Comparison of oral hygiene diagnosis using oral clinical examination and photography based on global oral health scale

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Original Article

Abstract

BACKGROUND AND AIM: The present study aims in assessing the compliance in diagnosis of oral hygiene by means of clinical examination, oral photography, and Global Oral Health Scale criteria.

METHODS: The total number of 100 patients referring to the school of dentistry was examined regarding the teeth decay, cavities, as well as gum and periodontal conditions. Finally, 20 patients were selected among them and the standard registered intraoral photos were provided from each of them in order to prepare an archive. The completed archive was examined by 60 specialists and specialist residents and 100 general dentists. The participants were requested to grade oral health of each patient based on the photographs. Grading system was as follows: very good (0), good (1), medium (2), and poor (3). The results of reviews were analyzed by Kruskal-Wallis test, t-test, chi-square, and Bonferroni correction via SPSS software. P-value of less than 0.05 was considered significant.

RESULTS: 94 persons or 59.1% correctly diagnosed the oral hygiene of 7 to 12 patients based on the photography. However, the number of the correct diagnoses did not exceed more than 14 cases by none of the participants. The overestimation was observed in 84.1% (134 persons) of the participants about the case number 10 (one 1st-grade patient) and also underestimation in the case number 1 (one 3rd-grade patient). The female participants showed higher compliance regarding the 2nd grade (P = 0.001), while male participants showed higher compliance regarding the 1st grade (P = 0.002). In addition, statistically significant differences were attained with respect to the field of specialization of respondents. General dentists had the highest conformity rate in their answer to grade one, and periodontists and postgraduate students had highest conformity rates reported for grades 2 and 3.

CONCLUSION: The results revealed that compared to the patients' photography, utilizing the Global Oral Health Scale as an innovative indicator can be very useful, especially for the patients with perfect or weak oral hygiene, epidemiological studies, and comparisons of different populations.

KEYWORDS: Diagnosis; Photography; Oral Examination

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Dental caries and periodontal disease are two kinds of infectious diseases that are related to colonization of bacteria (biofilm) on the tooth surface. The onset, pattern of progression, and clinical characteristics of these two diseases can be influenced by factors such as type of bacteria, its virulence, and resistant of the person.[1]

Periodontal disease and dental caries are the leading causes of adult tooth extraction and they are known as the most common chronic diseases in general population. These diseases have a big impact on health system of a country due to high prevalence rate, influence on person and society, and treatment fees; in some countries, the fourth budget in health and treatment fees is

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allocated to these diseases.[2,3]

Studies have shown that dental and oral health embraces psychological and social influences that can exert a direct impact on chewing, speaking, and appearance, and also exert an indirect impact on growth and social welfare.[4,5]

In recent years, several authors remarked upon the relation between oral infection and the increased risk of systemic diseases.[6,7] The most common related diseases in this field are cardiovascular disease (CVD),[8] respiratory diseases,[9] diabetes, rheumatoid arthritis (RA), osteoporosis, pancreatic cancer, metabolic syndrome, renal disorders,[9] premature birth, and even degenerative conditions such as Alzheimer's disease.[10-12]

According to research studies, the gold standard intraoral examination comes with visual and tactile examination that includes palpation of oral soft and hard tissues and related structures and use of a special light source for examination of oral cavity, periodontal probe, mouth mirror, gloves, mask, gowns, and etc.[8,13]

Based on the importance of oral health in prevention of systemic diseases, in early 1990, some of other major references mainly in nursing strived to smoke out a technique in quick examination of oral cavity, and this step led to attaining a simple improvement in oral examination technique, that included maintenance of guidelines in infection control and making use of an appropriate extra oral light source, designed in a sophisticated manner mainly for nurses, physicians, and other health team personnel.[14]

This technique is simply classified based on visual examination, and one of the most common uses of it is to examine quality of oral health of the elderly that can be performed by a social worker, and a little training is required.[15]

Literature review shows that few studies about combination of different variables in assessment of oral health exist, and epidemiological studies are not always renewable; therefore, there are always problems in comparison of these studies;[7] that's why various scales like Total Dental Index,[16] modified Total Dental Index,[17,18] Asymptotic Dental Score (ADS), and Brief Oral Health Status Examination (BOHSE) are designed.[19]

At any rate, the greater severity of criterion indicates higher grade for the patient. Chalmers and Pearson[18] inferred that evaluation of oral health status was only possible by visual examination. Visual examination gives more credibility to the result of oral examination being done by nurses and oral health team workers.

Jamieson et al. stated that visual oral examination could be done as a useful method for evaluation of oral health of children, and this method includes predictive values, specificity and sensitivity more than 90% (in order for evaluation of prevalence of dental caries) compared to visual examination and palpation of tissue of the mouth.[22]

Cross-sectional Burt surveys, that were conducted to assess the prevalence of dental caries, showed that the gold standard way to conduct research studies included visual examination and palpation of the tissue; and making use of an appropriate light source, periodontal probe, mouth mirror, gloves, face mask, and gown is essential for running oral examination.[8-13] Currently, the clinical photographs are a visual tool used for an examination.[23-25]

Latest scale designed in this field is Global Oral Health Scale that was designed in 2013 by Relvas et al.[13] According to designer's claim, this scale provides evaluation of factors of oral health (dental caries and periodontal disease) in a simple way.[13] This index indicates presence of dental caries and gingival disease and is designed based on the number of carious teeth, extent of supragingival plaque, gingivitis, severity of dental caries, extent of periodontal plaque, and number of periodontal pocket and their severity.[12,13]

This study was aimed to evaluate the conformity of diagnosis of oral hygiene using clinical oral examination and photography based on criteria of Global Oral Health Scale.

Table 1. Grade of dental health and periodontal health

Dental health	Grade 0	Grade 1	Grade 2	Grade 3
Supragingival plaqe	0	1-56	57-112	> 112
Careis	0	1-4	5-8	9≥
Severity of caries (median)	0	1	2	3
Periodontal health				
Gingival inflammation	0	1-56	57-112	> 112
Pockets ≥ 4 mm	0	1-56	56-112	> 112

Methods

This descriptive cross–sectional study received ethical approval from Ethics Committee of Kerman University of Medical Sciences, Kerman, Iran (KA. 930572).

Initially, 100 patients (aged 20 years or older and having at least 24 teeth) referring to the school of dentistry were evaluated for dental caries and periodontal status. Examination was performed by a senior dental student and accomplished under the supervision of oral medicine specialists in the dental school. All teeth (except third molar) were evaluated from 6 sites as follows: mesio-buccal, medio-buccal, mesio-lingual, medio-lingual, disto-bucaal, and disto-lingual as well as tooth surfaces with supragingival plaque; the number of decayed teeth (detected using mouth mirror and explorer), severity of dental caries (zero: caries free, 1: enamel dental caries, 2: dental caries of dentin and enamel, 3: dental caries of enamel, dentin extended to pulp), tooth surfaces in vicinity of inflamed gingival,[17] average periodontal probing depth, and pocket depth more than 4 mm were recorded (Table 1).

From each of the groups listed in table 1, four patients (total of 20 patients) were selected and these patients had documented standard photos of following views: frontal, left lateral, right lateral, occlusal, lingual and palatal of occlusion, and occlusal surface of upper and lower jaw (photos were taken under the same conditions in terms of location, light source, and the photographer (Canon Rebel T7i With 18-135 mm Lens with 18-135 mm Lens– Japan). Photos were processed and prepared in form of an album. In the next stage, the provided album was rendered to 60 specialists and postgraduate students in periodontics, oral diseases and reconstructive surgery, oral and maxillofacial surgery, endodontics, and prosthodontics, as well as 100 general dentists of Kerman City (Figures 1-4).

Figure 1. Grade 0

The purpose of this study was explained and verbal informed consent was obtained from the participants. The participants were requested to grade oral health of each patient based on the photographs. Grading system was as follows: very good (0), good (1), medium (2), poor (3).

Figure 2. Grade 1

Figure 3. Grade 2

The data was compared with the data attained from the examination of patients based on the Global Oral Health Scale, and the overestimation, underestimation, and concordance was identified and reported. Meanwhile, a number of demographic questions such as age, sex, profession, work history, and profession background were collected from dentists.

Figure 4. Grade 3

The result of reviews was analyzed by Kruskal-Wallis test, t-test, chi-square, and Bonferroni correction via SPSS software (version 18, SPSS Inc., Chicago, IL, USA). P-value < 0.05 was considered significant.

Results

In this study, 60 specialists and postgraduate students and 100 general dentists were assessed. 96 persons were women and 64 persons were men. The average age of participants was 31.14 ± 5.90 (range: 25-66 years) (Table 2).

Table 2. Demographic profiles of the participants (n = 160)

Parameter		n (%)
Sex	Men	64 (40.00)
	Women	96 (60.00)
Years since graduation	< 2	30 (18.75)
	2-5	70 (46.87)
	> 5	60 (55.62)
Degree of education	Dentist specialist	50 (31.25)
	Postgraduate student	10 (6.25)
	General dentist	100 (62.50)
Type of activity	Clinic	12 (7.50)
	Dental office	80 (50.00)
	Dental faculty	30 (18.75)
	Multiple locations	38 (23.75)

More than half of the participants (59.1%) diagnosed the oral health of 7-12 patients correctly based on photographs. None of the participants diagnosed oral health of more than 14 patients correctly based on photographs. Overestimation was observed by 84.1% of postgraduate students and general dentists in case number 10 (one patient with grade 1) and underestimation in case number 1 (one patient with grade 3). The study showed that the diagnostic concordance for grade zero was high (61.2%) and for grade 1 was too low (15.1%), mainly overestimation for grade 2 was low (25.1%) and for grade 3 was average (36.6%).

For grade one, the average diagnostic matching was 1.15 ± 3.57 and the least diagnostic concordance was for grade 2 and 3 with average of 1.22 ± 2.11 and 0.77 ± 1.13, accordingly. Case analysis in this study showed a considerable discrepancy (Table 3).

According to gender, significant differences were observed in response to the case (Table 4). Women had respectively the highest correct grade allocation (CGA) for grade 2 (P = 0.001) and men had the highest rate for grade 1 (P = 0.020). Moreover, statistically significant differences were attained with respect to the field of specialization of respondents. General

dentists had the highest conformity rate in their answer to grade one, and periodontists and postgraduate students had highest conformity rates reported for grades 2 and 3.

Table 3. Overestimation, underestimation, and concordance in 20 cases

	Grade 3	Grade 2	Grade 1	Grade 0
Case number	17	3	2	8
Overestimation	12.9	45.9	23.6	32.1
Underestimation	56.1	12.8	29.8	12.2
Concordance	32.4	34.3	54.7	56.4
Case number	18	7	4	9
Overestimation	34.0	34.2	23.5	34.4
Underestimation	12.0	21.3	18.7	1.2
Concordance	56.5	45.2	47.9	57.1
Case number	19	11	5	13
Overestimation	34.1	32.1	70.5	43.1
Underestimation	22.7	24.4	12.1	34.2
Concordance	78.2	45.1	44.6	22.1
Case number	12	15	6	20
Overestimation	45.0	44.4	45.1	24.1
Underestimation	47.2	13.5	7.4	0
Concordance	12.1	32.1	48.0	81.2
Case number	1	14	10	16
Overestimation	0	1.1	84.1	18.7
Underestimation	57.2	53.7	1.2	0
Concordance	32.8	43.9	8.9	71.5
Case number	Total	Total	Total	Total
Overestimation	12.5	14.1	65.3	39.6
Underestimation	45.4	25.2	43.8	0
Concordance	36.6	25.1	15.1	61.2

Data are presented as percentage.

Discussion

This study evaluated the level of conformity in the diagnosis of oral hygiene using oral clinical examination and photographs based on Global Oral Health Scale criteria. New index of Global Oral Health Scale was introduced by Relvas et al. in 2013 for evaluation of oral health status.[13]

In this study, we requested the participants to diagnose the oral health status of the patients based on provided photographs, and there was not any clinical examination conducted.

Besides restrictions of the use of photographs, we could mention restriction in retraction of cheek and tongue and exposing oral mucosa. In addition to that, we should try to present a three dimensional object in two dimensional image in a way that it would provide the complete visibility to lay out the right clinical decision. Studies show that the appearance of the person and making use of cosmetics could have a good influence on the examiner.[20-22]

More than half of the respondents (59.1%) diagnosed the oral health of 7-12 patients correctly based on photographs; none of the respondents diagnosed oral health of more than 14 patients correctly, based on the photographs. In a study conducted by Relvas et al., 69.1% diagnosed the patients' oral health status correctly in 8-12 patients based on photographs.[13]

Table 4. Mean of grades based on demographic characteristics

Parameter		Grade 3	Grade 2	Grade 1	Grade 0	P
Sex (mean ± SD)	Men	2.21 ± 1.40	2.19 ± 1.02	3.11 ± 0.42	2.21 ± 1.01*	0.001
	Women	1.13 ± 0.77*	2.34 ± 1.12	3.16 ± 1.12	3.42 ± 0.21	
Age (year) (mean ± SD)	< 30	2.18 ± 0.54	3.12 ± 1.02	2.58 ± 1.40	3.25 ± 0.45	0.125
	> 30	2.45 ± 1.02	3.49 ± 1.12	2.45 ± 1.45	3.21 ± 1.12	
Years since graduation (mean ± SD)	< 2	3.12 ± 1.34	3.39 ± 1.08	3.10 ± 1.14	2.61 ± 0.25*	0.010
	2-5	3.34 ± 1.23	3.29 ± 1.42	3.14 ± 1.24	3.12 ± 1.11	
	> 5	3.45 ± 1.02	3.44 ± 1.02	3.24 ± 1.21	3.15 ± 1.40	
Degree of education (mean ± SD)	Dentist specialist	3.19 ± 1.08	3.19 ± 1.22*	3.57 ± 1.15	2.68 ± 1.40*	0.001
	Postgraduate student	3.09 ± 0.42	2.11 ± 1.22	3.17 ± 1.40	2.41 ± 1.42*	
	General dentist	3.09 ± 1.09	2.32 ± 1.12	3.31 ± 1.01	3.12 ± 0.98	
Type of activity (mean ± SD)	Dental school	3.19 ± 1.41	3.21 ± 0.42	3.14 ± 1.40	3.01 ± 1.14	0.090
	Dental office	3.39 ± 1.25	3.19 ± 0.23	2.49 ± 1.25	3.00 ± 0.42	
	Clinic	3.09 ± 1.34	3.19 ± 1.21	2.45 ± 1.16	3.13 ± 1.45	
	Multiple locations	3.19 ± 1.45	3.23 ± 0.88	2.36 ± 1.54	3.15 ± 1.14	

*P < 0.05 is significant, SD: Standard deviation

The highest rate of CGA is obtained in grade zero that does not have conformity with the study of Relvas et al.,[13] in which, the highest rate of CGA was for grade 3 and zero, which it shows that respondents in the study were not able to diagnose the patients with one surface caries and complex caries based on the photograph.

The lowest conformity of CGA was observed among cases with grade 1 and 2. Moreover, in this study, dental plaque was not identified by photograph, and number of tooth surfaces with supragingival plaque was estimated by participants. The survey shows that thorough clinical oral examination is more effective than examination that is exclusively visual for detection of dental plaque, but both techniques are appropriate for examination of teeth without plaque.[23-26]

In this study, the researcher made use of periodontal probe for evaluation of periodontal status of patients, average depth of periodontal pocket, and number of periodontal pockets that are pathologic in nature; and participants in this study evaluated the periodontal status of the patient only based on the appearance of gingiva, that it might be the cause of underestimation in patient one with grade 3.

Periodontal probe is a critical tool used in visual examination for evaluation of quality of periodontal tissue and conducting epidemiologic studies. However, in a study conducted in 2001, it was inferred that periodontal probes provided a few diagnostic information and in some of cases it might exert a negative influence.[27]

In this study women gained the highest CGA rate for grade zero and men gained the highest CGA rate for grade 1. General dentists showed the highest conformity in grade 1 and periodontists and residents of postgraduate studies had highest conformity for grade 2. Relvas et al.[13] conducted a study which showed the similar results observed in men and women, and surgeons showed the highest conformity. One of the main causes of this discrepancy could be the difference in educational methods of different specialties. Review of related literature implies that until now dental researches are being done by visual and clinical examination. Although, current study and study conducted by Relvas et al.[13] show that making use of Global Oral Health Scale as a new index and comparison with photography of patients especially in patients with very good and poor oral hygiene could be useful for epidemiologic studies and comparison of different populations.

Conclusion

Current study shows that making use of Global Oral Health Scale as a new index and comparison with photographs of patients, especially in patients with very good and poor oral hygiene, could be useful for epidemiologic studies and comparison of different populations.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

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