Analytical study of signs and symptoms of TMD, fluorosis and caries in different age groups to validate and to find reliability of oral health-related quality of life.

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Abstract

Aim and objective: To evaluate the effect of dental caries, fluorosis and temporo-mandibular joint disorders on quality of life.

Material and methodology: Total sample size was categorized into three groups: Group A-Participants 3-10 y: for assessment of fluorosis and dental caries. Group B-Participants of age 11-18 y: for assessment of fluorosis and dental caries. Group C-Participants of age 18 y and above for assessment of TMD, fluorosis and dental caries. These age groups were studied for the validity and reliability of oral health related quality of life in different oral and dental conditions as per their respective age groups. Simplified Oral Hygiene Index (OHI-S) was used to assess the oral cavity and hygiene in first group. For fluorosis assessment, TSIF Score is used in the study.

Results: 4.5% patients in this study have minor scores for dental caries. 19% participants out of these were observed to have fair score of OHI-S (i.e. 1.3 to 3.0). 6% participants were found with TSIF score 3 fluorosis in Group A. 30% participants had TSIF score of 1 or greater and 13% have scores of 2 or greater while 70% patients in Group B have TSIF score more than 0. TMD was assessed in Group C and in this study participated patients were 33 males and 17 females. The test-retest reliability was satisfactory in the Group C samples.

Conclusion: Signs and symptoms of TMD, fluorosis and caries in different age groups helped to validate and to find reliability of OHRQoL.

Introduction

The assessment of quality of life related to the oral health is always helpful to evaluate the impact of oral health on the total health. Oral Wellness has always been influential factor for participants' total health quality of life. Toothache caused by dental caries is agonising and disruptive symptom for both parents of children and participants. Positive impact of good oral health always gives confidence to the participants [1].

Dental caries in early childhood are found in those participants who drink liquids with more sugar, who are socially underprivileged. Such participants not only suffer from pain and infection but also struggle with their speech, learning, dietary nutrition and quality of life in their preadolescent age too. The participants who do not to eat breakfast every day or who eat fruit and vegetables less than five times per day have more risk of having caries in primary teeth [2]. Distribution of symptoms of fluorosis is mostly symmetrical but the severity may vary in distinct teeth [3,4].

Dental fluorosis is an excess fluoride accumulation in developing tooth enamel. Many factors has been considered to be a reason for fluorosis but most prominent reason is total quantity of fluoride devoured during the phase of tooth evolution [5].

Temporo-Mandibular Disorders (TMD) is not well understood and is a set of conditions and presented with pain in the jaw joint and tissues surrounding it. It causes limitations in jaw movements. Local trauma and other disorders that commonly affect other joints of the body, like arthritis, also affect this Tempero-mandibular joint. One or both joints may be involved subject to the severity, and may affect a patient's capability to change facial expressions, swallow, chew, speak and even breathe. These may accompany the jaw joint problems or occur independently. The disorders related to function of the ruminant or masticatory structures are termed as Tempero-Mandibular Disorders (TMD). The study of TMD is based on signs and symptoms. This study have included third group of participants for evaluation of quality of life related oral disorder TMD along with OHIP 14.

Self-reported symptoms of temporo-mandibular joint disorder (TMD) include reports of problems related to the masticatory system such as pain when chewing tough food, limitations of mandibular movement, and joint sounds. While adult dental patients TMD issues have been widely discussed and analyzed since the earlier parts of the 20th century, fewer studies have been conducted about TMD among children and adolescents. However, research as early as 1995 showed that considerable percentages of children and adolescents do indeed experience symptoms of TMD. For example, studies with younger children showed that 16.5% of 3-5 y old children had one or more signs of TMD and that 17% of 4-6 y old children were affected by TMD. Among adult patients with TMD, there is clear evidence that female patients are more likely than male patients to report TMD symptoms. The evidence for a gender difference in the prevalence of TMD in children has been mixed. While some authors found that girls were more likely than boys to experience TMD.

Exclusion criteria for TMD patients were essential to design. The patients with neurological diseases, patients who has advised or underwent TMJ surgery, rheumatic disease; autoimmune diseases; or head and neck radiation treatment; participants who had history of head and neck trauma within last 3 months before the study, participants who were taking corticosteroids or muscle relaxants or whose treatment has suspended ten days prior to the study, patients treated with narcotic analgesics, pregnant patients, participants who had taken NSAIDs three days before study are excluded from the study.

The symptoms were determined by questioning the subjects for common complaints associated with TMJ disorders. Participants were also examined for common signs that are associated with TM disorders like temporo-mandibular joint tenderness, muscle tenderness, limited range of mandibular movement and temporo-mandibular joint sounds.

In the year 2003, the WHO has conducted as Global health programme in which the primary objective was the oral health related quality of life [6]. Quality of life is dependent on multiple factors like individuals physical health, psychological state, social contacts and relationships, personal beliefs and freedom concept. Hence QOL is always subjective and can be assessed with the help of questionnaire. The questionnaire evaluated the extent of disturbances of quality of life due to oral health diseases.

Oral conditions can have a number of consequences such as pain, difficulty in chewing, embarrassment and economic hardship. These consequences have a negative impact on Oral Health-Related Quality of Life (OHRQoL) when they are judged by the affected person to be of sufficient frequency, severity, or duration to be bothersome to valued aspects of their daily lives. Most studies find that dental caries has a negative impact on OHRQoL, particularly when it is moderate to severe, goes untreated or results in missing teeth. Studies on the association between fluorosis and OHRQoL are not as numerous as for caries. In their review of 8 quantitative studies, Chankanka et al. concluded that severe fluorosis has negative impacts on OHRQoL but very mild to mild fluorosis has either no effect or a positive one. A qualitative study found that enamel defects bother adolescents during social interactions, but the importance of appearance and approval from others in their senses of self has more impact than the severity of the defects themselves

This subjective measure was found to divide in different domains like physical status of the child/participant, psychological status and impact, and effect of dental wellness on their day to day work. To provide the comprehensive measure of self-reported dysfunction, discomfort and disability which is attributed to oral health conditions, the Oral health impact profile was specifically developed.

Aim and Objective

1. To evaluate the effect of dental caries on quality of life.
2. To evaluate the influence of fluorosis on quality of life of participants.
3. To evaluate effect of temporo-mandibular disorders on quality of life in participants.

Materials and Methods

Cross sectional analytical surveys were conducted in different age groups using a stratified one-stage cluster sample design after ethical committee approval of Weifang Medical University Institute. The study was conducted during the period from June 2015 to December 2016.

Participants

A total of 150 participants were included in the study (n=150) (Table 1). Each participant received a participant information sheet explaining purpose of this study. All groups of participants are selected from the Department of Orthodontics, School of Dentistry and furthermore, apart from the OHIP-14 questionnaire, the participants also assessed clinically with the help of OHI-S and TSIF. TMD patients were assessed with the help of signs and symptoms observed in the patients.

Table 1. *Assessment criteria for debris calculation.*

Scores	Assessment criteria
0	Absent debris/discolouration present.
1	Upto 1/3 tooth surface covered by soft debris/external stains present without debris irrespective of surface area covered.

2	>1/3 and <2/3 surface covered by soft debris of the uncovered tooth surface.
3	>2/3 surface of uncovered tooth is covered by soft debris.

Data was collected by clinical examination and face-to-face interviews. The structured questionnaire captured information on socio-demographics and oral-health behaviours. DMFT was measured according to WHO criteria. The assessment study was divided in two steps i.e. 1) examination and assessment of diseases in all three age groups and 2) Questionnaire was on oral health impact profile-14 (OHIP-14) disorders for evaluation of quality of life.

There were a total of 14 questions in the OHIP-14 questionnaire. All the participants were evaluated on the basis of frequent impactful experiences occurred in the last month.

Participants were asked how frequently they experienced the impact in the last month. The five-point scale for answers (0=never, 1=rarely, 2=occasionally, 3=often, and 4=very often). The higher scores represented impaired oral health and zero presented absence of impact of dental health. All participants from three different groups were monitored, and the participation rate was 100% and there were no drop outs and no missing data.

Validity

Correlation validity was checked in three groups containing 150 subjects. It shows that the measurement is related to the data in references, i.e. to the scores collected from investigation (12-17, 19-30). The correlative aspect was tested by investigating the relation between clinical assessments like OHI-S, TSIF, Signs and symptoms of TMD with oral health quality on an subjective five point scale ranging from 1 to 5 and the OHIP total score (0-56).

Reliability

The two types of reliability were evaluated: the internal reliability and the test-retest reliability.

Test-retest reliability: The group of 50 students participated and filled-in the OHIP 14 Questionnaire twice. No one from the Group C was managed with treatment of any dental and/or oral disorders in an interval of two weeks. This was considered that the OHRQoL would not alter in the period of two weeks without any dental and/or oral treatment. The ICC (Interclass correlation coefficient) was calculated. Being an observational study, the inter-item correlation was not done.

Clinical examination

The clinical examination of all participants of the study was done by a single investigator. The subjects were clinically examined for dental caries using OHI index simplified given by Greene et al. Quality of life evaluation with the help of characteristic features:

A. Simplified oral health index: It consists of two indices i.e. Debris index and Calculus index. Number of tooth surfaces scored for this index is also lesser than the original Oral health index (i.e. 6 instead of 12). Six tooth surfaces are inspected from four posterior teeth and 2 anterior teeth. The indices mentioned here are established on numerical calculations which illustrate the quantity of debris and calculus found [7].

B. Simplified debris index: For every participant, to calculate the simplified debris score, all the calculated score were added and then divided by the involved number of surfaces. At the minimum two out of six surfaces must be inspected for an independent score to be measured. The average individual or group score is known as the Simplified Debris Index (DI-S) which is shown in Table 1.

C. Simplified calculus index: This method has been used to calculate the calculus scores which is shown in Table 2. Scoring has been established with the help of clinical assessment of calculus.

Table 2. Assessment criteria for Calculus measurement.

Scores	Assessment criteria
0	Absent calculus.
1	<1/3 surface of uncovered tooth is covered by Supragingival calculus.
2	>1/3 and <2/3 surface of exposed tooth is covered by Supragingival calculus/individual flecks of subgingival calculus surrounding cervical part of the tooth/ both.
3	>2/3 surface of exposed tooth is covered by Supragingival calculus a continual dense belt of subgingival calculus surrounding cervical part of the tooth/ both.

The average individual/group debris and calculus scores are combined to obtain the Simplified oral hygiene index. The CI-S and DI-S values may range from 0 to 3; the OHI-S values from 0 to 6.

D. Simplified oral hygiene index: Simplified Oral Hygiene Index=Debris Index+Calculus Index.

E. Assessment index used for fluorosis in children (TSIF score): Horowitz et al. developed an index for fluorosis and is based on decorative side of tooth surface (TSIF). The index

was described to overcome the dean index. In this index, for the anterior tooth on both surfaces i.e. buccal and lingual which has not been restored, a value has been given and further, three values for posterior tooth surfaces (buccal, lingual and occlusal). It helps for assessment of fluorosis i.e. discolouration in fluorosis, pitting on surfaces. The author had given a separate score to every tooth surface that is not restored. Score 2 for anterior teeth (labial and lingual view) and Score 3 for posterior teeth (buccal, lingual and occlusal view) [8].

Score=0: Absent fluorosis.

1. Definite signs of fluorosis seen on enamel part. White fleck of fluorosis present on the only incisal edges of the anterior teeth and cusp tip of the posterior teeth which is involving less than 1/3rd of the total visible surfaces of the teeth.
2. White chalky flecks of fluorosis on more than 1/3rd of visible total surface but less than 2/3rd of visible total visible surfaces.
3. Chalky flecks of fluorosis on involving two third of the visible surfaces.
4. The discoloration and staining is associated with increased fluorosis levels. (Staining is confirmed change of color showing very light areas to very dark brown areas).
5. Pitting of enamel has been found but not associated with the discoloration of unharmed healthy enamel part.
6. Staining and pitting both are found separately on intact enamel.
7. Missing enamel in large areas, convergent pitting, altered anatomy of tooth and dark brown staining.

Statistical analysis

All the data were analyzed using SPSS 20.0 software. The differences in measurement data were analyzed by t-test. The differences in counting data were analyzed by χ^2 test. P values smaller than 0.05 were considered statistically significant; P values smaller than 0.01 were considered statistically significant.

Observations and Results of the Study

Group A: Out of 50 participants, 9 participants were found to be minor and major dental caries. 38 participants out of these were observed to have fair score of OHI-S (i.e. 1.3 to 3.0). 3 participants were found with TSIF score 3 fluorosis in Group A.

Group B: Total 50 participants were examined in this group by clinical examination with the help of TSF index and questionnaire of OHIP. The Demographic variables noted during the study are mentioned in the Table 3. The variables show the gender of participants found during the study in each group, education of parents subjective to the OHIP 14 to assess the quality of life. High education is considered as graduation or post-graduation, medium is 10th standard onwards till

graduation and low education is considered to less than standard 10.

Table 3. Social demographic variables noted during the study in all groups.

	Group A	Group B	Group C
Gender	Male 32	Male 24	Male 31
	Female 18	Female 26	Female 19
Parent's education	Low 22	Low 20	Low 26
	Medium 12	Medium 13	Medium 10
	High 16	Highn17	High 14
Religion	Christian 23	Christian 19	Christian 22
	Taoism 15	Taoism 7	Taoism 15
	Confucianism 4	Confucianism 5	Confucianism 3
	Islam 5	Islam 8	Islam 4
	Bauddha 3	Bauddha 11	Bauddha 6

Distribution of TSIF score for participants and surfaces was recorded as follows:

1. 30% had TSIF score of 1 or greater and 13% have scores of 2 or greater. Prevalent of fluorosis with high severity was observed more to the labial surfaces of maxillary anterior teeth compared to other surfaces.
2. 70% participants had TSIF scores>0.

Group C: On the basis of OHIP 14, we have found the 14 questions used for the studying the participants of TMD were categorized in following ways.

Functional restriction and pain was found to be highly statistically significant with a p value of <0.001and positively correlated with TSF index. Physical disability and psychological disability was also found to be highly statistically significant with a p value of <0.05 positively with TSF index.

Social hindrance was found to statistically significant with a p value<0.001 and positively correlated with TSIF Score. Total OHIP-14 score was found to be significantly highly (p<0.01) positively correlated with TSF score and it was found to be significantly (p<0.05) negative correlated with TSF index. Socio-demographic variable were assessed in the visits of different groups were noted and total sample collected was 150 in three different groups. In many observational studies the researchers have agreed with the fact that physical disability, functional limitations and psychological discomfort have the highest correlation with oral health and an important impact in QoL, confirmed in this study [9-11].

TSIF index is used for measuring the prevalence of dental fluorosis and to assess the condition of the permanent teeth in children [12].

Analytical Study of signs and symptoms of TMD, fluorosis and caries in different age groups to validate and to find reliability of oral health-related quality of life

This study focused on different age groups and how different dental conditions affect their quality of life. This study also focused on TMD, caries and fluorosis as major causative disorders for deranged quality of life in terms of psychological and social behaviour of the individual.

Age groups wise OHIP 14 scale gave significant indicators in terms of age wise acceptance and response of the disease (Table 4). The study confirmed that the Albanian version of the OHIP 14 has excellent psychometric properties and that it should be considered a reliable instrument (Table 4). The excellent psychometric properties of the OHIP-14 will allow the use of the questionnaire in diagnostic and treatment procedures, as well as in cross-sectional and longitudinal studies. Table 4 shows the mean increased in altered physical status and its impact on quality of life as well as the psychological impact is also found to be increased to affect the quality of life related to oral health.

Table 4. Questionnaire to assess quality of life related to oral health showing validity for OHIP-14.

	N	Mean	SD
Problems while uttering words	150	2.2825	1.3247
Feel like sense of taste has disrupted	150	1.3366	1.2892
Pain in oral cavity	150	1.9213	1.2471
Discomfort while eating food	150	0.9238	1.1518
Much aware of dental problems	150	0.6216	1.071
Felt stressed due to dental problems	150	0.7199	1.05
Not satisfied after taking food due to dental problems	150	2.4398	1.265
Interrupt meals due to dental problems	150	1.2653	1.1862
Difficult to relax due to dental problems	150	1.3464	1.2319
Embarrassed by dental problems	150	2.7813	1.233
Irritable due to dental problems	150	2.7076	1.06
Had difficulty in playing with friends	150	0.5626	0.9548
Felt that life was less satisfying due to your dental problem	150	0.9066	1.1057
Unable to lead a normal life due to your dental problem	150	0.7542	1.0637
N valid (according to list)	150		

Sample sizes taken in the different groups of the study are tested with clinical indices, sign symptoms and questionnaire. The OHRQoL is assessed by the help of questionnaire and previous clinical indices (Table 5). Quality of life is assessed with the help of OHIP 14 questionnaire. Five point scales has added benefits of evaluation of the questionnaire as every question will have the answer in terms of five points. For example pain caused due to dental caries or TMD was answered in five points mentioned in Table 6 like never/rarely or frequently etc. To assess the quality of life in the concerned group, correlation coefficient is used.

Table 5. Sample size, demographic variables (age, gender etc.), research type used for study.

Participants	Type of sample	N	Collection of data	Type of investigation
Group A (3-10 y)	simple random	50	OHI-S	Validity and internal correlation
Group B (11-18 y)	simple random	50	TSIF	Validity
Group C (18 y and above)	Purposive	50	TMD signes and symptoms, 5 point scale	Internal correlation, Test-re-test reliablity
Quality of life	-	150	5 point scale, questionnaire	

Table 6. Association of OHIP 14 questionnaire to five point scale.

Variable	N	Never	Rarely	Occasionally	often	Very often	Correlation coefficient
Group A participants (n=50)	50	0	0	9	21	20	
OHIP Summary Score mean (SD)				20.03 (5.23)	9.65 (4.71)	2.3 (1.90)	0.814
Group B	50	1	16	14	10	9	
OHIP Summary Score mean (SD)		31	24.6 (6.09)	18.80 (5.30)	11.32 (5.62)	7.45 (2.81)	0.663
Group C	50	0	0	5	19	26	
OHIP Summary Score mean (SD)				7.6 (8.7)	6.1 (2.76)	0.58 (0.97)	0.78
Total	150						

$P < 0.001$; Five point scale used is- 0=never, 1=rarely, 2=occasionally, 3=often and 4=very often.

Group C patients were taken for the study, tested before treating with the help of OHIP 14. They were treated and retested for the same questionnaire after two weeks period.

Hence the test-retest reliability is checked in this group which is showed in Table 7.

Table 7. *Test-retest reliability in Group C patients.*

Participants	Intergroup correlation coefficient	Mean difference	95% confidence interval	P
Group C participants (n=50)	0.953	0.138	-0.461	0.24

Discussion

The findings in this study primarily focuses that the impacts of dental carries, fluorosis and TMD on quality of life specially regarding dental issues have markedly from each other. Fluorosis was related with the OHRQoL of children participants or their parents at a significant level in Group A and Group B. The caries experienced have remarkable impact on OHRQoL for older children of all ages and their parents. The caries affecting older age children of Group B was remarkably large. The effect size was large with Group C participants with TMD was estimated to be larger than Group A and Group B children on OHRQoL.

This study have evaluated the OHI-S in dental caries patients, TSIF score in fluorosis patients and duration of symptoms in TMD patients pursuing treatment affects the quality of life related to oral health with the OHIP.

Oral disorders have a greater impact on physical, psychological and social life of person [13]. Dental caries is still a major public health disorder and significant threat to the oral health of populations [14]. Dental caries is still a disease of high value in the population despite the decline in incidence in recent decades [15].

4.5% patients in this study have minor scores for dental caries. 19% participants out of these were observed to have fair score of OHI-S (i.e. 1.3 to 3.0). 6% participants were found with TSIF score 3 fluorosis in Group A.

The patients in all age groups were categorized as per demographic variables. The variables are given in Table 1. Different age group were assessed to understand gravity of social and personal behaviours affected due to dental problems. 30% participants had TSIF score of 1 or greater and 13% have scores of 2 or greater while 70% patients in Group B have TSIF score more than 0.

TMD was assessed in Group C and in this study participated patients were 33 males and 17 females.

The OHIP-14 was prepared according to validity and reliability parameters. The reliability was confirmed by calculating the correlation of the questions with Cronbach's alpha coefficient.

The questionnaire taken in the study was noted by examiner only. This questionnaire was be used for evaluating physical health and mental status in children and adults.

The test-retest reliability was satisfactory in the Group C samples. The Cronbach's alpha coefficient also showed

satisfactory results for the internal consistency of the OHIP 14. Values for all groups were higher than 0.90. Moreover, the average inter-item correlation also confirmed satisfactory reliability of the Albanian language version of the OHIP questionnaire (Table 8).

Table 8. *Average inter group correlation for OHIP 14 in Group A and Group B.*

Participants	Intergroup correlation coefficient	Chronbach alpha
Total population	0.25	0.85
Group A (n=50)	0.36	0.87
Group B (n=50)	0.23	0.8

The studies conducted by the Robinsol et al. in the year 2005, Do et al. in the year 2007 and Locker et al. in 2007 revealed that the dental caries has a negative impact on OHRQoL, particularly when caries experience is severe and treatment rates are low [16-18]. However, findings related to enamel fluorosis and OHRQoL are inconsistent in these studies. At a prevalence level for fluorosis found in most populations, the impact on OHRQoL was weakly negative, positive, or non-existent [16-18]. The one study conducted in a high-fluoride area of a Mexican state (drinking water fluoride concentration=3.38 ppm) found a strong impact of moderate to severe fluorosis on OHRQoL in eight-to ten-year-old children.

According to Reissmann et al. the magnitude of TMD impact depends on the definition of the comparison group without TMD diagnoses. Although patients in the general population are the most plausible choice for comparison, they may have some signs and symptoms of TMD. These are insufficient to warrant an RDC/TMD diagnosis but sufficient to influence QoL [19]. Other authors suggest that differences in scores of QoL measures can be properly interpreted only after minimally important differences have been recognized. The minimum important difference is defined as the smallest difference in scores that patients perceive as being important, which would suggest a change in the patient's management. This score can be determined only following longitudinal studies in which some individuals changed and some did not, either as the result of therapy or natural fluctuations in the disorder.

Sitar et al. revealed that the scores derived from both questionnaires indicated that the QoL of children and preadolescents diagnosed with TMD was markedly worse than that of individuals with no current signs or symptoms of TMD,

which suggested that diagnoses associated with pain (e.g. myofascial pain, arthralgia) have a higher impact than non-pain-related diagnoses (e.g. disc displacement with reduction). Considering that muscle tenderness was the most frequent diagnosis observed among the evaluated TMD sample, greater impact on QoL was expected for these subjects [20].

The research works that used a validated scale and multi-para-analysis had considered the association of caries and fluorosis with OHRQoL and also to study TMD with special reference to QoL.

Conclusion

Signs and symptoms of TMD, fluorosis and caries in different age groups helped to validate and to find reliability of OHRQoL. In all age groups dental issues from minor carries to TMD like conditions hamper the normalcy of life. It significantly affects the quality of life. As an integrated model, it may serve as a foundation for assessing, planning, implementing, and evaluating outcomes to dental hygiene care. This paper reviews possible application of the model for clinical practice, research, and education.

References

1. Loc GA, Spencer A. Oral health-related quality of life of participants by dental caries and fluorosis experience. J Public Health Dent 2007; 67: 132-139.

2. Dye BA, Shenkin JD, Ogden CL. The relationship between healthful eating practices and dental caries in participants ages 2-5 years in the United States, 1988-1994. J Am Dent Assoc 2004; 135: 55-66.

3. Sundstrom B, Jongebloed WL, Bouchouchi M. Morphology of outer regions of fluorosed deciduous enamel. Caries Res 1980; 14: 381-388.

4. Larsen MJ, Richards A, Fejerskov O. Development of dental fluorosis according to age at start of fluoride administration. Caries Res 1985; 1: 19-27.

5. Clarkson J. Review of terminology, classifications, and indices of developmental defects of enamel. Adv Dent Res 1989; 3: 104-109.

6. The World Oral Health Report 2003. Continuous improvement of oral health in the 21st century: The approach of the WHO Global Oral Health Programme. Geneva, Switzerland 2013.

7. Greene JC, Vermillion JR. The simplified oral hygiene index. J Am Dent Assoc 1964; 68: 25-31.

8. Horowitz HS, Driscoll WS, Meyers RJ. A new method for assessing the prevalence of dental fluorosis: The tooth surface index of fluorosis. J Am Dent Assoc 1984; 109: 37-41.

9. Soe KK, Gelbier S, Robinson PG. Reliability and validity of two oral health related quality of life measures in Myanmar adolescents. Community Dent Health 2004; 21: 306-311.

10. Lopez R, Baelum V. Spanish version of the Oral Health Impact Profile (OHIP-Sp). BMC Oral Health 2006; 6: 11.

11. Von Rueden U, Gosch A, Rajmil L. Socioeconomic determinants of health related quality of life in childhood and adolescence: Results from a European study. J Epidemiol Community Health 2006; 60: 130-135.

12. Wong MC, Lo EC, McMillan AS. Validation of a Chinese version of the Oral Health Impact Profile (OHIP). Community Dent Oral Epidemiol 2002; 30: 423-430.

13. Zhang M, Mcgrath C, Hagg U. The impact of malocclusion and its treatment on quality of life: a literature review. Int J Paediatr Dent 2006; 16; 381-387.

14. Marcenes W, Kasebaum NJ, Bernabé E. Global burden of oral conditions in 1990-2010: a systematic analysis. J Dent Res 2013; 92: 592-597.

15. Tannure PN, Costa MC, küChler EC. Caries experience in individuals with cleft lip and palate. Pediatr Dent 2012; 34: 127-131.

16. Robinson PG, Nalweyiso N, Busingye J, Whitworth J. Subjective impacts of dental caries and fluorosis in rural Ugandan children. Community Dent Health 2005; 22: 231-236.

17. Do LG, Spencer A. Oral health-related quality of life of children by dental caries and fluorosis experience. J Public Health Dent 2007; 67: 132-139.

18. Locker D. Disparities in oral health-related quality of life in a population of Canadian children. Community Dent Oral Epidemiol 2007; 35: 348-356.

19. Reissmann DR, John MT, Schierz O, Wassell RW. Functional and psychosocial impact related to specific temporomandibular disorder diagnoses. J Dent 2007; 35: 643-650.

20. Rener-Sitar K, Celebić A, Stipetić J, Marion L, Petricević N, Zaletel-Kragelj L. Oral health related quality of life in Slovenian patients with craniomandibular disorder. Coll Antropol 2008; 32: 513-517.

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