without dental caries. The same statistical test was also used to assess the differences between mean total ML COHIP-SF 19 scores among children with or without pain experience. To determine the association between maximum individual ICDAS score and pain score, Spearman's correlation test was performed. Further analysis using multiple regression was used to explore the factors associated with total ML COHIP-SF 19 scores.

All data analyses were conducted using SPSS software (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). A statistical significance was set at $p<0.05$ for all analyses.

Results

A total of 70 Malay children (35 caries; 35 caries-free) aged 9-to-16-year-old (mean: 12.03±1.96) with almost equal gender distribution were included in this study. In Malaysia, households are categorized into three main income categories: Bottom 40% (B40), Middle 40% (M40), and Top 20% (T20). Near half (48.5%) of the participant's families in the present study were categorized in the middle-income group (M40), followed by B40 (28.8%) and T20 (22.7%). There was no significant difference in the mean household income ($p=1.00$) and parental education ($p=0.95$) between children with and without dental caries. Furthermore, children with a higher household income have reported a lower OHRQoL scores, however, the result was not statistically significant ($p=0.22$). 82.4% of the participants recruited have the habit of daily toothbrushing twice or more and 68.7% had visited the dentist within the past 1 year. There was no significant difference in the oral health behaviours of daily toothbrushing ($p=0.50$) and last dental visit ($p=0.94$) between children with and without dental caries. The socio-demographic characteristics of the participants recruited are shown in Table 1.

Table 1: Socio-demographic characteristics of the children

Socio-demographic background		Caries-free, n=35	Caries, n=35	Total n=70
Child age in years	Mean (SD)	12.2 (1.91)	11.8 (2.02)	-
Child gender	Male	16 (45.7%)	15 (42.9%)	44.3%
	Female	19 (54.3%)	20 (57.1%)	55.7%
Ethnicity	Malay	35 (100%)	35 (100%)	100%
Household income	B40 (< RM 4,850)	10 (30.3%)	9 (27.3%)	28.8%
	M40 (RM 4,850-10,959)	15 (45.5%)	17 (51.5%)	48.5%
	T20 (>RM 10,959)	8 (24.2%)	7 (21.2%)	22.7%
Parental employment	Presence	28 (80%)	28 (80%)	80%
	Absence	7 (20%)	7 (20%)	20%
Parental education level	No formal education	1(3%)	0 (0%)	1.5%
	Primary school	0 (0%)	0 (0%)	0%
	Secondary school	4 (12.5%)	6 (17.7%)	14.9%
	Certificate program/ Vocational/ Diploma	6 (18%)	13 (37.1%)	27.1%
	Degree	13 (39.5%)	10 (29.4%)	34.3%
	Master/ PhD	9 (27%)	5 (14.7%)	20.9%
Oral health behaviours				
Daily toothbrushing habit	≥2 times	30 (88.2%)	28 (85.9%)	82.4%
	<2 times	4 (11.8%)	6 (17.6%)	13.9%
Last dental visit	Within a year	23 (67.6%)	23 (69.7%)	68.7%
	More than a year	10 (29.4%)	8 (24.2%)	26.9%
	Never	1 (2.9%)	2 (6.1%)	4.5%
Clinical characteristics				
Dentition	Mixed	14 (40%)	24 (68.6%)	54.3%
	Permanent	21 (60%)	11 (31.4%)	45.7%
Presence of dental pain	Yes	18 (51.4%)	19 (54.3%)	52.9%
	No	17 (48.6%)	16 (45.7%)	47.1%
Caries severity based on maximum ICDAS score	No disease (code 0)	35 (100%)	-	50%
	Initial (code 1-2)	-	9 (25.7%)	12.9%
	Moderate (code 3-4)	-	12 (34.3%)	17.1%
	Extensive (code 4-5)	-	14 (40%)	20%

Table 2: Caries experience among the children

Dentition	Type of lesion	Caries experience (mean±SD)
Primary teeth	Non-cavitated (ICDAS-II code 1-2)	0.16 (0.53)
	Cavitated (ICDAS-II code 3-6)	0.77 (1.85)
Permanent teeth	Non-cavitated (ICDAS-II code 1-2)	0.87 (1.91)
	Cavitated (ICDAS-II code 3-6)	0.47 (1.39)

The inter-examiner and intra-examiner correlation for caries examination (ICDAS) were 0.78 and 0.85 respectively. Over half (54.3%) of the children were in the mixed dentition stage while the others (45.7%) were in permanent dentition. Additionally, 68.6% of them in mixed dentition presented with caries compared to only 31.4% of them in permanent dentition (Table 1). There were more cavitated caries noted in the primary teeth (mean 0.77±1.85) compared to the permanent teeth (mean 0.47± 1.39). Furthermore, there were 52.9% of the recruited participants reported dental pain experience in the past three months (Table 2). Children with dental caries had lower mean scores of ML COHIP-SF 19 (52.83; SD 8.74) compared to children without dental caries (55.11; SD 11.10), however, this difference was not statistically significant (p=0.34). On the other hand, the overall mean scores of ML COHIP-SF 19 for children with dental pain were found to be significantly lower (50.57; SD 9.40) compared to those without pain (57.79; SD 9.33) (p<0.01). These significances were also evident statistically in all domains: oral health (p<0.01), functional well-being (p<0.05) and socio-emotional well-being (p<0.05) (Table 3). Besides, a significant positive correlation (r=0.37, p=0.03) was detected between individual maximum ICDAS scores and pain scores among the participants.

Table 3: The association of ML COHIP-SF 19 with dental caries and dental pain

		Mean score			
		Total score (S.D)	**Oral health (S.D)**	**Functional well-being (S.D)**	**Socio- emotional well-being (S.D)**
Dental caries	No	55.1 (±11.10)	14.5 (±3.66)	12.3 (±3.03)	28.3 (±6.60)
	Yes	52.8 (±8.74)	13.3 (±3.42)	12.3 (±2.22)	27.2 (±6.23)
p-value		0.34	0.17	0.96	0.46
Dental pain	No	57.8 (±9.33)	15.3 (±3.48)	13.0 (±2.25)	29.5 (±6.27)
	Yes	50.6 (±9.40)	12.7 (±3.22)	11.68 (±2.83)	26.2 (±6.19)
p-value		<0.01*	<0.01*	<0.05*	<0.05*

*p-value <0.05

Table 4: Predictors of children's OHRQoL

Variables	Adjusted bd	95% CI	P-value	T-statistics
Pain experience	-4.64	-8.82, -0.46	0.03*	-2.22
Self-perceived oral health status	4.46	1.92, 7.00	<0.01*	3.52
Caries experience	-1.03	-5.01, 2.94	0.61	-0.52
Age	-1.26	-2.31, -0.21	0.02*	-2.40
Gender	-4.65	-8.75, -0.45	0.03*	-2.27
Household income	1.75	-1.08, 4.57	0.22	1.24

*p-value <0.05

(R^2 = 0.422, the model reasonably fits well; model assumptions are met; there is no interaction between independent variables and no multicollinearity problem)

[d]Adjusted regression coefficient

Previous pain experience (β=-4.64, p=0.03), self-perceived oral health status score (β=4.46, p<0.01), age (β=-1.26, p=0.02) and gender (β=-4.65, p=0.03) were found to be predictors for total ML COHIP-SF 19 score (Table 4). These findings suggested that males, younger children, those without previous pain experience and children who rated their oral health status more positively had better OHRQoL.

Discussion

This study has compared the OHRQoL between children with and without dental caries, and between children with and without dental pain among children aged 9-to-16-year-old in Malaysia. All participants in this study were Malay, primarily due to the demographic composition of the study location, which is predominantly populated by individuals of Malay ethnicity. A similar pattern has

been observed in other studies in Malaysia. For example, the Malay version of the Child Oral Impacts on Daily Performances (C-OIDP) questionnaire validation study (97.7% Malay) and the Malay version of the Early Childhood Oral Health Impact Scale (Malay-ECOHIS) questionnaire validation study (97.6% Malay) (23). Despite having a higher representation of the middle class and a lower representation of the lower class, the socio-economic distribution of the participants in this study remains similar to the overall distribution in Malaysia.

There was a significant difference in the prevalence of dental caries in primary and permanent teeth in children (24). The prevalence of dental caries in primary dentition (64.2%) was reported to be higher than in permanent dentition (26.6%) (25). Similarly, this preliminary study found that children in their mixed dentition stage have a higher incidence of caries (68.6%) compared to children in the permanent dentition stage (31.4%). This could be attributed by older children with permanent dentition are likely to be more capable of taking better care of their oral hygiene compared to younger children.

The findings of this study suggested that having dental caries did not significantly affect the children's OHRQoL (p=0.34). The similarity in the prevalence of previous dental pain experiences among children with caries (54.3%) and caries-free (51.4%) in the current study may account for the observed phenomenon. The dental pain experience in children with no caries could have been attributed to other reasons including dental trauma and exfoliating deciduous teeth. Similar findings were observed in studies conducted among children living in Taranaki (New Zealand) (26) and Sheffield (United Kingdom) (27) where OHRQoL of children with and without dental caries were not significantly different.

Furthermore, Wilson and Cleary model proposed that a complex relationship exists between dental caries and the OHRQoL (28). The model included biological and physiological factors (number of decayed teeth and number of teeth presenting clinical consequences of untreated dental caries), symptom status (dental pain), individual characteristics, such as sense of coherence, environmental characteristics (social support), and OHRQoL. Therefore, dental caries experience alone did not affect the overall oral health-related quality of life, instead, other factors may have also contributed to the individual's well-being status. A cross-sectional study involving 400 schoolchildren selected from public schools in a socioeconomically disadvantaged region in the city of Manaus, Brazil have looked into the role of dental pain, sense of coherence (SOC) and social support on the relationship between dental caries and oral health-related quality of life (OHRQoL) in children aged 12 years (29). It was shown that clinical consequences of untreated caries were directly linked with poor OHRQoL and the number of dental caries was indirectly linked with OHRQoL through dental pain, SOC and social support. It was suggested that improving symptom status and psychosocial factors along with dental restoration may improve children's clinical status and OHRQoL to a greater extent than providing dental restorations only (29). Thus, to promote good oral health, it is important to understand the predictors of OHRQoL to alleviate the impact of oral diseases on people's daily lives and well-being.

In the current study, 52.9% of the children have experienced dental pain and the result revealed that they have a statistically significantly ($p<0.01$) poorer OHRQoL (mean 50.6; SD=9.40) compared with children without dental pain (mean 57.8; SD=9.33). This result has been supported by previous studies (30, 31) which suggested dental pain as a mediator on the OHRQoL. Commonly, children with carious lesions into dentine or with pulpally-involved or abscessed teeth had poorer OHRQoL than children without such lesions (32). Despite the exclusion of children with acute abscess/fistula in this study, a correlation was observed between a higher maximum ICDAS score (indicating deeper caries) and an increase in pain score. Besides, the children with previous pain experience have also reported a poorer OHRQoL. Hence, it is crucial for clinicians to identify the cause of dental pain and address it appropriately in order to enhance the OHRQoL of the children.

Although females have been reported to have significantly better OHRQoL than males (33), another study has suggested that both gender and age have no impact on OHRQoL (34). Furthermore, a recent systematic umbrella review on the impact of social determinants on adolescents' OHRQoL has concluded that female was significantly associated with poorer OHRQoL (35). Besides, a previous study

has found that females reported higher impact levels on their daily lives related to dental pain compared to their counterparts (36). These results are in accordance with the finding of the current study.

There was a significant linear relationship between the participant's general health perception and OHRQoL scores ($p<0.01$). Those with 1 unit more in the index, had OHRQoL scores higher by 4.46 (95% CI: 1.92, 7.00) indicating children with higher total ML COHIP-SF 19 scores rated their health more positively compared to those with lower total ML COHIP-SF 19 scores. Hence, self-perception of health can be used as an indicator to estimate the OHRQoL.

The use of child self-reported outcome measures was a strength of this study, avoiding parent/carers as proxy reporters. Clinicians used to rely on the proxy such as parents or caregivers to report on the child's quality of life, however, there was a concern on the reliability of these proxy reports truly representing the child's own experiences (37). The true impact of oral disease on their children's social and emotional well-being may have not been reported by the parents as the majority chose the option 'don't know' response concerning to activities or relationships that exist outside the home and the states of their children's internal feeling (38, 39). Parents' reports should only be considered as complementary information (40).

Nevertheless, the present study comes with certain limitations. Firstly, it is a preliminary study with a relatively small sample size. Secondly, a convenient sampling method was employed. Additionally, all participants in this study share the same ethnicity. Therefore, it is recommended that future studies adopt larger sample sizes, involve multi-centres, and include participants from diverse ethnic backgrounds to ensure better generalizability among Malaysian children.

Conclusion

Children who had no previous dental pain demonstrated better OHRQoL compared to those with a history of dental pain. Besides, no significant differences in OHRQoL were observed between children with and without dental caries.

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Competing interests

The authors declare that they have no conflicts of interest.

Ethical clearance

The study protocol was reviewed and approved by the Research Ethics Committee, Research Management Centre, Universiti Teknologi MARA (REC/07/2021 (FB/44)). All children assented to participate in the survey, and informed consent was obtained from the children and their parents/caregiver.

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