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Correlation and comparative analysis of the CPQ_{8-10} and child-OIDP indexes for dental caries and malocclusion

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Abstract: The aim of this study was to evaluate the correlation between the Child Perceptions Questionnaire 8 to 10 (CPQ8-10) and child-Oral Impact on Daily Performances (child-OIDP) indexes according to their total and item scores, as well as assess the discriminative validity of these assessment tools regarding dental caries and malocclusion among schoolchildren. A sample of 300 children aged between 8 and 10 years answered the questionnaires in two distinct steps. First, half of the sample (G1 = 150) answered the CPQ_{8-10} and the other half (G2 = 150) answered the child-OIDP. A week after, G1 answered the child-OIDP and G2 answered the CPQ_{8-10}. Dental Aesthetic Index and WHO criteria were used to categorize malocclusion and dental caries, respectively. Descriptive analysis, Spearman's correlation and Mann-Whitney test were performed in this study. The CPQ_{8-10} and child-OIDP demonstrated a statistically significant and moderate correlation between their total scores. Regarding the discriminative validity, CPQ_{8-10} demonstrated a significant association between the "emotional status" daily activity and dental caries, and between the "eating", "sleeping", and "studying" daily activities and malocclusion. Concerning the child-OIDP, a significant difference was found only between the "social contact" activity and presence of dental caries. Both instruments were not capable of distinguishing children with and without dental caries and/or malocclusion by their total scores. However, the instruments were able to discriminate between children with and without those oral disorders in different dimensions. Thus, the CPQ_{8-10} and the child-OIDP demonstrated a different capacity to assess the impact on OHRQoL among schoolchildren.

Keywords: Dental Caries; Malocclusion; Quality of Life; Child.

Introduction

The concept of oral health-related quality of life (OHRQoL) refers to the impact of oral health conditions in daily activities, quality of life and well-being of individuals.[1] The need to determine this impact led to the development of quality of life assessment tools, which have been increasingly used in scientific investigations.[2] One of the most used methods to evaluate the oral health-related quality of life in schoolchildren is an interviewer and self-administered questionnaires. Among those

instruments, the Child Perceptions Questionnaire 8 to 10 (CPQ_{8-10})[3,4] and the child-Oral Impact on Daily Performances (child-OIDP[5]) have been widely applied. The instruments were originally developed in English and subsequently adapted and validated to be used in several countries,[6,7,8,9,10,11] including Brazil.[12,13,14]

The CPQ_{8-10} was developed by Jokovic et al.,[4] and translated and validated to be used in Brazil by Barbosa et al.[15] This assessment tool is widely used in children, addressing issues concerning oral symptoms, functional limitations, emotional well-being, social welfare, global oral health and the extent to which oral health affects the general well-being.[13,14,15,16,17,18,19] The prevalence of impact on OHRQoL observed in previous studies using this assessment tool has ranged from 29.5% to 94.8%, with the "oral symptoms" domain reported as the most negatively affected.[20,21,22,23]

The child-OIDP was developed by Gherunpong et al.,[5] and translated and validated for the Brazilian population by Castro et al.[14] This index evaluates the impact of oral health in the quality of life through eight daily activities (eating, speaking, mouth cleaning, sleeping, smiling, emotional status, studying, and social contact). Previous studies using child-OIDP have reported the prevalence of impact on OHRQoL ranging from 28.6% to 89.8%.[6,16,17,18] Among these studies, the "eating" daily activity has been the most negatively affected activity.

Instruments of high quality are important to evaluate the reliability of data collected by an examination or clinical investigations.[24] The investigation of the assessment tool capacity to discriminate between affected and unaffected individuals is also essential. OHRQoL measures play an important role in clinical practice, used for identifying patients' needs and selecting therapies.[25] Therefore, the ability of such measures to identify oral disorders and treatment necessities of a population becomes imperative for the development of efficient oral health programs.

However, the assessment of OHRQoL in children can be difficult due to their limited understanding of what is being evaluated.[26] It is possible that when applying different OHRQoL assessment tools in the same population of children, the prevalence of impact, as well as the discriminant validity of the instruments, might by different. This becomes a problem when researchers seek to compare results obtained through different questionnaires.

Thus, the aim of this study was to evaluate the correlation between the CPQ_{8-10} and child-OIDP indexes according to their total and item scores, as well as assess the discriminant validity of these assessment tools regarding dental caries and malocclusion among schoolchildren.

Methods

Study population

A cross-sectional study was carried out with schoolchildren aged 8 to 10 years, recruited in two public schools randomly selected in the city of Diamantina, Brazil. Children with any systemic disorder that could affect cognitive development were excluded from the study. The present study was conducted in accordance with the STROBE statement for cross-sectional studies.[27]

The sample size was calculated using the formula for the estimate of linear correlation between two quantitative variables.[28] Taking into account a two-sided α of 0.05 and β of 0.10, 113 children would be needed to ensure that a correlation coefficient of 0.30 was significantly different from the null hypothesis. The hypothesis of this study was that there is some correlation between the instruments. To compensate possible losses, an extra 37 participants were selected for each group, totaling 300 children.

Evaluation of impact on OHRQoL and socio-demographic data

Children were asked to answer the Brazilian versions of the CPQ_{8-10}[15] and child-OIDP[14], and their parents/caregivers were asked to fill out a questionnaire addressing socio-demographic data, such as household income (categorized based on the Brazilian monthly minimum salary = approximately US$ 200,00), and maternal schooling (years of study). The sample was split into two groups, G1 (n = 150) and G2 (n = 150). G1 initially answered the CPQ_{8-10}, whereas G2 answered the Child-OIDP. A week after, G1 answered the child-OIDP and G2 answered the CPQ_{8-10}.

The CPQ_{8-10} index is composed of 25 items, which address four subdomains: oral symptoms, functional limitations, emotional well-being, and social well-being. The answers have five options: never (0), once or twice (1), sometimes (2), often (3) and every day or almost every day (4); the total score may vary from 0 to 100 points. The children were asked to answer the questionnaire based on oral problems perceived on the last one month preceding the assessment.

The child-OIDP index was applied in two phases. On the first phase, the children answered a questionnaire about 17 oral problems perceived on the last three months preceding the assessment. On the second phase, children reported the negative effects (or no effect) that each oral problem generated on 8 daily activities (eating, speaking, mouth cleaning, sleeping, smiling, emotional status, studying, and social contact). The impact of each perceived oral problem was also evaluated taking into account its gravity (no effect, little effect, moderate effect, or severe effect) and frequency (1 = once or twice a month, 2 = three times or more a month, or 3 = three or more times a week). A facial scale was used to facilitate the children's comprehension of the level of impact, which was attributed the same answer options of the original version.[5] Three response options were used to measure the frequency of each impact. The child-OIDP score is calculated by multiplying the frequency and gravity perceived on each daily activity, resulting in a partial score that can range from 0 to 9. The sum of the 8 daily activities varies from 0 to 72. This sum is multiplied by 100 and divided by the maximum possible score (72), to give a percentage score. Thus, the total score can vary from 0 to 100. The higher the scores of both instruments, the greater is the negative impact on quality of life.

Oral examination

The children were submitted to a clinical examination that evaluates malocclusion based on the Dental Aesthetic Index (DAI),[29] and dental caries measured by WHO criteria (DMFT index).[30] The DAI addresses 11 parameters of dentofacial disorders related to both clinical and esthetic aspects: missing anterior teeth, midline diastema, maxillary and mandibular incisal spacing, anterior maxillary and mandibular crowding, largest anterior irregularity in the mandible and maxilla, anterior maxillary overjet, anterior mandibular overjet, anterior open bite, and antero-posterior molar relationship. The DAI index assesses malocclusion using four scores, with priorities and orthodontic treatment recommendations assigned to each grade: 1 (DAI ≤ 25), normal or minor malocclusion/no treatment needed; 2 (DAI 26-30), definite malocclusion/treatment is elective; 3 (DAI 31-35), severe malocclusion/treatment is highly desirable; and 4 (DAI ≥ 36), handicapping malocclusion/treatment is mandatory. For statistical analysis, the variable was dichotomized, recording malocclusion as "absent" (DAI≤25) or "present" (DAI>26).The WHO criterion (DMFT index) evaluates teeth that are cavitated, filled or lost due to dental caries, recording these conditions as "present" or "absent".

The oral exam was performed by two examiners who underwent training and calibration using the DAI and WHO criteria to evaluate malocclusion and dental caries, respectively. First, a clinical exam was performed at a school with 50 children, in order to calculate the inter-examiner Cohen Kappa. In a second time, 30 children were reexamined for the calculation of the intra-examiner Cohen Kappa values. The Cohen Kappa agreement was satisfactory (greater than 0.80) for all clinical conditions.

Data analysis

Data analysis was performed with the aid of the Statistical Package for Social Sciences (SPSS for Windows, version 20.0, SPSS Inc. Chicago, USA) and included descriptive analysis for the socio-demographic data, presence of dental caries and malocclusion, and total scores of child-OIDP and CPQ_{8-10}. The Kolmogorov-Smirnov test was used to determine the distribution of the quantitative variables. Since the distribution was non-normal, the Mann-Whitney test was used to analyze the discriminative validity of each questionnaire in relation to dental caries and malocclusion, using a significance level of 5%. Furthermore, the effect size was investigated.

Spearman's correlation coefficient was calculated to determine the strength of the correlation between child-OIDP and CPQ_{8-10} indexes. The classification

suggested by Landis and Koch[31] was assumed to interpret the correlation coefficient values: less than 0 = no correlation; between 0 and 0.19= poor correlation; between 0.20 and 0.39 = fair correlation; between 0.40 and 0.59 = moderate correlation; between 0.60 and 0.79 = substantial correlation; and between 0.80 and 1.00 = almost perfect correlation. The Cronbach's alpha values of 0.79 and 0.89 were found for child-OIDP and CPQ_{8-10}, respectively.

To correlate each domain of both questionnaires, the items of CPQ_{8-10} were organized to match the eight activities of child-OIDP. Since the child-OIDP daily activity "mouth cleaning" had no equivalence in the CPQ_{8-10}, only seven activities were used to perform the analysis. Similarly, some items from the CPQ_{8-10} were excluded from analysis due to the absence of equivalence with the other instrument: "How often have you felt pain in your teeth or mouth in the past four weeks?"; "How often have you had sore spots in your mouth in the past four weeks?"; "How often have you had food stuck in your teeth in the past four weeks?"; and "How often have you had bad breath in the past four weeks? Therefore, the correlation between both CPQ_{8-10} and Child-OIDP indexes was performed based on seven overall activities: eating, speaking, sleeping, smiling, emotional status, studying, and social contact.

Ethical considerations

This study received approval from the Human Research Ethics Committee of the Federal University of Jequitinhonha and Mucuri Valleys, Diamantina, Brazil (protocol number 045/2011). All parents or caregivers signed a statement of informed consent.

Results

Three hundred children aged between eight and 10 years participated in the present study. No questionnaire was excluded from the analysis due to incomplete data. The prevalence of malocclusion and dental caries was 69.7% and 62.0%, respectively. Other socio-demographic characteristics of the sample are described in the Table 1.

The CPQ_{8-10} score ranged from 0 to 74 (mean: 13.15; SD = 11.57), and the child-OIDP score ranged from 0 to 100 (mean: 15.13; SD = 15.23). According to the CPQ_{8-10}, the prevalence of impact on OHRQoL was 99% in the present study, whereas according to the child-OIDP, the prevalence of impact was 85.3%. When total scores of both instruments were analyzed, no significant difference was observed (p = 0.359) (Table1).

A moderate correlation (r = 0.419; p < 0.001) was found between the total scores of CPQ_{8-10} and child-OIDP. Regarding the daily activities of both instruments, moderate and significant correlations (r = 0.413; p < 0.001 and r = 0.453; p < 0,001) were observed for "sleeping" and "social contact", respectively. Other daily activities had poor, fair or no correlation (Table 2).

Significant differences among children with and without malocclusion were not found when child-OIDP was applied. However, a significant difference was observed among children with and without dental

Table 1. Descriptive statistics of the participating children (n = 300).

Variables	n (%)
Sex	
Male	118 (39.3)
Female	182 (60.7)
Malocclusion	
Absence	91 (30.3)
Presence	209 (69.7)
Dental caries	
Absence	114 (38)
Presence	186 (62)
Mother's schooling	
Without study	9 (3)
1 to 4 years of study	11 (3.7)
5 to 8 years of study	85 (28.3)
9 to 11 years of study	151 (50.3)
Incomplete Graduate	5 (1.7)
Complete Graduate	37 (12.3)
Household Income	
< 1 monthly minimum salary	64 (21.3)
1 to 2 monthly minimum salary	122 (40.7)
2 to 5 monthly minimum salary	88 (29.3)
5 to 10 monthly minimum salary	26 (8.7)
Total score of instruments	
CPQ8-10 median (1st; 3rd)	9 (5; 17)*
Child-OIDP median (1st; 3rd)	8.3 (4.2; 26)*

*Wilcoxon test >0.05

caries in the "social contact" daily activity ($p < 0.035$). When the CPQ_{8-10} was applied, a significant difference was found among children with and without dental caries in the "emotional status" activity ($p < 0.014$). Moreover, significant differences were found among children with and without malocclusion in the "eating" ($p < 0.007$), "sleeping" ($p < 0.045$) and "studying" ($p < 0.011$) daily activities (Table 3).

Table 2. Correlation between daily activities subscales and total scores from CPQ_{8-10} and child-OIDP.

Daily activities from CPQ_{8-10} and child-OIDP	Spearman's rho	p-value
Eating	0.049	0.402
Speaking	0.091	0.115
Sleeping	0.413	< 0.000
Emotional Status	0.270	< 0.000
Smiling	0.162	0.005
Studying	0.360	< 0.000
Social Contact	0.453	< 0.000
Total scores of CPQ_{8-10} and child-OIDP	0.419[a]	< 0.001

Spearman's rho: Spearman's correlation coefficient; p-value: significant correlation ($p \leq 0.05$); [a]Spearman's correlation coefficient between total scores of the CPQ_{8-10} and the child-OIDP indexes.

Table 3. Discriminative validity of the child-OIDP and the CPQ_{8-10} according to the presence or absence of dental caries and malocclusion.

Variable	Presence of dental caries		Absence of dental caries		p-value	Presence of malocclusion		Absence of malocclusion		p-value
	Mean(SD)	CI 95%	Mean(SD)	CI 95%		Mean(SD)	CI 95%	Mean(SD)	CI 95%	
Child-OIDP										
Eating	2.35(2.45)	1.99-2.70	2.96(2.84)	2.43-3.48	0,116	2.45(2.52)	2.11-2.80	2.87(2.82)	2.28-3.46	0.367
Speaking	1.04(1.74)	0.79-1.29	1.21(1.92)	0.85-1.57	0.429	1.25(2.00)	0.98-1.53	0.76(1.19)	0.51-1.01	0.144
Sleeping	1.09(1.92)	0.81-1.36	1.02(1.70)	0.70-1.33	0.607	1.21(2.07)	0.92-1.49	0.73(1.08)	0.50-0.95	0.594
Smiling	0.96(1.41)	0.76-1,17	1.25(2.49)	0.78-1.71	0.301	0.94(1.50)	0.73-1.14	1.37(2.57)	0.84-1.91	0.797
Emotional status	1.85(2.38)	1.51-2.20	1.95(2.37)	1.51-2.39	0.726	1.93-2.42	1.60-2.26	1.80(2.29)	1.33-2.28	0.750
Studying	0.50(1.09)	0.34-0.66	0.91(2.10)	0.52-1.30	0.537	0.70(1.66)	0.48-0.93	0.55(1.31)	0.27-0.82	0.727
Social contact	0.49(1.27)	0.31-0.68	0.75(1.78)	0.41-1.08	0.035*	0.46(1.24)	0.29-0.63	0.89(1.91)	0.49-1.29	0.104
Total score	14.11(12.63)	12.28-15.93	16.79(18.65)	13.33-20.25	0.869	15.29(15.94)	13.12-17.47	14.74(13.52)	11.92-17.55	0.745
CPQ_{8-10}										
Eating	2.02(2.57)	1.64-2.39	1.68(2.19)	1.28-2.09	0.378	1.64(2.29)	1.33-1.95	2.46(2.66)	1.91-3.02	0.007*
Speaking	0.13(0.53)	0.05-0.21	0.25(0.74)	0.11-0.38	0.106	0.21(0.70)	0.11-0.31	0.09(0.38)	0.01-0.17	0.109
Sleeping	0.28(0.81)	0.17-0.40	0.18(0.66)	0.05-0.30	0.214	0.31(0.87)	0.19-0.43	0.09(0.38)	0.01-0.17	0.045*
Difficulty smiling	0.27(0.75)	0.17-0.38	0.25(0.63)	0.13-0.36	0.616	0.23(0.69)	0.14-0.33	0.33(0.73)	0.18-0.48	0.181
Emotional status	1.68(2.05)	1.38-1.97	1.48(2.26)	1.06-1.90	0.014*	1.57(2.13)	1.28-1.86	1.68(2.14)	1.23-2.13	0.704
Studying	0.62(1.14)	0.46-0.79	0.57(1.45)	0.30-0.84	0.130	0.17(1,41)	0.52-0.91	0.35(0.79)	0.19-0.52	0.011*
Social contact	0.26(0.65)	0.16-0.35	0.68(1.72)	0.36-1.00	0.415	0.40(1.17)	0.24-0.56	0.46(1.25)	0.20-0.72	0.868
Total score	13.71(10.77)	12.15-15.27	12.24(12.77)	9.87-14.61	0.056	13.49(12.42)	11.80-15.19	12.36(9.34)	10.42-14.31	0.940

Mann-Whitney test. *Statistically significant difference ($p<0.05$).

Discussion

The present study revealed a moderate correlation between total scores of CPQ_{8-10} and child-OIDP. The application of these assessment tools was carried out in two steps to two groups (G1 and G2), aiming to minimize the potential order effect that might occur as children get familiar with some questions from the first instrument, consequently affecting responses given to the second instrument.[32] Even though a moderate correlation was found, the CPQ_{8-10} and child-OIDP revealed different results concerning activities associated with the presence or absence of dental caries and malocclusion. Thus, the authors suggest the development of future studies, aiming to identify possible reasons for such divergences between both assessment tools.

The child-OIDP revealed a lower prevalence of impact on OHRQoL when compared to CPQ_{8-10}. However, the quantitative data analysis showed no significant difference between both instruments applied to the same sample. Thus, further studies should analyze OHRQoL assessment tools in a quantitative way, considering their total scores. Also, further studies should investigate the performance of these instruments considering the severity of dental caries and malocclusion. Due to the high prevalence of impact on OHRQoL in most studies using CPQ_{8-10}, it is possible to infer that this instrument is more sensitive than the child-OIDP in detecting children who have low caries severity and less malocclusion.

The present study found an 85.3% prevalence of impact on OHRQoL measured by child-OIDP, which is comparable to those values found in other countries, such as in Peru (82%) and Thailand (89.8%).[10,11] For the CPQ_{8-10}, a prevalence of impact of 99% was revealed, a greater value compared to other Brazilian findings (29.5% and 47%).[20,21] The discrepancy observed between the present investigation and other Brazilian studies may be explained by the fact that the mentioned studies have been carried out with children from both public and private schools, unlike our study that evaluated only children from public schools. In Brazil, children attending public schools generally present a lower socioeconomic status (SES).[21,33,34] Moreover, low SES is closely associated with a worse psychological and cognitive functioning,[35] which in turn could affect the children's understanding of the questionnaires. Previous studies have revealed that socioeconomic factors exert a direct influence on answers regarding the impact of adverse health conditions on quality of life.[36,37] Comparing to studies carried out in other countries[22, 23], the present finding also revealed a higher prevalence of impact measured by the CPQ_{8-10}. This difference could be attributed to the oral health condition of the children, different perceptions of OHRQoL in distinct cultural settings, or a combination of both factors.[22] Therefore, further studies should be conducted with children from different cultural and social conditions to clarify such discrepancies.

The high prevalence of impact on OHRQoL found by the CPQ_{8-10} can also be justified by the sensibility of the assessment tool. Additionally, the value found was attributed considering a score greater than or equal to the cutoff point of 1. Thus, the higher the number of items of an instrument, the greater the likelihood of a higher score. Therefore, these results must be interpreted with caution, since many variables could affect the final outcomes.

The present investigation provides substantial and original evidence that the measures of OHRQoL by the child-OIDP and CPQ_{8-10} indexes can be divergent when both are applied to the same population. This finding could limit an adequate treatment planning and, consequently, the development of public health programs might be impaired. Furthermore, both instruments exhibited significant associations with dental caries in different dimensions, and these differences should be evaluated in future studies. Longitudinal studies are also needed to assess the responsiveness of the child-OIDP and the CPQ_{8-10} after treatment for dental caries.

Conclusion

The CPQ_{8-10} and the child-OIDP indexes revealed a moderate correlation between their total scores. Concerning the discriminative validity, both

instruments were incapable of distinguishing children with and without dental caries and/or malocclusion by their total scores. However, the instruments discriminated children with and without those oral disorders in different dimensions. Thus, both instruments demonstrated a different capacity to assess the impact on OHRQoL among schoolchildren.

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