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Oral health-related quality of life in children: Part II. Effects of clinical oral health status. A systematic review

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Abstract: *Objective:* Children are affected by numerous oral and orofacial disorders, which have the potential to compromise functioning, well-being and the quality of life (QoL). The purpose of this paper was to review the literature about children's clinical oral health status and health-related quality of life (HRQoL) and to assess the respective association. *Materials and methods:* The authors searched Medline, ISI, Lilacs and Scielo for articles from 1985 to 2007. The inclusion criteria were randomized, cross-sectional, longitudinal or retrospective studies that used well-validated oral health-related QoL instruments, children self-applied questionnaires and quantitative measurements of clinical oral health status. *Results:* Of the 402 articles that were critically assessed, 12 studies were included in the critical appraisal of the project. *Conclusions:* There is a relationship between clinical oral health status and HRQoL in children. In the studies that suggested weak relationships between children's oral conditions and HRQoL, the explanations were low disease levels in the sample, the conditions under investigation may have caused immeasurably low levels of impact or the impacts were mediated by inter- and intravariables according to culture and education. Moreover, relationships between biological or clinical variables and HRQoL outcomes are not direct, but mediated by a variety or personal, social and environmental variables, as well as by the child development, which have influence on the comprehension about the relationship among health, illness and QoL. So, longitudinal studies are necessary to determine validity, responsiveness and minimal clinically important difference.

Key words: children; clinical oral health status; quality of life; systematic review

Introduction

The assessment of quality of life (QoL) has become an integral part of evaluating health programmes. A number of approaches have been developed and vary from broad-based instruments, such as the Short Form 36 (1) to more specific health-related measures (2). Over the past two decades, there was substantial development of oral health-related QoL assessments (3). These have been generated for adult participants. More recently, there has been an interest in the QoL in children (4, 5), including oral health (6, 7).

Oral health was defined as the standard of oral and related tissue health that enables individuals to eat, speak and socialize without active disease, discomfort or embarrassment, and that contributes to general well-being (8). Traditional methods of measuring oral health use mainly clinical dental indices and focus on the absence or presence of oral diseases without information about the oral well-being of people in terms of feelings about their mouths or, for example, their ability to chew and enjoy their food (9). For that reason, QoL measures were developed to help to evaluate both the physical and psychosocial impact of oral health. These are an attempt to quantify the extent to which dental and oral disorders interfere with daily life and well-being together with the outcomes of clinical care, such as the effectiveness of treatment interventions (e.g. 10, 11). Children were also considered, as they are affected by numerous oral and orofacial disorders, all of which have the potential to compromise functioning, well-being and QoL (12). These range from common conditions, such as dental caries and malocclusions, to relatively rare conditions, such as cleft lip and/or palate and craniofacial anomalies.

Associations were found between psychological variables and dysfunction in children (13, 14). A small but clinically challenging population of children and adolescents became chronic reporting not only pain, but also associated emotional distress and disability (15, 16). Palermo (17) reviewed the impact of chronic pain on child and family functioning, and found widespread interruption in tasks of everyday life (e.g. sleep, schooling, peer relations and physical activity).

A recent Medline search found that the number of articles listed under the key words 'child oral health-related quality of life' had increased dramatically. Indeed, the number of articles published between 2000 and 2006 was three times higher than that between 1995 and 1999, and six times higher than that between 1990 and 1994. However, to date, no systematic reviews exist on child oral health-related quality of life (OHRQoL). Accordingly, a systematic review on child OHRQoL became important to identify which clinical conditions affect child's everyday life considering his/her self-perception. Thus, the purpose of this study was to identify the literature on child clinical oral status and health-related QoL, review the findings systematically, and assess the nature and consistency of any relationship between clinical status and OHQoL.

Materials and methods

Question addressed by this review

What is the relationship between clinical oral health status and quality of life in childhood?

Literature searching

The Medline, ISI, Lilacs, Scielo computerized literature databases were searched for articles, from January 1985 to October 2007, which had the following terms in the title or abstract: 'QoL', 'oral' and 'children'. A total of 402 records were originally identified.

In a second step, two researchers independently selected the articles to be collected by reading the title and abstracts. Only original articles were considered. Interim reports, abstracts, letters, short communications and chapters in textbooks were discarded. In this phase, 100% agreement was obtained between the two researchers. The reference lists of the selected articles were also searched manually for additional relevant publications that may have been missed in the database searches.

The two researchers independently evaluated the selected complete articles. A consensus was reached with regard to articles that actually fulfilled the inclusion criteria, and were finally included in this systematic review.

Inclusion and exclusion criteria

Studies were eligible for review if they matched the following inclusion criteria: (1) used specific and well-validated HRQoL instrument for children; (2) the search was limited to randomized, cross-sectional (CS), longitudinal and retrospective studies (RS); (3) the questionnaires were self-applied by the children; and (4) the studies provided quantitative measurements of clinical oral health status. Oral health was considered as free from oral diseases, which have six major categories: dental and periodontal infection, mucosal disorders, oral and pharyngeal cancers, development disorders and certain chronic and disabling conditions affecting the craniofacial complex, including orofacial pain (18).

A well-validated HRQoL instrument was considered to be an instrument that had the ability to assess the patient's self-reported perception of health status and that had been shown in the scientific literature to be valid, reliable and responsive, including at least an assessment of physical function, mental status and social interaction (19, 20).

Narrative reviews and studies involving patients who had undergone treatment that could have altered their oral environment, such as radiotherapy and/or chemotherapy for maxillofacial trauma were excluded. Studies involving patients with oral mucosa disease, with both oral and other systemic symptoms, were also excluded because factors not related to oral health might also have affected subjects' health-related QoL. Figure 1 shows the screening process to select articles for the review.

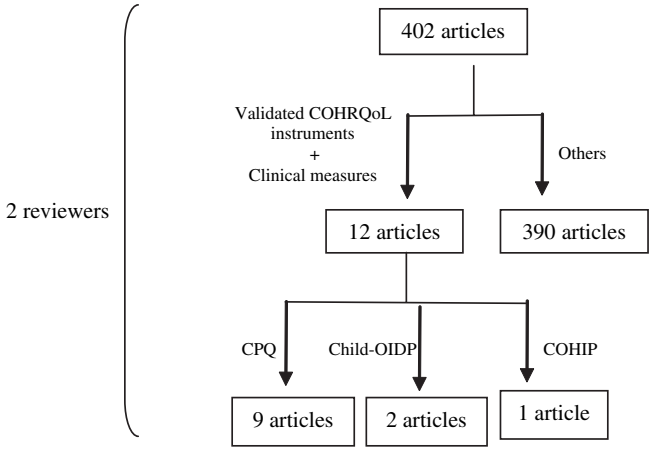

Fig. 1. The screening process to select articles for the review.

Results

Of the 402 articles that were critically assessed, 12 studies (21–32) identified during the search were included in the critical appraisal of the project, on the grounds that HRQoL instruments should therefore be used in conjunction with clinical measures. The commonest reason for exclusion was either a lack of clinical data or no validated OHRQoL instrument. Some narrative reviews were discarded. Several studies involving patients with certain disorders that could alter the oral environment were excluded. Studies in which children's HRQoL was measured using parents as informants were also excluded, as well as studies that have used adult QoL measures.

Three well-validated OHRQoL instruments were found in this review: Child-Oral Impacts on Daily Performances index (Child-OIDP), Child Oral Health Impact Profile (COHIP) and Child Perception Questionnaire (CPQ). Two studies (24, 29) used Child-OIDP, one study used COHIP (22) and nine studies (21, 23, 25–28, 30–32) used CPQ (Table 1).

All of the articles were observational and cross-sectional. Dental caries was highly associated with reduced health-related QoL in four studies (21, 23, 29, 31). One article (31) showed that higher levels of fluorosis were associated with more impacts on child OHRQoL. Of seven articles (23–25, 27, 28, 30, 31) that assessed malocclusion and QoL, six (23–25, 27, 30, 31) found statistical associations and one did not (28). One study (26) found that children with orofacial conditions (e.g. cleft lip or palate) rated their oral health better than children with dental conditions (e.g. dental caries). Other paper (22) showed that craniofacial group (e.g. cleft lip or palate) was found to report greater negative impact on their OHRQoL than either pediatric or orthodontic groups (e.g. decayed surfaces and greater overjet respectively). One study (32) suggested the importance of retaining primary teeth in children with severe hypodontia, to minimize the impacts on children's QoL. Oral impacts on their lives, particularly related to difficulty with cleaning, were experienced by children with bleeding and swollen gums (24). One study (27) suggested the influence of socioeconomic disparities in child OHRQoL. A summary of the results of each selected article is presented in Table 2.

Discussion

A total of 402 articles were retrieved and 12 articles were selected for the review. Of all the studies, 11 found associations between clinical oral health status and health-related QoL. The different oral diseases were chosen in these studies due to the distinct clinical characteristics that were expected to have differential effects on the children's QoL, thus maximizing variation for validity testing. The following sections discuss the results.

Dental caries, fluorosis and children's quality of life

Dental caries is the commonest chronic disease of childhood. The World Health Organization (WHO) has estimated that 60–90% of all school-age children are affected (33, 34). It was hypothesized that children with greater dental caries experience would have higher impacts on their QoL, suggesting they are likely to have experienced more oral pain, had difficulties with chewing, have been worried or upset about their mouths or to have missed school due to their cumulative disease

Table 1. **Selected articles: summary of methodology**

First author	Year published	Reference	Study design	Number of subjects	Age (years)	OHQoL instruments
Brown	2006	(21)	CS	174	11–14	CPQ
Broder	2007	(22)	CS	523	8–15	COHIP
Foster Page	2005	(23)	CS	430	12–13	CPQ
Gherunpong	2004	(24)	CS	1126	11–12	Child-OIDP
Kok	2004	(25)	CS	204	10–12	CPQ
Locker	2005	(26)	CS	71	11–14	CPQ
Locker	2007	(27)	CS	370	11–14	CPQ
Marshman	2005	(28)	CS	89	11–14	CPQ
Mtaya	2007	(29)	CS	1601	12–14	Child-OIDP
O'Brien	2007	(30)	CS	147	11–14	CPQ
Robinson	2005	(31)	CS	174	12	CPQ
Wong	2006	(32)	CS	25	11–15	CPQ

OHRQoL, oral health-related quality of life; CS, cross-sectional; CPQ, child perception questionnaire; COHIP, child oral health impact profile; Child-OIDP, child-oral impacts on daily performances.

experience (23), showing an indirect effect of clinical signs on daily functioning via reported symptom status, as predicted by Wilson and Cleary (20). Further, despite low levels of dental caries and fluorosis, children experienced appreciable impacts on oral HRQoL (31). Brown & Al-Khayal (21), applying the same questionnaire as used in two of the above-mentioned studies (23, 31), found significant correlation only between the decayed, missing and filled teeth index (DMFT) and the oral symptom subscales, but not with other domains (functional limitations, emotional well-being and social well-being) in Arabian children. These contradictory outcomes suggest that cultural norms and expectations influence children's perception of their oral health and its effect on their QoL, as considered, as causal pathways between clinical variables may include individual and environment variables as both moderators and mediators (20).

In this way, studies of the relationship between the number of carious teeth and the OHRQoL are subject to criticism, as a result of the conceptual distinction between health and disease. Consequently, although dental caries is relatively prevalent, it may not affect the child's ability to perform daily activities in its early stages. This implies that the relationship between OHRQoL and clinical indicators should be interpreted with caution, as the inconsistencies found in the relationships between clinical data and OHRQoL may not be due to the psychometric properties of the measures, but due to the fact that impacts are mediated by other factors. All contemporary models of disease and its consequences, such as that of Wilson and Cleary (20), indicate that the relationships between biological variables and HRQoL outcomes are not direct, but mediated by a variety or personal, social and environmental variables. In addition, it has been suggested that cultures and material deprivation can influence the extent of the impact of disease (32).

Variables such as general health status, household income and life stress have been shown to explain as much variance in the impact of oral disorders on adults as clinical indicators such as missing teeth (35). Socioeconomic disparities in OHRQoL in a group of children were found in Locker study (27). That is, children from low-income households had higher impacts on QoL than children from high-income households, indicating poorer OHRQoL. Further, household income remained a predictor of OHRQoL scores after controlling for the potential confounding effects of oral diseases and disorders such as dental caries, dental injury and malocclusion. A potential explanation may be differences in psychological assets and psychosocial resources.

Malocclusion and children's quality of life

Considering the categories of malocclusion severity, Foster Page *et al.* (23) observed a distinct gradient in the mean of emotional and social well-being domain scores, whereby those in the 'Handiccapping' category had the highest scores and those in the 'Minor/none' category had the lowest ones, on average. Similarly, O'Brien *et al.* (30) found statistically significant difference between the malocclusion and non-malocclusion groups only for the emotional and social well-being health domains. Further, difficulty with smiling due to the position of teeth has been found to be one of the most important impacts of children's OHRQoL (24). These results suggest that the most significant impact of malocclusion on QoL is psychosocial, rather than conditions that influence oral health, such as oral or functional problems. However, according to O'Brien *et al.*, the CPQ was not developed specifically to measure the impact of orthodontic problems and some of the questions in the functional and oral symptoms subscales are not necessarily

Table 2. **Results of references appraised**

Reference	Subjects	Oral conditions	Material and files	Association between OHRQoL and clinical oral health status
(21)	Children aged 11–14 years	1. DMFT 2. Malocclusion	1. DMFT 2. Bitewing and Panoramic RX 3. Malocclusion examination (none, slight and moderate or severe) 4. CPQ	Subjects with both caries and malocclusion showed high impacts on QoL ($P < 0.05$)
(22)	Active treatment-seeking patients and community-based participants (aged 8–15 years)	1. Dental caries 2. Malocclusion 3. Craniofacial conditions	1. Decayed surfaces 2. Overjet 3. COHIP	Craniofacial group was found to report greater negative impact on their OHRQoL than either pediatric or orthodontic groups ($P < 0.05$)
(23)	Children with different categories of dental caries and malocclusion (aged 12–13 years)	1. DMFS 2. Malocclusion	1. Caries examination (WHO) 2. DAI 3. CPQ	Subjects with both severe malocclusions and greater caries experience showed higher impact on QoL ($P < 0.05$)
(24)	Thai students aged 11–12 years	1. Sensitive tooth 2. Oral ulcers 3. Toothache 4. Exfoliating primary tooth 5. Others	1. Oral examination (WHO) 2. IOTN 3. OHI-S 4. Child-OIDP	Oral impacts were mainly related to difficulty with eating and smiling ($P < 0.001$)
(25)	Students aged 10–12 years	1. Malocclusion	1. CPQ 2. IOTN AC	Children with a normative need for orthodontic treatment did not have a worse OHRQoL ($P < 0.001$)
(26)	Patients with dental caries and orofacial conditions (aged 11–14 years)	1. Dental caries 2. Cleft lip or palate 3. Craniofacial anomalies	1. Oral examination 2. CPQ	Both groups had impact on their QoL with few differences between them ($P < 0.05$)
(27)	Students aged 11–14 years	1. Dental caries 2. Malocclusion 3. Dental trauma 4. Fluorosis	1. DMFT 2. IOTN AC 3. DTI 4. Tooth Surface Index of Fluorosis 5. CPQ	Oral disorders had little impact on the HRQoL in higher income children but a marked impact on lower income children ($P < 0.05$)
(28)	Children with oro and oro-facial conditions (aged 11–14 years)	1. Dental caries 2. Malocclusion 3. Gingivitis 4. Enamel opacities	1. Caries examination 2. IOTN 3. Presence or absence of dental opacities 4. CPQ	Number of impacts correlated with the total number of missing teeth and missing teeth due to caries ($P < 0.05$)
(29)	Urban and rural children of primary schools (aged 12–14 years)	1. Caries experience 2. Oral hygiene 3. Gingivitis 4. Enamel opacities	1. DMFT 2. OHI-S 3. Child-OIDP	Oral impacts were mainly related to problems eating and cleaning teeth ($P < 0.001$)
(30)	One group with malocclusion and other group with no malocclusion (aged 11–14 years)	1. Crowding 2. Overjet 3. Hypodontia	1. IOTN DHC 2. IOTN AC 3. CPQ	Malocclusion had a negative impact on the OHRQoL in an adolescent ($P < 0.01$)
(31)	Rural students aged 12 years	1. Dental caries 2. Gingivitis 3. Calculus 4. Fluorosis	1. Oral examination (WHO) 2. TFI 3. CPQ	Despite low levels of dental caries and fluorosis, children experienced appreciable impacts on OHRQoL ($P < 0.05$)
(32)	Patients with hypodontia (aged 11–15 years)	1. Severe hypodontia	1. Oral examination 2. CPQ	Patients with severe hypodontia reported OHRQoL impacts ($P < 0.05$)

OHI-S, simplified-oral hygiene index; DMFS, dental caries prevalence; TFI, index of Thylstrup and Fejerskov; IOTN, index of orthodontic treatment need; IOTN AC, index of orthodontic treatment need – aesthetic component; DAI, dental aesthetic index; DMFT, decayed, missing and filled teeth index; DTI, dental trauma index; IOTN DHC, index of orthodontic treatment need – dental health component; OHRQoL, oral health-related quality of life.

relevant to patients with malocclusion. Nevertheless, Kok *et al.* (25) using different questions to test the construct validity of CPQ in schoolchildren, found the same results as the studies above (23, 30) and only one study (28) found no relationship between malocclusion and QoL in children. This may reflect the difficulties that children may have with the concept of 'oral health' in relation to malocclusion (27). These contradictory outcomes can be explained by the use of some OHRQoL measures in orthodontics, as is the Index of Orthodontics Treatment Need (IOTN) (36) which can emphasize malocclusion that may not be important to QoL, such as posterior cross bites (28). Moreover, different meanings of QoL vary between and within individuals (37) according to culture and education (38), contributing for distinct impacts of malocclusion on OHRQoL.

Cleft lip and palate and children's quality of life

Because cleft lip and palate are more clinically severe and can affect facial appearance throughout life, it has been assumed, not unreasonably, that they will have a correspondingly greater impact on the QoL. Nonetheless, as stated by Locker and Slade (35), health and disease belong to different dimensions of human experience; so, paradoxes occur when disease is assumed by researchers to cause an impact. Relevance is possibly the intervening variable mediating between disease and impact. In this way, Broder and Wilson-Genderson (22), using COHIP questionnaire, showed that craniofacial patient was found to report greater negative impact on their OHRQoL than either the general pediatric or orthodontic patients. In accordance with Gregory *et al.* (37), oral health varies between people and over time, demonstrating the existence of response shift in relation to QoL. Such variation and change emerges through OHRQoL as the recursive relationship between impact and relevance, the individual and the social structure. For these authors (37), OHRQoL can be defined as the cyclical and self-renewing interaction between the relevance and impact of oral health in everyday life. In addition, Locker *et al.* (26), using CPQ questionnaire, observed that the majority of children with orofacial conditions are well adjusted and able to cope with the adversities they experience as a result of their conditions. They also observed that the orofacial group may encounter more challenges in daily life (mouth breathing, problems with speech, missing school, being teased and being asked questions about their functional condition). Moreover, the overall QoL in those children was not different from children with commoner oral conditions, such as dental decay, but children with orofacial conditions rated their oral health better than the ones with dental decay. This comparison of the two scales highlighted the COHIP's relative discriminative abilities and sensitivity to detect differences.

Hypodontia and children's quality of life

Few studies have been conducted among subjects with severe hypodontia, which in part, relates to the very low prevalence of the condition (less than 1% in the general population) and to the lack of appropriate measures with which to assess the impact of oral conditions on QoL, particularly among children, until recently. Only one study about the impact of severe hypodontia on oral HRQoL was met in this literature search (32), in which all subjects with severe hypodontia reported considerable impact on OHRQoL, with one or more oral health, oral symptoms and social impacts, and the majority experienced functional limitations and impacts on emotional well-being. Such data confirm that chronic oral conditions can influence an individual's wider well-being by impacting on everyday physical, psychological and social functioning (39). The number of missing permanent teeth was moderately correlated with OHRQoL. However, when retained primary teeth were taken into account, the number of missing teeth was highly correlated with OHRQoL, suggesting the importance of retaining primary teeth in children and adolescents with severe hypodontia. However, the authors emphasized that given the cross-sectional study design, an association rather than evidence of causation was observed. Further studies are warranted to confirm or refute these findings.

Gum problems and children's quality of life

Gum problems were the other important oral conditions affecting children's OHRQoL, as shown by Gherunpong *et al.* (24), as more than one-fifth of children perceived that bleeding and swollen gums caused oral impacts on their life, particularly in relation to difficulty cleaning, a problem experienced by nearly half of all children. Moreover, children who had difficulty with cleaning their teeth because of gum inflammation are unlikely to achieve good levels of oral hygiene, because brushing may lead to bleeding, and their gum problems would undoubtedly persist or even get worse. It is apparent that an important reason for the high prevalence of oral impacts in children is due to natural processes, such as exfoliating primary teeth or space due to a non-erupted permanent tooth. In addition, sensitive teeth, toothache, oral ulcers were factors that contributed significantly to the incidence of impacts in pre-adolescent children, and although this was high, the severity was not; many

children had their QoL affected at low levels. This reveals a need for further longitudinal studies to better understand and interpret OHRQoL measures in children.

Given the cross-sectional nature of the data studies, the observed findings addressed only the descriptive and discriminative potential of the OHRQoL measures in relation to child oral conditions. The following explanations may account for the weak relationships found between OHRQoL and clinical data: there are low disease levels in the samples, the conditions under investigation may cause immeasurably low levels of impact or that impacts are mediated by a variety of factors such as culture and deprivation (28). Although the observed prevalence of impacts was high in some studies, the severity was not; many children had their QoL affected at low levels (24, 25, 32). Furthermore, longitudinal studies need to be conducted to assess the evaluative properties of these OHRQoL measures. What needs to be considered is that the way people feel about their QoL does not develop in isolation from their existing expectations (that constrain what is relevant) as well as the environment in which the margins of relevance are constructed, as the meaning of QoL changes over time (37). Moreover, developmental changes unavoidably affect HRQoL between childhood and adolescence. Maturity and an increase in age generate a more sophisticated understanding and perceptions about health and illness (19), changing the perceptions about health and QoL in children (40).

Conclusions

On the basis of this systematic review, it can be concluded that there is a relationship between clinical oral health status and OHRQoL in children. Further studies evaluating other oral conditions should be carried out to maximize validity of the instruments. In the studies that suggested weak relationship between children's oral conditions and QoL, three principle explanations could account for this: there were low disease levels in the sample, the conditions under investigation may have caused immeasurably low levels of impact or the impacts could vary between and within individuals according to culture and education. Moreover, relationships between biological or clinical variables and HRQoL outcomes are not direct, but mediated by a variety or personal, social and environmental variables, as well as by the child development, which have influence on the comprehension about the relationship among health, illness and QoL. So, longitudinal studies are necessary to determine longitudinal validity, responsiveness and minimal clinically important difference.

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