

# Gingivitis and oral health-related quality of life: a systematic literature review

Gengivite e qualidade de vida relacionada à saúde bucal: uma revisão sistemática da literatura

Taís de Souza BARBOSA<sup>1</sup>, Maria Beatriz Duarte GAVIÃO<sup>1</sup>, Fábio Luiz MIALHE<sup>2</sup>

1 – Department of Pediatric Dentistry – Pedodontic Division – Piracicaba Dental School – State University of Campinas – UNICAMP – Piracicaba – SP – Brazil.

2 – Department of Community Dentistry – Division of Health Education and Health Promotion – Piracicaba Dental School – State University of Campinas – UNICAMP – Piracicaba – SP – Brazil.

## ABSTRACT

**Objective:** The aim of this study was to review systematically the literature about the relationship between gingivitis and oral health-related quality of life (OHRQoL). **Material and Methods:** Relevant databases were searched for articles in English, which had been published from October 1990 to February 2014. Two independent examiners selected relevant papers, by initially assessing the abstracts and subsequently the full-text articles. Selected studies were grouped based on clinical and OHRQoL instruments and submitted to qualitative analyses. **Results:** Out of 184 references, ten were eligible for synthesis. All studies were cross-sectional and reported data from the following four different countries: India (n = 1), Brazil (n = 3), Thailand (n = 5) and Sudan (n = 1). The number and age of subjects included ranged from 53 to 1874 and from eight to 106 years, respectively. The following five OHRQoL instruments were used: Oral Health Impact Profile (OHIP-14), Child Perceptions Questionnaire (CPQ), Oral Impacts on Daily Performance (OIDP), Child-OIDP and Geriatric Oral Health Assessment Index (GOHAI). The different methods to evaluate the presence of gingivitis were: Gingival Index (n = 2), Community Periodontal Index (n = 7) and gingival bleeding after tooth brushing (n = 1). **Conclusion:** This systematic literature review suggests that gingivitis is associated with impairment of OHRQoL.

## KEYWORDS

Gingivitis; Literature; Oral health; Quality of life; Review.

## RESUMO

**Objetivo:** O objetivo deste estudo foi revisar sistematicamente a literatura sobre a relação entre gengivite e qualidade de vida relacionada à saúde bucal (QVRSB). **Material e Métodos:** Bases de dados relevantes foram utilizadas para busca de artigos em Inglês, publicados entre Outubro de 1990 a Fevereiro de 2014. Dois examinadores independentes selecionaram os artigos relevantes, avaliando inicialmente os resumos e posteriormente os artigos completos. Os estudos selecionados foram agrupados de acordo com os instrumentos clínicos e de QVRSB e foram submetidos à análise qualitativa. **Resultados:** Das 184 referências, dez foram selecionadas para análise. Todos os estudos eram transversais e reportavam dados de quatro países: Índia (n = 1), Brasil (n = 3), Tailândia (n = 5) e Sudão (n = 1). O número e idade dos sujeitos avaliados variaram de 53 a 1874 e de oito a 106 anos, respectivamente. Os seguintes instrumentos de QVRSB foram utilizados: Oral Health Impact Profile (OHIP-14), Child Perceptions Questionnaire (CPQ), Oral Impacts on Daily Performance (OIDP), Child-OIDP e Geriatric Oral Health Assessment Index (GOHAI). Os diferentes métodos para avaliar a presença de gengivite foram: Índice Gingival (n = 2), Índice Periodontal Comunitário (n = 7) e sangramento gengival após escovação dentária (n = 1). **Conclusão:** A presente revisão sistemática da literatura sugere que a gengivite está associada com o comprometimento da QVRSB.

## PALAVRAS-CHAVE

Gengivite; Literatura; Saúde bucal; Qualidade de vida; Revisão

## INTRODUCTION

Gingivitis is the most prevalent form of periodontal disease. It begins in early childhood, increases in prevalence and severity into the early teenage years, and then subsides slightly and levels off until approximately 20 years of age [1]. The severity of the disease is directly related to the accumulation of biofilm due to poor oral hygiene. The presence of the biofilm for a period of 10 to 21 days is sufficient to establish a condition of gingival inflammation, but it is reversible if methods for controlling the biofilm are established [2].

A variety of clinical indicators have been used for the diagnosis of gingivitis, but there is still no consensus about the most effective measure for obtaining valid clinical data [3]. Moreover, the use of clinical measures alone has been criticized, as they give little indication of subjectively perceived symptoms and do not capture the impact of oral health on the individual as a whole [4]. Therefore, measures of oral health-related quality of life (OHRQoL) are being used more often to complement clinical measures and to explore the functional and psychosocial outcomes of oral disorders [4]. In addition, these measures function as important clinical indicators when assessing the oral health of individuals and populations, making treatment decisions, or evaluating dental interventions, services and programs.

In the literature, the impact of gingival disease on an individual is usually characterized through self-reported symptoms, such as bleeding gums or bleeding after tooth brushing [5]. However, with clinical measures such as Gingival Index (GI) [6] and Community Periodontal Index (CPI) [7], it is clear that gingival disease produces a wide range of clinical signs and symptoms, some of which may have a considerable impact on the patient's day-to-day life or quality of life [8]. Little is known about this aspect of the disease.

Thus, it is necessary to have a better understanding of the patient's perception of the

impact of gingival disease on their lives. It is also important to plan gingival care, which addresses patient's needs and key concerns. Finally, it is crucial to evaluate the outcomes of gingival treatments from the patient's perspective and to draw attention to the overall significance of gingival care [9].

The aim of this study was to conduct a systematic literature review of previously published data regarding the impact of gingivitis on OHRQoL from the patient's perspective. The question addressed by this review was whether gingivitis is associated with impairment of people's OHRQoL.

## MATERIAL AND METHODS

### *Systematic literature search*

Medline, Pubmed, Embase and the Cochrane Library were searched for articles that had been published from October 1990 to February 2014, using the following terms: "gingivitis" OR "gums" OR "gingival" AND "quality of life". Medical Subject Headings (MeSH) terms were used if the database search engine allowed this. Reference lists of the selected articles were also searched manually for additional relevant publications that may have been missed in the database searches (saturation). Only publications written in English were considered.

### *Study selection and eligibility criteria*

Two researchers independently selected the articles to be included by reading the title and abstracts. Studies were included if they met the following criteria: (1) they were observational studies, including cohort studies, randomized trials, cross-sectional (CS) and case-control studies [10], (2) they used specific OHRQoL self-measure and (3) they provided quantitative measurements of clinical oral health status. We excluded qualitative studies, case reports, (narrative) reviews, studies with incomplete sample information, insufficient methods or involving medically compromised

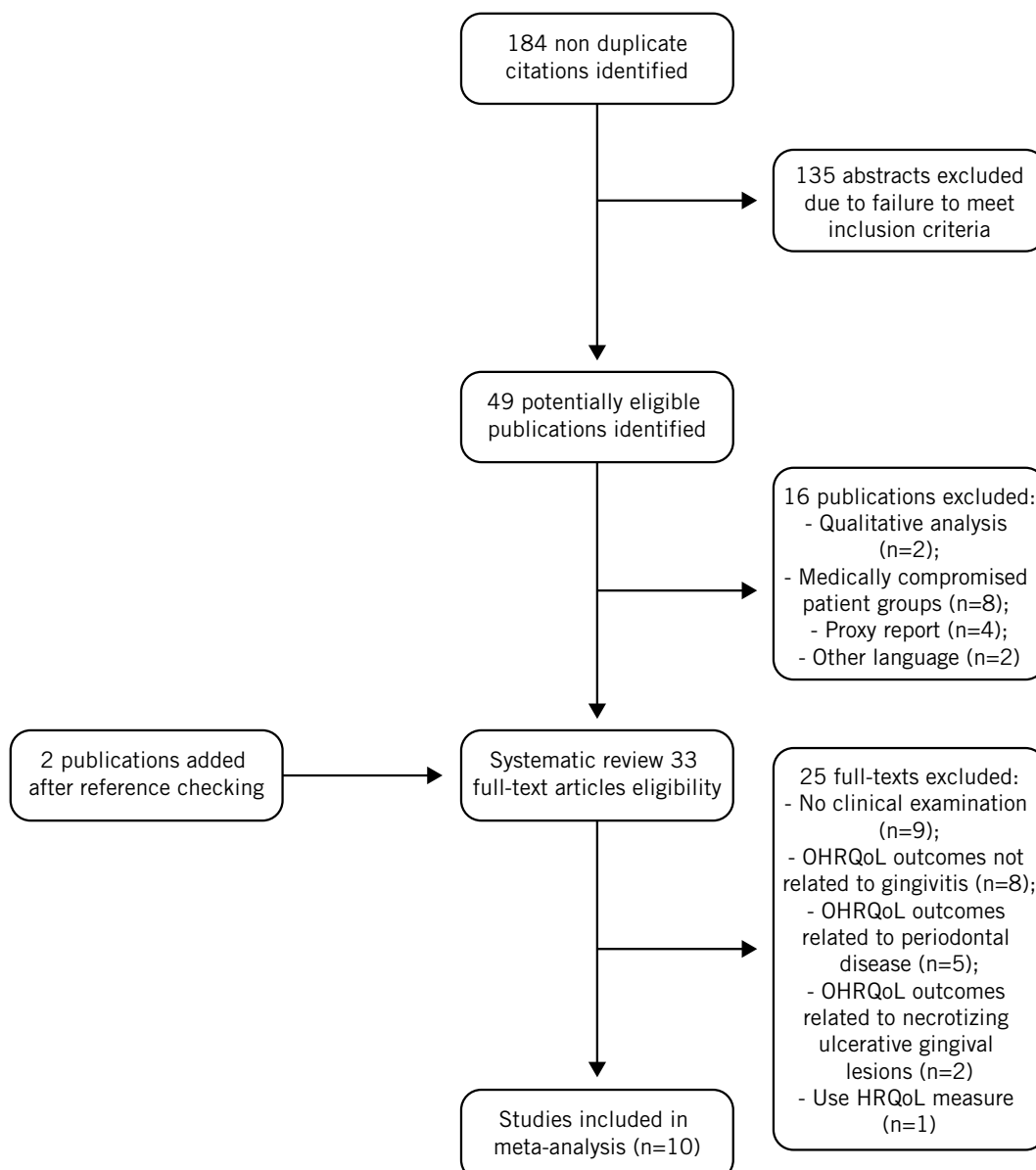
patient groups (e.g., irradiated patients and those with systemic diseases such as diabetes).

Inter-reader calibration at the beginning of the systematic literature review and duplicate selections throughout the study collection were carried out. The respective agreement using Kappa statistics was found to be 0.79. Disagreement between reviewers was discussed and resolved by consensus. A full copy of all potentially or definitely relevant studies was

retained for further assessment. The search procedure and reasons for exclusion of studies are shown in Figure 1. The intra-observer agreement for the final selection using Kappa statistics was found to be 0.90.

### Synthesis of data

Studies were grouped based on clinical and OHRQoL instruments used. The rationale for this grouping was the incompatibility of



**Figure 1** - Flowchart of publication selection for inclusion in the systematic review.

the various instrument-scoring systems. For qualitative analyses, study characteristics, main outcomes concerning gingivitis and other potentially relevant outcomes were extracted and grouped according to clinical and OHRQoL measures used.

## RESULTS

### Study characteristics

The main characteristics of the ten eligible CS studies are summarized in Table 1. Of these researches, one was conducted in India [11], three in Brazil [12-14], five in Thailand [15-19] and one in the Sudan [20]. The number and age of subjects included in these studies varied considerably, ranging from 53 to 1874 in number and from eight to 106 years of age, respectively. The following five OHRQoL instruments were found in this review: (1) Oral Health Impact Profile (OHIP-14) [11], (2) Child Perceptions Questionnaire (CPQ) [12], (3) Oral Impacts on Daily Performance (OIDP) [17,18,19], (4) Child-OIDP [13,15,16,18,19] and (5) Geriatric Oral Health Assessment Index (GOHAI) [20]. Two publications evaluated the

presence of gingivitis using GI scores [11, 20], seven used CPI scores [12,14,15,16-19] and one recorded gingival bleeding after tooth brushing [13] (Table 1).

The OHIP has 49 items designed to measure self-reported dysfunction, discomfort and disability attributed to oral conditions [21] in the adult population. The five response categories assigned values of 0-4, ranging from “never” = 0 to “very often” = 4. In 1997, Slade [22] developed the OHIP-14, which is a shorter version of the OHIP and consists of 14 items. These items are organized in seven subscales (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap), and address aspects of oral health that may compromise a person’s physical, psychological and social well-being. The CPQ is a group of self-completed questionnaires, designed to assess the frequency of the impact of oral conditions on the quality of life in children aged 8-10 years (CPQ8-10) [23] and aged 11-14 years (CPQ11-14) [24]. The CPQ8-10 and CPQ11-14 consist of 25 and 37 items, respectively. They are divided into four subscales:

**Table 1** - Description of the methodology of the studies included in the systematic review

Reference	Year published	Country	Study design	Number of subjects	Age (years)	Clinical measure	OHRQoL measure
11	2008	India	CS	414	18-65	GI	OHIP-14
12	2009	Brazil	CS	210	8-14	CPI	CPQ <sub>8-10</sub>
15	2009	Thailand	CS	1034	11-12	CPI	Child-OIDP
13	2010	Brazil	CS	571	11-12	Gingival bleeding after tooth brushing	Child-OIDP
20	2010	Sudan	CS	1109	12	GI	Child-OIDP
16	2012	Thailand	CS	1063	12	CPI	Child-OIDP
17	2012	Thailand	CS	811	15	CPI	OIDP
18	2012	Thailand	CS	1874	12 and 15	CPI	Child-OIDP OIDP
19	2012	Thailand	CS	1874	12 and 15	CPI	Child-OIDP OIDP
14	2012	Brazil	CS	587	60-106	CPI	GOHAI

CS, cross-sectional; GI, gingival index; CPI, community periodontal index; OHIP, oral health impact profile; CPQ, child perceptions questionnaire; OIDP, oral impact on daily performance; Child-OIDP, child oral impact on daily performance; GOHAI, geriatric oral health assessment index

(1) oral symptoms, (2) functional limitations, (3) emotional well-being and (4) social well-being. A four-point response format, ranging from “Never” = 0 to “Very often” = 4 is used for these questionnaires. The OIDP and Child-OIDP assesses the oral impacts during the past 6 and 3 months, respectively, in relation to eight daily performances (eating, speaking, cleaning mouth, relaxing, smiling, studying, emotion and social contact) in adolescents [25] and children [26]. For each performance, frequency and severity score (ranging from 0-5 for the OIDP and for 0-3 for Child-OIDP) are recorded. The GOHAI contains 12 questions about oral health, which are scored from 1 to 3, for a total score between 12 to 36, characterizing the worst and best assessment, respectively, of self-perceived oral health [27].

### *Qualitative analysis*

A summary of the research according to clinical measures is shown in Table 2. Two studies found statistically significant associations between GI scores and OHRQoL in adults [11] and schoolchildren [20]. Eight- to ten-year-old children without gingival bleeding on probing, recorded by CPI, rated their OHRQoL worse than those with gingivitis [12]. Other studies found negative impacts on OHRQoL of children [15] and the elderly [14] with normative treatment needs for periodontal disease, which was measured using CPI scores. Four publications showed that children [16,18,19] and adolescents [17-19] with extensive gingivitis, recorded by CPI, were more likely to report negative impacts on their OHRQoL. Worse OHRQoL was also associated with the perception of gingival bleeding after tooth brushing in 11- to 12-year-old children [13].

Table 3 summarizes the findings of the ten eligible publications according to the OHRQoL measure. One study used OHIP-14, which is a

shorter version of OHIP and consists of 14 items [11]. In this study, the results of a multivariate analysis showed GI scores to be significant impacting factors on OHRQoL in Indian dental patients. The CPQ study used mean total scores as outcome measures [12]. Differences in the mean scores showed that CPQ8-10 scores were higher for children without gingival bleeding on probing (CPI  $\geq$  1), indicating a worse OHRQoL. All studies using OIDP and/or Child-OIDP presented the differences between the clinical categories such as OR [13, 15-20], except for one publication that considered differences in the mean scores. The latter showed that Child-OIDP scores were higher for Thai students with normative treatment needs for periodontal disease, indicating worse OHRQoL [15]. Twelve-year-old students with mean GI scores  $>$  1 were 1.3 times more likely to report an impact than those with mean GI scores  $\leq$  1 [20]. Adolescents who presented with bleeding gums after tooth brushing reported a four times higher negative impact on their daily lives than those without gingival bleeding [13]. Children [16] and adolescents [17] with extensive gingivitis in 3 or more mouth sextants were twice as likely to experience moderate/high condition-specific impacts. At a moderate or higher level of condition-specific impact, there were significant associations of relationships with extensive gingivitis in 12- (OR = 2.1;  $p <$  0.01) and 15-year olds (OR = 2.2;  $p <$  0.05) [18]. Another study found significant association between gingivitis and negative impacts on relaxing (OR=2.0;  $p <$  0.05), smiling (OR = 1.7;  $p <$  0.01), studying (OR = 3.8;  $p <$  0.01) and social (OR = 2.2;  $p <$  0.01) contact in 12-year-olds, but not with any performance in 15-year-olds [19]. One study showed that elderly persons with gingival problems had 5.7 times more negative self-perception of OHRQoL, rated by GOHAI [14].

**Table 2** - Summary of studies according to clinical measure

Reference	Population, sample n, (% females)	Subject of the study	Main outcomes regarding gingivitis
<b>Gingival Index (GI)</b>			
11	Indian dental patients (n = 414) (♀58.0)	Description of the OHRQoL and its associated factors in Indian adult population.	GI scores were significant impacting factors on OHRQoL.
20	Sudanese schoolchildren from public and private schools (n = 1109) (♀50.1)	Estimation of the prevalence, severity and causes of oral impacts on daily performances in 12-year-old public and private schoolchildren.	Mean GI showed statistically significant association with OHRQoL.
<b>Community Periodontal Index (CPI)</b>			
12	Brazilian schoolchildren from public schools (n = 210) (♀50.0)	Assessment of the validity of the Brazilian-Portuguese version of CPQ in Brazilian children.	Children with gingival bleeding had lower impacts on the overall and emotional well-being domains than those without gingivitis.
15	Thai schoolchildren (n = 1034) (♀47.6)	Assessment of OHRQoL in groups defined by their normative treatment need.	OHRQoL overall score distinguished between children with and without normative treatment needs for periodontal disease, with the former presenting worse OHRQoL than the latter.
16	Thai schoolchildren (n = 1063) (♀50.4)	Assessment of association between oral diseases and OHRQoL in a nationally representative sample of 12-yr-old children	Children with gingivitis in three or more sextants were twice as likely to report condition-specific impacts.
17	Thai adolescents (n = 811) (♀52.0)	Assessment of association between oral diseases and OHRQoL as a basis for proposing OHRQoL-based goals for the population of 15-year-olds.	Adolescents with extensive gingivitis in 3 or more mouth sextants were twice as likely to experience moderate/higher condition-specific impacts.
18	Thai children (n = 1874) (♀51.0)	Assessment of association of socio-demographic, behavioural and the extent of gingivitis with OHRQoL in nationally representative samples of 12- and 15-year-old children.	At a moderate or higher level of condition-specific impacts, there were significant relationships with extensive gingivitis in 12- and 15-year-old children.
19	Thai children (n = 1874) (♀51.0)	Assessment of association between oral disease and OHRQoL in a nationally representative sample of 12- and 15-year-old children.	Gingivitis was significantly associated with impacts on relaxing, smiling, study and social contact in 12-year-olds, but not with any performance in 15-year-olds.
14	Brazilian institutionalized elderly (n = 587) (♀48.6)	Assessment of association among OHRQoL, objective and subjective conditions and oral health-related behaviour, individual traits, and environmental factors	Elderly with gingival problems had 5.7 times more negative self-perception of OHRQoL.
<b>Gingival bleeding after tooth brushing</b>			
13	Brazilian schoolchildren from public schools (n = 571) (♀61.4)	Assessment of association between OHRQoL and clinical oral health measures among scholars.	OHRQoL was associated with the perception of gingival bleeding after tooth brushing.

OHRQoL, oral health-related quality of life; OHIP, oral health impact profile; CPQ, child perceptions questionnaire

**Table 3** - Summary of studies according to clinical measure

Reference	Reference group	Continuous data		Dichotomized data	
		Mean	SD	OR	95% CI
<b>OHIP-14 (0-56)</b>					
11	GI score (n = 414)	0.249 (mean square)*	-	-	-
<b>CPQ<sub>8-10</sub> (0-100)</b>					
12	CPI $\geq 1$ (n = 73)	17.6	10.9	-	-
	CPI 0 (n = 137)	28.9	22.9	-	-
OIDP (0-100)	Gingivitis 3/more sextants (n = 287)	-	-	2.4	1.3-4.5
17	Gingivitis 1-2 sextants (n = 269)				
<b>Child-OIDP (0-100)</b>					
15	Need for periodontal treatment (n = 870)	0.72	2.61	-	-
	No need for periodontal treatment (n = 164)	1.26	2.60	-	-
13	Bleeding gums after tooth brushing (n = 259)	-	-	3.7	1.3-10.8
	No bleeding (n = 312)				
20	GI $\geq 1$ (n = 71)	-	-	1.3	1.0-1.7
	GI $\leq 1$ (n = 1038)				
16	Gingivitis $\geq 3$ sextants (n = 395)	-	-	1.9	1.0-3.8
	Gingivitis 1-2 sextants (n = 319)				
<b>OIDP and Child-OIDP</b>					
18	12-yr-old				
	Gingivitis 3/more sextants (n = 395)	-	-	2.1	1.3-3.3
	Gingivitis 1-2 sextants (n = 319)				
	15-yr-old				
	Gingivitis 3/more sextants (n = 287)	-	-	2.2	1.2-4.1
	Gingivitis 1-2 sextants (n = 269)				
19	12-yr-old (Domains: relaxing, smiling, study, social contact)				
	Gingivitis 4-6 sextants (n = 371)	-	-	2.0, 1.7, 3.8, 2.2	1.1-3.6, 1.1-2.5, 1.3-11.1, 1.2-4.2
	Gingivitis 1-3 sextants (n = 472)				
<b>GOHAI (12-36)</b>					
14	Presence of gingival problems (n = 330)	-	-	5.7	1.7-18.5

OHIP, oral health impact profile; CPQ, child perceptions questionnaire; OIDP, oral impact on daily performance; Child-OIDP, child oral impact on daily performance; GOHAI, geriatric oral health assessment index

Values in square brackets indicate range of possible scores

GI, gingival index; CPI, community periodontal index; SD, standard deviation; OR, odds ratio; CI, confidence interval

\*F = 1.752; p < 0.05 (multivariate analysis)

## DISCUSSION

In the present study, we conducted a systematic review of the literature on the relationship between OHRQoL and gingivitis.

Data from CS studies suggest that gingivitis can have a negative impact on daily life. This finding appears to be independent of the clinical and OHRQoL measures used.

There were apparent differences in OHRQoL associated with clinical gingival status. Those with higher GI scores had a poorer OHRQoL [11,20]. Adolescents who presented with bleeding gums after tooth brushing were four times more likely to report an impact on their daily lives than those without gingival bleeding [15]. Other studies considering a variety of forms of extension of gingivitis [gingival bleeding on probing, normative treatment needs, sextants], recorded by CPI, found worse OHRQoL in a wide age-range of population [children, adolescents and the elderly [12-14,16-19]. These results suggest that the OHRQoL measure is sensitive to gingival health, irrespective of whether it is self-reported or clinically observed [28]. In contrast, Barbosa et al. [12] found that children with gingivitis had a better OHRQoL than their counterparts. Additionally, eight out of 22 excluded studies found no association between the presence of gingivitis and OHRQoL scores [29-36]. These discrepancies in findings may be because the clinical instrument was not administered as a discriminative measure. Other explanations may be that there was oral disease in the sample of a small size, or that the impacts were affected by a variety of factors, such as relevance [12].

Given the limitations cited above, we used specific exclusion criteria for quality assessment of the included studies. In addition to being representative of larger populations, the studies also had to use clinical measures and well-validated OHRQoL instruments. Hence, nine out of 33 initially selected publications, which evaluated the impact on QoL only on patients' reported symptoms of gingivitis, were excluded from this systematic literature review [28,37-44]. The rationale for exclusion was that although these studies found statistically significant associations between self-perceived symptoms of gingivitis and OHRQoL, they failed to show evidence of the clinical impact of gingivitis on daily life. According to Tsakos et al. [45], subjective measures cannot replace clinical

measures. Therefore, to minimize the statistical weight of self-reporting, clinical and subjective measures should be complementary. However, if the objective is to assess QoL changes after a certain treatment modality, then the survey instrument may be acceptable.

We may have introduced a form of selection bias, as stated by Grégoire et al. [46] and Moher et al. [47], by only including articles written in English. However, this is a controversial subject. The effect of inclusion or exclusion of articles written in English was shown in two studies of meta-analyses. Exclusion of trials reported in a language other than English did not significantly affect the results of the meta-analyses [48]. However, non-English trials were more likely to produce significant results at  $p < 0.05$  because the average estimates of intervention effects were 16% (95% CI 3% to 26%) higher in non-English-language trials than in English-language trials [49]. Nevertheless, the extent and effects of language bias may have diminished recently because of the shift towards publishing studies in English (Cochrane manual on line).

We defined HRQoL instruments as well validated if they had the ability to assess the patient's self-reported perception of health status, had been shown in the scientific literature to be valid, reliable and responsive and included at least an assessment of physical function, mental status and social interaction [50,51]. According to Weintraub [52], discriminative ability is an important attribute of patient-centered measures if they are to play a role in understanding the consequence of gingivitis, identifying the need for treatment and helping in determining and planning the appropriate treatment method. In their study, Bernabé et al. [15] confirmed the ability of the condition-specific version of the Child-OIDP to distinguish between children with and without normative treatment needs in a variety of oral conditions, including periodontal disease. In contrast, the generic version of the Child-OIDP was only able to distinguish between children



with and without normative treatment needs for dental caries. One of the 11 excluded articles that used a HRQoL measure found minimal effects due to gingivitis but a higher degree of disability secondary to periodontal pocket depths of greater than 6 mm [53]. These findings justify the inclusion of studies that use only condition-specific OHRQoL instruments, as they are more sensitive for detecting slight changes in specific conditions and may allow a more detailed evaluation of the limitations caused by oral diseases.

Certain limitations, such as potential selection bias and absence of quantitative analysis, are common in these types of studies. Despite the extensive search strategy, the number of included studies in each OHRQoL group was limited. Another limitation is caused by the difficulty in accessing literature not published in English. Because no intervention studies were available, this review was conducted based only on CS studies and cannot prove causality. Additional studies and longitudinal research are needed before quantitative analysis and causality can be determined.

## CONCLUSIONS

The data presented in this systematic literature review are suggestive of a relationship between gingivitis and OHRQoL. This association appears to be independent of the clinical and OHRQoL instruments used. Further studies and longitudinal research are needed before quantitative analysis and causality can be determined.

## REFERENCES

- Califano JV; Research, Science and Therapy Committee American Academy of Periodontology. Position paper: periodontal diseases of children and adolescents. *J Periodontol* 2003 Nov;74(11):1696-704.
- van der Velden U. The significance of supragingival plaque accumulation in periodontal disease. *Int J Dent Hyg* 2006 Sep;4 Suppl 1:11-4.
- Blicher B, Joshipura K, Eke P. Validation of self-reported periodontal disease: a systematic review. *J Dent Res* 2005 Oct;84(10):881-90.
- Locker D. Concepts of oral health, disease and quality of life. *Measuring Oral Health and Quality of Life*. Department of Dental Ecology, School of Dentistry: University of North Carolina, 1997.
- Pihlstrom BL. Measurement of attachment level in clinical trials: probing methods. *J Periodontol*. 1992 Dec;63(12 Suppl):1072-7.
- Loe H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontol Scand* 1963 Dec;21:533-51.
- Holmgren C. CPITN: interpretations and limitations. *Int Dent J*. 1994; 44:533-46.
- Locker D. Measuring oral health: a conceptual framework. *Community Dent Health* 1988 Mar;5(1):3-18.
- McGrath C, Bedi R. The value and use of 'quality of life' measures in the primary dental care setting. *Prim Dent Care* 1999 Apr;6(2):53-7.
- Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D, Moher D, Becker BJ, Sipe TA, Thacker SB. Meta-analysis of observational studies in epidemiology: a proposal for reporting. *Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group*. *JAMA* 2000 Apr 19;283(15):2008-12.
- Acharya S. Oral health-related quality of life and its associated factors in an Indian adult population. *Oral Health Prev Dent* 2008;6(3):175-84.
- Barbosa TS, Tureli MC, Gavião MB. Validity and reliability of the Child Perceptions Questionnaires applied in Brazilian children. *BMC Oral Health* 2009 May 18;9:13.
- Castro RA, Portela MC, Leão AT, de Vasconcellos MT. Oral health-related quality of life of 11- and 12-year-old public school children in Rio de Janeiro. *Community Dent Oral Epidemiol* 2011 Aug;39(4):336-44.
- Piuevam G, de Lima KC. Self-perceived oral health status in institutionalized elderly in Brazil. *Arch Gerontol Geriatr*. 2012 Jul-Aug;55(1):5-11.
- Bernabé E, de Oliveira CM, Sheiham A, Tsakos G. Comparison of the generic and condition-specific forms of the Oral Impacts on Daily Performances (OIDP) Index. *J Public Health Dent* 2009 Summer;69(3):176-81.
- Krisdapong S, Prasertsom P, Rattananangsim K, Adulyanon S, Sheiham A. Using associations between oral diseases and oral health-related quality of life in a nationally representative sample to propose oral health goals for 12-year-old children in Thailand. *Int Dent J*. 2012 Dec;62(6):320-30.
- Krisdapong S, Prasertsom P, Rattananangsim K, Adulyanon S, Sheiham A. Setting oral health goals that include oral health-related quality of life measures: a study carried out among adolescents in Thailand. *Cad Saude Publica*. 2012 Oct;28(10):1881-92.
- Krisdapong S, Prasertsom P, Rattananangsim K, Sheiham A, Tsakos G. The impacts of gingivitis and calculus on Thai children's quality of life. *J Clin Periodontol*. 2012 Sep;39(9):834-43.
- Krisdapong S, Prasertsom P, Rattananangsim K, Sheiham A. Relationships between oral diseases and impacts on Thai schoolchildren's quality of life: evidence from a Thai national oral health survey of 12- and 15-year-olds. *Community Dent Oral Epidemiol*. 2012 Dec;40(6):550-
- Nurelhuda NM, Ahmed MF, Trovik TA, Åström AN. Evaluation of oral health-related quality of life among Sudanese schoolchildren using Child-OIDP inventory. *Health and Quality of Life Outcomes* 2010, 8:152 . doi:10.1186/1477-7525-8-152.

21. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. *Community Dent Health* 1994 Mar;11(1):3-11.
22. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol* 1997 Aug;25(4):284-90.
23. Jokovic A, Locker D, Tompson B, Guyatt G. Questionnaire for measuring oral health-related quality of life in eight- to ten year- old children. *Pediatr Dent* 2004 Nov-Dec;26(6):512-8.
24. Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *J Dent Res* 2002 Jul;81(7):459-63.
25. Adulyanon S, Sheiham A. Oral impacts on daily performances. In: Slade GD, editor. *Measuring Oral Health and Quality of Life*. Chapel Hill, NC: University of North Carolina; 1997. p.151-60.
26. Gherunpong S, Tsakos G, Sheiham A. Developing and evaluating an oral health-related quality of life index for children; the CHILD-OIDP. *Community Dent Health* 2004 Jun;21(2):161-9.
27. Atchinson KA. The General Oral Health Assessment Index (GOHAI). In: Slade GD, editor. *Measuring Oral Health and Quality of Life*. Department of Dental Ecology, University of North Carolina: Chapel Hill, NC; 1997. p.71-80.
28. Needleman I, McGrath C, Floyd P, Biddle A. Impact of oral health on the life quality of periodontal patients. *J Clin Periodontol* 2004 Jun;31(6):454-7.
29. Marshman Z, Rodd H, Stern M, Mitchell C, Locker D, Jokovic A, et al. An evaluation of the Child Perceptions Questionnaire in the UK. *Community Dent Health* 2005 Sep;22(3):151-5.
30. Robinson PG, Nalweyiso N, Busingye J, Whitworth J. Subjective impacts of dental caries and fluorosis in rural Ugandan children. *Community Dent Health* 2005 Dec;22(4):231-6.
31. Schaefer I, Braumann B. Halitosis, oral health and quality of life during treatment with Invisalign® and the effect of a low-dose chlorhexidine solution. *J Orofac Orthop* 2010 Nov;71(6):430-41.
32. Al-Haboubi M, Zoitopoulos L, Bighton D, Gallagher JE. The potential benefits of sugar-free chewing gum on the oral health and quality of life of older people living in the community: a randomized controlled trial. *Community Dent Oral Epidemiol*. 2012 Oct;40(5):415-24.
33. Barbosa TS, Castelo PM, Leme MS, Gavião MB. Associations between oral health-related quality of life and emotional statuses in children and preadolescents. *Oral Dis*. 2012 Oct;18(7):639-47.
34. Gururatana O, Baker S, Robinson PG. Psychometric properties of long and short forms of the Child Perceptions Questionnaire (CPQ11-14) in a Thai population. *Community Dent Health*. 2011 Sep;28(3):232-7.
35. Pakpour AH, Yekaninejad MS, Sniehotta FF, Updegraff JA, Dombrowski SU. The Effectiveness of Gain- Versus Loss-Framed Health Messages in Improving Oral Health in Iranian Secondary Schools: A Cluster-Randomized Controlled Trial. *Ann Behav Med*. 2014 Jun;47(3):376-87.
36. Zaitso T, Ueno M, Shinada K, Ohara S, Wright FA, Kawaguchi Y. Association of clinical oral health status with self-rated oral health and GOHAI in Japanese adults. *Community Dent Health*. 2011 Dec;28(4):297-300.
37. Acharya S, Sangam DK. Oral health-related quality of life and its relationship with health locus of control among Indian dental university students. *Eur J Dent Educ* 2008 Nov;12(4):208-12.
38. Aslund M, Pjetursson BE, Lang NP. Measuring oral health-related quality-of-life using OHQoL-GE in periodontal patients presenting at the University of Berne, Switzerland. *Oral Health Prev Dent* 2008;6(3):191-7.
39. Cunha-Cruz J, Hujoel PP, Kressin NR. Oral health-related quality of life of periodontal patients. *J Periodontol Res* 2007 Apr;42(2):169-76.
40. Hägglin C, Berggren U, Lundgren J. A Swedish version of the GOHAI index. Psychometric properties and validation. *Swed Dent J* 2005;29(3):113-24.
41. Krisdapong S, Sheiham A, Tsakos G. Oral health-related quality of life of 12- and 15-year-old Thai children: findings from a national survey. *Community Dent Oral Epidemiol* 2009 Dec;37(6):509-17.
42. Ng SK, Leung WK. Oral health-related quality of life and periodontal status. *Community Dent Oral Epidemiol* 2006 Apr;34(2):114-22.
43. Naidoo S, Sheiham A, Tsakos G. The relation between oral impacts on daily performances and perceived clinical oral conditions in primary school children in the Ugu District, Kwazulu Natal, South Africa. *SADJ*. 2013 Jun;68(5):214-8.
44. Yusof ZY, Jaafar N. Health promoting schools and children's oral health related quality of life. *Health Qual Life Outcomes*. 2013 Dec 10;11:205.
45. Tsakos G, Gherunpong S, Sheiham A. Can oral health-related quality of life measures substitute for normative needs assessments in 11 to 12-year-old children? *J Public Health Dent* 2006 Fall;66(4):263-8.
46. Grégoire G, Derderian F, LeLorier J. Selecting the language of the publications included in a meta-analysis: is there a Tower of Babel bias? *J Clin Epidemiol* 1995 Jan;48(1):159-63.
47. Moher D, Fortin P, Jadad AR, Jüni P, Klassen T, Le Lorier J, et al. Completeness of reporting of trials published in languages other than English: implications for conduct and reporting of systematic reviews. *Lancet* 1996 Feb 10;347(8998):363-6.
48. Moher D, Pham B, Lawson ML, Klassen TP. The inclusion of reports of randomised trials published in languages other than English in systematic reviews. *Health Technol Assess* 2003;7(41):1-90.
49. Jüni P, Hohenstein F, Sterne J, Bartlett C, Egger M. Direction and impact of language bias in meta-analyses of controlled trials: empirical study. *Int J Epidemiol* 2002 Feb;31(1):115-23.
50. Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. *JAMA* 1995 Jan 4;273(1):59-65.
51. Drotar D. Measuring health-related quality of life in children and adolescents: implications for research and practice. Mahwah, NJ: Lawrence Erlbaum Associates, 1998.
52. Weintraub JA. Uses of oral health related quality of life measures in Public Health. *Community Dent Health* 1998 Mar;15(1):8-12.
53. Brennan DS, Spencer AJ, Roberts-Thomson KF. Quality of life and disability weights associated with periodontal disease. *J Dent Res* 2007 Aug;86(8):713-7.

**Prof. Taís de Souza Barbosa  
(Corresponding address)**

Faculdade de Odontologia de Piracicaba/UNICAMP -  
Departamento de Odontologia Infantil - Área de Odontopediatria  
Avenida Limeira 901 CEP 13414-903 Piracicaba – SP, BR  
E-mail: tais\_sb@fop.unicamp.br

Date submitted: 2014 Jun 17

Accept submission: 2014 Dec 01