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Correlation between Gingival Redness and Oral Health Related Quality of Life in A Group of Egyptian Children at New Giza University

Fayrouz Saber
Lecturer of Dental Public Health and Community Dentistry, School of Dentistry, New Giza University, Giza, Egypt., fayrouz.saber@ngu.edu.eg

Manal Ahmed Al Sayed
Professor, Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University, Egypt

Ola Moustafa Omar
Professor, Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University, Egypt

The World Health Organization (WHO) was the first to attempt defining quality of life as the "Perceptions of people's position in life in the context of culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns" (1). On the other hand, the term "oral health related quality of life" had no fixed definition. However, there was a general agreement that it was considered a multidimensional concept. Definitions varied from the simplest to more rigorous forms. The United States Surgeon General's report defined OHRQoL as "A multidimensional structure that reflects (among other things) people's comfort when masticating, sleeping, and engaging in social interaction; their self-esteem; and their satisfaction with respect to their oral health" (1).

The concept of OHRQoL is of great significance in the three areas of dental health in particular: the clinical practice of dentistry, research, and education. OHRQoL has an obvious role in clinical dentistry which translates into the clinical recognition of dentists not just treating the organs, but the human beings. In addition to all this it is considered the motivation that drives the oral-related behavior like having regular checkups, practicing good oral hygiene, and spending more money on aesthetic restorations. OHRQoL is of tremendous importance in dental research. All aspects of research: scientific, clinical studies or community research contribute to patients' quality of life. At the community level, understanding the concept of OHRQoL is very vital for promotion of oral health and access to care (2).

With the availability of multiple evaluative tools, professionals were better equipped to accurately weigh the risks and benefits related to a certain treatment. Moreover, it provided evidence that costs associated with treatment protocols were cost effective if they generally improved patients' OHRQoL (3). The use of OHRQoL as an outcome measure was congruent with patient-centered care. In addition to other clinical assessments, it allowed oral healthcare professionals to assess the efficacy of treatment protocols from patients' perspectives (4).

The Child Perception Questionnaire has four short forms, two including 16 items and another two with eight items, each derived from the questionnaires for 11-14-year-olds. An eight and 16-item version were produced by item impact data from the original study producing questionnaires containing two and four items per domain, respectively. These questionnaires were referred to as "impact short forms" or (ISF:8 or ISF:16). The high correlations between the original version of the CPQ11–14 and the short-forms suggested that they were measuring the same construct. The regression short-forms had stronger association in comparison to impact short-forms, that is due to the fact the questions chosen for the regression short-forms were those indicating the most variation in the overall scores of the CPQ11–14. It was reported that in practice, the regression approach performs reasonably well (5).

Since the reliability of a measure is a function of its length, the deduction of the number of questions might further affect construct validity in the manner of increasing the measurement error. However, it was reported that all short forms had good construct validity since they were positively correlated with global ratings (5).

Developing countries tend to complain more from periodontal diseases compared to developed countries on account of the decreased efficiency of awareness and lack of proper oral hygiene practices. In addition to the impact on oral health, periodontal diseases have been reported to impact general health as well. Multiple studies linked periodontal disease to increased incidence of major systemic diseases such as cardiovascular diseases, rheumatoid arthritis and possible complications of pregnancy, respiratory diseases, and kidney diseases (6).

Professionally, more than 85% of subjects were never shown proper methods of tooth brushing by a dental professional. This service had to be offered routinely to all individuals either on individual or community levels. Although high prevalence of periodontal disease was reported, no serious national preventive approaches were taken to address the matter either by screening to confirm the magnitude of the problem or by planning to tackle it (7).

In 2018 another study was conducted in Egypt due to the limitation of data regarding the prevalence of periodontal diseases and their association to multiple risk factors. The study

aimed to assess the prevalence and the severity of periodontal disease and whether it was correlated with different risk factors. The study results concluded that 58.9% of participants had calculus deposits (8).

Chrysanthakopoulos 2016 conducted a study targeting the adolescents in Greece to assess the prevalence of gingivitis and investigate the potential associations among gingivitis with socioeconomic, demographic variables and oral hygiene habits. The study concluded that gingivitis was associated with the following factors: male gender, lower educational, income parental level, inadequate oral hygiene, presence of dental plaque and smoking. The prevalence of this condition in the study sample was 72.8% (9).

Digital imaging in oral care started with efforts focused on quantifying dental plaque and then tooth color measurement and eventually it reached the gingival health assessments. The development of the digital camera together with image analysis software yielded the first attempts to develop an imaging system able to capture pictures of disclosed plaque and the consequent measurement of plaque coverage (10).

Smith et al. 2008 showed that digital imaging was proven to have excellent reliability for both intra- and inter-examiner measurements. It was concluded that digital photography technique proved a reliable method for investigating changes in gingival redness (11).

Prabhu et al., performed a study in 2017 aiming to evaluate the gingival status after scaling and root planning. They used Adobe software to analyze the digital photographs taken to assess the gingival redness and swelling in 20 adult patients. It was reported by the study that the software and the method of recording were accurate, simple, and objective (12).

In 2015 a systematic review was conducted aiming to figure out if there was a relationship between gingivitis and oral health-related quality of life. The results suggested that there was a relationship between gingivitis and OHRQoL and that this association appeared to be independent of the clinical and OHRQoL instruments used (13).

Gingival diseases (induced and not induced by dental plaque) and periodontitis are inflammatory responses of the soft tissues surrounding the teeth and are considered a direct immune response to the establishment of a supra-subgingival biofilm. Periodontitis had recently been reported to have an impact on the QoL of patients (14).

As multiple studies in the literature reported, there are common risk factors shared between gingival status of adolescence and their consequent OHRQoL, which indicates a sustained relation between both. It is also established that Oral health education is considered an effective method to improve oral and specifically gingival status in adolescence and children, which suggests that oral health education could in turn impact the OHRQoL in children and adolescence.

This study aims to evaluate whether there is a correlation between gingival redness as evaluated by digital photographs and oral health related quality of life as measured by the short form of child perception questionnaire 11-14.

Subjects and methods

Ethical approval:

Methodology of this study was previously revised and approved by the ethics research committee of Faculty of Dentistry, Cairo University (approval #181047).

Consent:

Prior to program administration the aim of the study was explained to the mothers/ fathers and written informed consent was obtained. The child's assent was verbally obtained prior to the photographing the session.

Tools of assessment

Oral health related quality of life was interpreted using the Arabic version of the regression Short form (RSF) Child perception questionnaire 11-14 which evaluated Oral symptoms, functional limitations, emotional and social wellbeing. ***(Jokovic et al., 2006)*** calculated by scores from 0 to 16 each domain and total from 0 to 64 (5).

Oral health related quality of life (primary outcome): Regression Short form of CPQ11–14 is 16 items; questionnaire is presented to each participant. They answered it on their own and could only ask the investigator questions about what they did not understand. The questionnaire was in Arabic. The shortened version of the Arabic CPQ11–14 questionnaire was found to be a reliable and valid instrument to measure dental quality of life (15).

Gingival Redness: Digital photographic evaluation for redness of the gingiva was analyzed using Adobe Photoshop following what was previously implemented by ***(Prabhu, et al., 2017)*** (12). The used version was the Adobe Photoshop Creative Cloud (CC) 2021 which is the most recent version of the software.

Photograph Capturing

Digital photographs were taken by positioning the patient in the frontal head position and using the following camera settings for standardization:

- Nikon digital camera D7200
- Prime lens Nicor with set focal length of 105.
- Twin flashes R1 C1
- Nude 1:4
- Photo med twin flash bracket
- Shutter 1:250
- Magnification ratio 1:3

To standardize the distance, the magnification ratio was set to 1:3 and photographs were set on a specific focal length in addition to the previously mentioned Camera settings. This way the photograph can only be focused on a standardized distance and a fixed magnification (16). Figure (1) indicates an example of a participant's digital photographs taken for analysis of gingival redness.

Figure (1)

Photograph Analysis

Photograph analysis for gingival redness was carried out using Adobe Photoshop CC. The histogram option in the Adobe Photoshop software was selected, which gave the mean, standard deviation, median, and percentile of red pixels related to the selected gingival area. The method is highly reliable, easy to perform after initial training and provides an additional tool for assessing gingival health individually on a patient level or in research ***(Smith et al., 2008).*** Figure (2) is an example of an analyzed picture with histogram using the software.

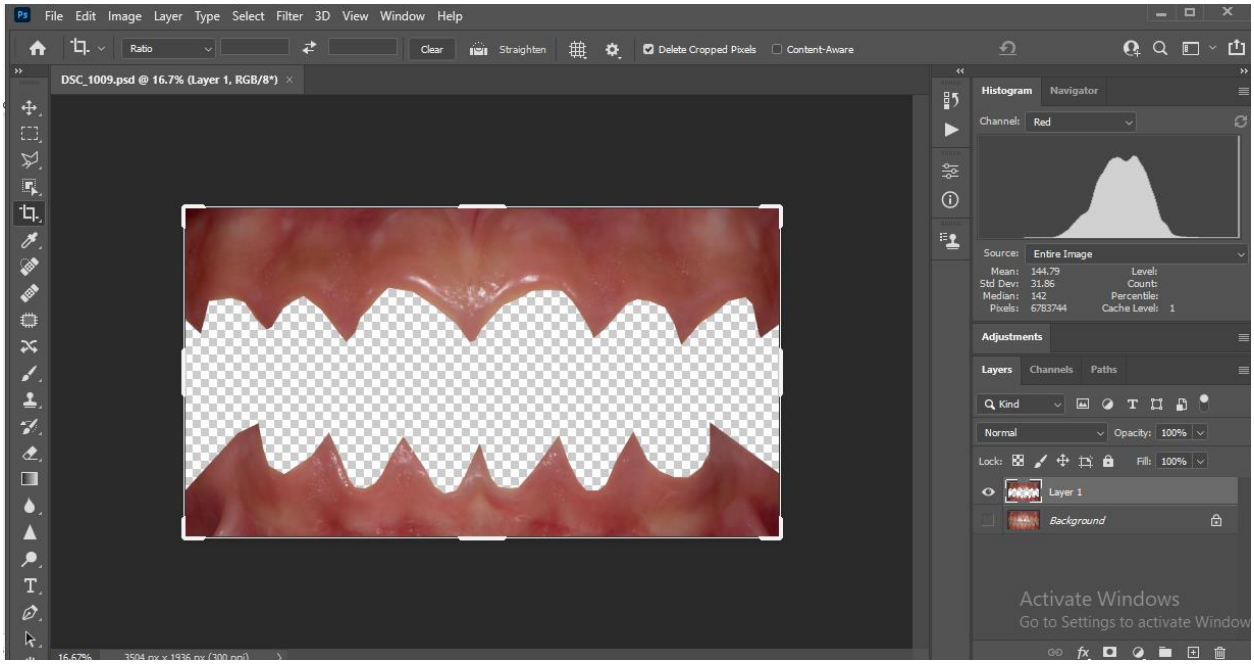

Figure (2)

Patient recruitment

In this study the following strategy was followed to achieve adequate participant enrolment to reach target sample size. Patients were recruited from the outpatient clinic database of the Department of Paediatric Dentistry and Dental Public Health, School of Dentistry, New Giza University, by one calibrated educator aware of the eligibility criteria.

The participants' assents were taken verbally and none of the participants that showed up for this visit refused to participate. The investigator then distributed the Arabic version of the CPQ11-14 questionnaire which was the method used to evaluate their baseline OHRQoL. Along with the questionnaire each participant was handed in a file that included a simple colored flyer simulating the proper brushing technique, an Arabic calendar to document brushing, and a pen.

The participants assents were taken verbally and none of the participants that showed up for this visit refused to participate. They were reassured that the photographs

will only be used for this research purposes and will not be used or uploaded in any platform.

The participants were seated in the same socially distanced manner and were allowed to socialize without leaving their seats or taking off their masks unless they were being photographed. The camera was set and standardized. They were called one by one to the photographing area where they were allowed to take off their masks. The dental photographer used his gloved hands to place the cheek retractor then took off the gloves and photographed the participant the digital photographs.

Results:

Statistical analysis was performed using SPSS 20®1, Graph Pad Prism®2 and Microsoft Excel 20163. Data was represented as count, minimum, maximum, mean, and standard deviation for qualitative data, and presented as frequency and percentages in quantitative data with significant level at P value < 0.05.

Pearson`s correlation coefficient was calculated for qualitative data for evaluation the level of correlation needed in this study. The values range between -1.0 and 1.0. A correlation of -1.0 shows a perfect negative correlation, while a correlation of 1.0 shows a perfect positive correlation.

Oral symptoms:

Concerning oral symptoms questions, mean ± standard deviation was (2.14 ±1.32), (1.91 ±1.36), (1.55 ± 1.25), (2.48 ± 1.46) and (8.09 ± 3.22) for question 1,2,3,4, and oral symptoms domain, respectively. The maximum score in all questions was 4 and the maximum score in oral health domain was 14, while the minimum was (0) as shown in figure (3).

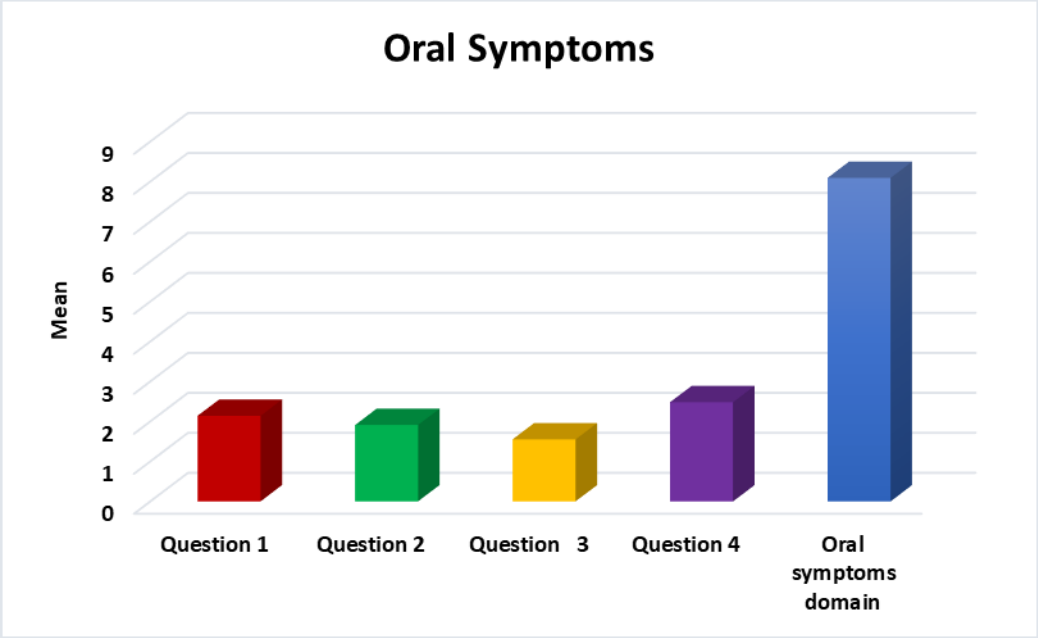

Figure (3): Bar chart represents questions 1,2,3,4, and oral health domain

Functional limitation

Regarding functional limitation questions, mean ± standard deviation was (2.02 ±1.39), (1.68 ±1.47), (0.87 ± 1.1), (1.69 ± 1.36) and (6.26 ± 3.29) for question 5,6,7,8, and functional limitation domain respectively. The maximum score in all questions was 4 and maximum score in functional limitation domain was 13, while the minimum was (0) as shown in figure (4).

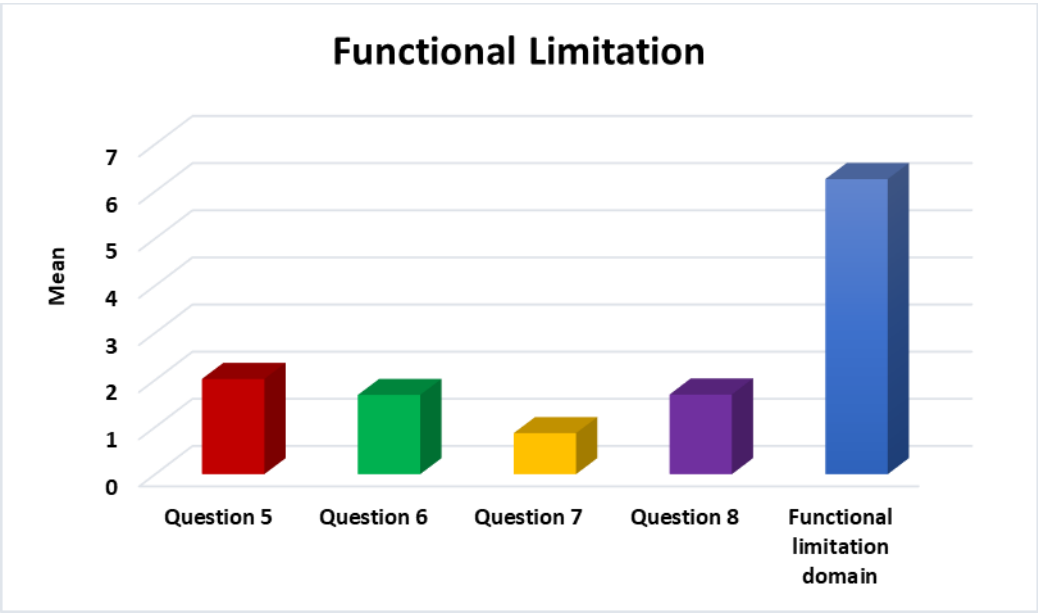

Figure (4): Bar chart represents questions 5,6,7,8, and functional limitation domain

Emotional wellbeing

Concerning emotional wellbeing questions, mean ± standard deviation was (1.86 ±1.37), (1.75 ±1.33), (1.63 ± 1.3), (1.57 ± 1.46) and (6.80 ± 3.68) for question 9,10,11,12 and emotional wellbeing domain, respectively. The maximum score in all questions was 4 and in emotional wellbeing domain it was 13, while the minimum was (0) as shown in figure (5).

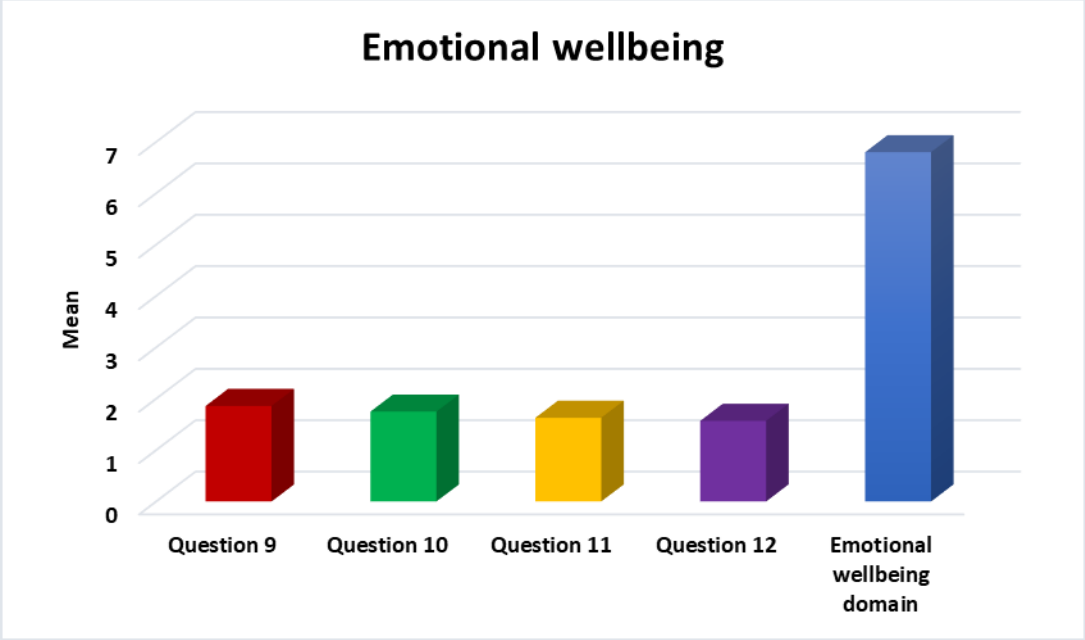

Figure (5): Bar chart represents questions 9,10,11,12, and emotional wellbeing domain

Social wellbeing

Regarding social wellbeing questions, mean ± standard deviation was (1.12 ±1.29), (1.25 ±1.40), (1.41 ± 1.3), (1.23 ± 1.49) and (5.01 ± 3.93) for question 13,14,15,16, and social wellbeing domain respectively. The maximum score in all questions was 4 and maximum score was 16 in social wellbeing domain, while the minimum was (0) as shown in figure (6).

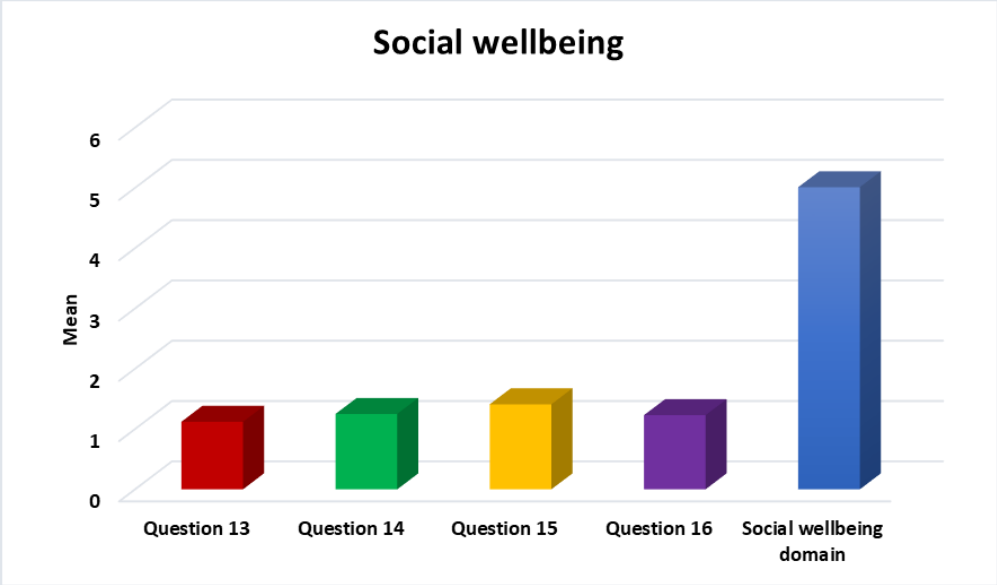

Figure (6): Bar chart represents questions 13,14,15,16, and social wellbeing domain

Digital photographic evaluation for number of red pixels

Digital photographic evaluation showed mean ± standard deviation was (173.91 ± 15.35) with 124.51 minimum and 202.98 maximum as shown in table (1).

Table (1): Digital photographic evaluation

Photo	N	Min.	Max.	Mean	SD	P value
	47.00	124.51	202.98	173.91	15.35	0.001*

N: count Min: minimum Max: maximum SD: standard deviation

Correlation between digital photographic evaluation for number of red pixels (gingival status) and OHRQoL questionnaire

Pearson`s correlation was performed to detect correlation between digital photographic evaluation and OHRQoL questionnaire. It was revealed that there was insignificant (P >0.05), weak (r < 0.5), positive (+) correlation between photos and oral symptoms domain and functional limitation domain, while there was insignificant (P >0.05), weak (r < 0.5), negative

(-) correlation between photos and emotional wellbeing domain as well as social wellbeing domain as shown in table (2).

Table (2): Correlation between digital photographic evaluation for number of red pixels (gingival status) and OHRQoL questionnaire before oral health education:

	Digital Photographs		
	r	**P value**	**Indication**
Oral symptoms domain	.023	.879	Insignificant weak positive
Functional limitation domain	.029	.845	Insignificant weak positive
Emotional wellbeing domain	-.170	.253	Insignificant weak negative
Social wellbeing domain	-.046	.758	Insignificant weak negative
Total	-.062	.679	Insignificant weak negative

r; Pearson`s correlation

Discussion

This study assessed the correlation between gingival redness OHRQoL by Pearson`s correlation to detect the relation between digital photographic evaluation and OHRQoL questionnaire after oral health education. It was revealed that there was insignificant ($P > 0.05$), weak ($r < 0.5$), positive (+) correlation between non polarized photos and all domains and total – polarized and all domains. The results are inconsistent with other studies indicating the association between gingivitis and different domains of quality of life (17).

One explanation could be relevant to the short form of CPQ11-14 while testing its construct validity that was reported to be positive with global ratings, however, there was confusing data regarding its correlations with clinical statuses it simply means that while the

questionnaire used for assessment is valid in detecting even the minor changes in OHRQoL, it might not be the most suitable tool when correlation with clinical condition is needed (18).

Another explanation is that the association between gingivitis and OHRQoL can be linked to esthetic self-perception. If an individual suffers from clinical signs, such as redness and swelling of the gums, that may affect self-esteem and social interactions and consequently OHRQoL, if they do not perceive the presence of these signs then the change of OHRQoL may appear independent from the signs the individual exhibits as shown here in the current study because individuals who are satisfied with their appearance are more self-confident and report better perception of their OHRQoL. A study by Tomazoni et al., in 2014 previously assessed gingival bleeding versus OHRQoL (17). they deduced that the association between extensive-level gingivitis and CPQ11–14 scores were found mainly in the emotional well-being domain may also be explained by self-image dissatisfaction**.**

There were scarce studies that linked gingival redness with OHRQoL therefore it was hard to compare. However, A study took place In Thailand that had consistent results with the current study. A survey was conducted that concluded that gingivitis and calculus were not associated with oral impacts on quality of life. Gingivitis was associated with psychosocial aspects of oral health, namely performances of smiling, study, and social contact and smiling. Since smiling is a form of social interaction the perceived ability or self-consciousness during smiling might affect the OHRQoL (19).

Conclusion:

- There was no statistically significant correlation between the gingival redness and the oral health related quality of life.
- More gingival status evaluation methods need to be introduced and linked versus the oral health related quality of life.

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Conflict of Interest

The authors have no personal interest of any kind in any of the services presented in this article.

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