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Study on the Oral Health Attitude and Behaviour and the Changes in Dental Plaque According to the Use of Qraycam

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Abstract

Background/Objectives: The study aimed to identify changes in dental plaque after intraoral application of a disclosing agent in two Qraycam groups and to investigate changes in oral health attitudes and behaviours.

Method/Statistical Analysis: The study population consisted of 80 people who participated in the study between May and August 2019. The equipment used was Qraycam and a plaque control records (O'Leary index); oral health attitudes and behaviours were investigated. Differences in participant characteristics according to Qraycam use were analysed by χ^2 test, while changes in the PCR(O'Leary index) by area for Qraycam use and non-use groups were analysed by pre-post paired-samples t-test. The influence on the oral health attitudes of the Qraycam use group was analysed by multiple linear regression analysis. All analyses were performed using IBM SPSS ver. 25.0 (IBM Co., Armonk, NY, USA) and the significance level for statistical testing was set to 0.05.

Findings: In the Qraycam use group, a decrease in the PCR in the left and right sides showed statistically significant differences ($p<0.05$), while a change in the total PCR also showed a statistically significant difference ($p<0.05$), with the right side showing a greater change in dental plaque. In the Qraycam non-use group, there were no statistically significant differences in the decrease in the left, right, and total PCR. In the Qraycam-use group, the biggest influencing factor on oral health attitudes was oral health behaviour ($p<0.05$).

Improvements/Applications: PCR(O'Leary index) decreased significantly in the Qraycam use group, influencing oral health education, attitudes, and behaviours. The active use of Qraycam for community-based oral health activities and clinical dentistry would assist oral health promotion.

Keywords: *O'Leary index, Oral health attitude, Oral health behaviour, Plaque control record(PCR), Qraycam.*

Introduction

The most basic care method for maintaining healthy oral conditions and enjoying better quality of life is dental plaque management through proper tooth brushing[1]. If dental plaque is not removed physically or chemically, the types and amount of microorganisms can increase. Dental plaque is a non-calcified bacterial mass, which can typically be removed sufficiently by the physical force used when brushing teeth with a toothbrush[2]. Since dental plaque has a yellow or milky white colour, similar to teeth, people sometimes have difficulty in distinguishing dental plaque from natural teeth with the naked eye. As dental plaque becomes worse, periodontal disease may occur. With periodontal disease, subjective symptoms caused by incipient lesions do not appear until the disease has progressed to a considerable extent and is left untreated in most cases since there is no discomfort. Therefore, such periodontal diseases can be viewed as a chronic disease since they

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are often treated in the advanced stage[3]. Periodontal disease is preventable by dental plaque control, and up to now, the method of using a disclosing agent to test the effect of dental plaque control has helped increase the effectiveness of oral health education. It has been reported that oral health education method for motivating patients and the maximization of the visual effect by using a disclosing agent are effective in improving oral hygiene[4]. To achieve behavioural changes in patients, it is necessary to induce motivation. In particular, for oral health education, continuous and long-term behavioural changes are very important. Proper oral health education and the use of oral care products can build reasonable oral care habits. Oral health education through a disclosing agent for dental plaque examination is very effective, but using a disclosing agent is time consuming in that the surface of each tooth must be coloured and the examination must be performed after rinsing the mouth. Moreover, it requires effort from both the patient and examiner and there is discomfort when cleaning the coloured tooth surface upon completion of the examination[1].

To resolve such discomfort, new technology has been developed which would allow dental plaque to be detected without colouring. Recently, the latest diagnostic equipment using fluorescence have been introduced in dentistry, a prime example of which is quantitative light-induced fluorescence (QLF) used for detecting incipient caries lesions[5-6]. QLF is an equipment that detects the red fluorescence emitted by a metabolite called porphyrin, which is secreted by intraoral bacteria[7]. It has been reported that dental examinations using Qraycam can produce results similar to directly observing the teeth of study participants and it has the excellent ability of visual inspection in distinguishing between dental caries and restorations[8]. The advantages of this equipment include the fact that it does not use a disclosing agent for dental plaque assessment and that older dental plaques show redder fluorescence[7], which could be very helpful visually when educating patients. A study by Lee[9] investigated and reported on the oral hygiene status of adolescents who smoke by addressing the disadvantage of observing dental plaque by using a disclosing agent to overcome the problem of different results being found according to the subjective perspective and skill level of the examiner.

The present study aimed to apply a disclosing agent inside the oral cavity to check whether any change in dental plaque is actually observed in both Qraycam use and non-use groups. The study also aimed to investigate changes in oral health attitudes and oral health care behaviour. Oral care education and motivation through the use of a disclosing agent is an appropriate and excellent method, but Qraycam is very beneficial for motivating patients and can help the effectiveness of education in addition to being more convenient to patients. For dental hygienists, it helps examine the overall health status of patients and the quantification of the results, while also being helpful in providing such information to patients to promote behavioural changes.

Accordingly, the objective of the present study was to investigate the effectiveness of oral health education and changes in attitude and behaviour based on changes in PCR(O'Leary index) in groups that used or did not use Qraycam.

Method

The study population consisted of 80 people who visited the 00 university for clinical dental hygiene practical training between May and August 2019. The appropriate sample size needed for the χ^2 test, paired t-test, and multiple linear regression analysis was calculated via priori power analysis using the G*power 3.1 program. The present study was conducted with approval from the Institutional Review Board (IRB) of Silla University (1041449-201904-HR-002).

Qraycam is a dental diagnostic equipment developed by AIOBIO (Seoul, South Korea). The students who participated in the present study have experience from repeated training in treating patients, and thus were familiar with the items that appeared in the questionnaire. During practical training, a dental hygiene assessment was performed according to normal lessons and the items were surveyed using a preliminary questionnaire and records. Upon completion of all preliminary surveys, the investigation was conducted by dividing participants into those who received oral health education by Qraycam images and those who did not.

A plaque control record (O'Leary index) is used to assess the ability of patients to perform dental plaque control. It indicates the location or amount of dental plaque and measurement is possible with just the dental mirror and a probe. Generally, since it can accurately investigate the areas with dental plaque build-up, the areas where a toothbrush and dental floss should be used can easily be identified, while the surfaces of the teeth are coloured with a disclosing agent and each

tooth is divided into four surfaces for the assessment of any remaining dental plaque in the tooth margins[10]. In the present study, the PCR(O'Leary index) of all participants were investigated to determine the changes in dental plaque.

The study used thirteen oral health attitude items that Lee[11] applied to workers aged 18 to 65. Each item was graded on a five-Likert scale with 1 point for "not at all" and 5 points for "very much so". The maximum possible score was 65 points, with higher scores indicating higher oral health attitudes.

This is the contents extracted from the chart records in clinical dental hygiene practice[12]. Oral health care behaviour consisted of eight items regarding the frequency of tooth brushing, duration of tooth brushing, tooth brushing intensity, tooth brushing time, tooth brushing method, the use of fluoride toothpaste, interdental cleaning, and tongue cleaning. The maximum possible score was sixteen points, with higher scores indicating better oral health care behaviour.

To analyse the differences in the general characteristics of the participants according to the use of Qraycam, a χ^2 test was performed. Changes in PCR by area in the Qraycam use group were investigated by a pre-post paired-samples t-test. Changes in PCR by area in the Qraycam non-use group were also investigated by a pre-post paired-samples t-test. The influence on the oral health attitudes of the Qraycam use group was analysed by multiple linear regression analysis. All analyses were performed using IBM SPSS ver. 25.0 (IBM Co., Armonk, NY, USA) and the significance level for statistical testing was set to 0.05.

Result and Discussion

Typical oral diseases, such as dental caries and periodontal disease, are caused by bacterial dental plaque; thus, dental plaque control is the simplest and most efficient method for preventing oral disease. Therefore, sound dental plaque control practices can be very helpful in preventing oral disease. There is a variety of oral health education method for achieving dental plaque removal. The present study investigated whether using Qraycam can be helpful for dental plaque removal by dividing the participants into Qraycam use and non-use groups.

[Table 1] shows general characteristics of participants, the Qraycam usage rate in males and females was 59.4 percent and 47.9 percent, respectively; the Qraycam usage rate was relatively higher due to the participants being involved in practical training in school. When the participants brushed their teeth, they usually used their right hands. The Qraycam usage rate in the groups with and without negative experiences during previous treatments was 50.0 percent and 52.9 percent, with and without regular visits to the dental clinic was 50.0 percent and 53.4 percent, with and without scaling experience was 54.5 percent and 48.0 percent, and with and without oral health care education experience was 51.6 percent and 53.1 percent, respectively. The Qraycam use and non-groups according to general characteristics of participants showed no statistically significant differences.

Table 1. General characteristics of participants

		A	B	Total	χ^2	p
1	Men	19(59.4)	13(40.6)	32(100.0)	1.011	0.219
	Women	23(47.9)	25(52.1)	48(100.0)		
2	Right	41(53.2)	36(46.8)	77(100.0)	0.459	0.602
	Left	1(33.3)	2(66.7)	3(100.0)		
3	NO	36(52.9)	32(47.1)	68(100.0)	0.035	0.548
	Yes	6(50.0)	6(50.0)	12(100.0)		
4	NO	31(53.4)	27(46.6)	58(100.0)	0.076	0.489
	Yes	11(50.0)	11(50.0)	22(100.0)		
5	NO	12(48.0)	13(52.0)	25(100.0)	0.295	0.381
	Yes	30(54.5)	25(45.5)	55(100.0)		
6	NO	26(53.1)	23(46.9)	49(100.0)	0.016	0.541
	Yes	16(51.6)	15(48.4)	31(100.0)		

1:Gender, 2:Use of hands, 3:Negative experience during previous treatment, 4: Regular visits to the dental clinic, 5: Scaling experience, 6:Oral health care education experience, A: Use group of Qraycam, N(%), B: Non-use group of Qraycam, N(%), *p<0.05 by χ^2 test

[Table 2] shows the changes in plaque control record by area in the Qraycam use group. A decrease in the right PCR showed a statistically significant difference (p = 0.002) and a decrease in the left PCR also showed a statistically significant difference (p = 0.002). Changes in the total PCR also showed a statistically significant difference (p = 0.001), with the right side showing greater change in dental plaque (diff. 9.01). As shown in Table 2, dental plaque was removed better on the left side than on the right side. Most of the participants were right-handed and right-handed people typically have difficulty cleaning the right side of their mouths, as compared to the left side. This is because there may be difficulties with the appropriateness of the direction or approach of the toothbrush, as compared to the left side. Generally, when oral health education is conducted, instructions are given on how to clean the right teeth, left teeth, and anterior teeth. Since oral health education was conducted in many cases after showing images in the Qraycam use group, the decrease in dental plaque may have shown significant change.

Table 2: Changes in plaque control record by area in the Qraycam use group (N = 42)

PCR	Before	After	Mean diff	p
Right side	45.91	36.90	9.01	.002
Left side	42.65	34.81	7.84	.002
Total	46.28	37.73	8.55	.001

*p<0.05 by paired t-test

[Table 3] shows the changes in plaque control record by area in the Qraycam non-use group. A decrease in right, left, and total PCR did not show statistically significant differences. However, as shown in Table 3, dental plaque was removed better on the left side than on the right side. The PCR of the right teeth appeared relatively higher in the Qraycam non-use group, while the PCR of the left teeth was very similar to that of the Qraycam use group. However, the difference between the before and after was not high.

Table 3: Changes in plaque control record by area in the Qraycam non-use group (N = 38)

PCR	Before	After	Mean diff	p
Right side	49.68	47.65	2.03	0.471
Left side	42.65	43.38	4.30	0.102
Total	46.90	42.17	4.72	0.138

*p<0.05 by paired t-test

As shown in [Table 4], oral health attitudes in the Qraycam use group appeared significantly higher in the order of oral health behaviour (β = 1.715) and total plaque control record (before) (β = 0.134), while the explanatory power was approximately 33.2 percent with adjusted R square = 0.332.

Table 4: Influence on oral health attitude in the Qraycam use group (N = 42)

	β	Std. Error	t	p
(Constant)	22.092	9.668	2.285	0.028*
1	3.344	1.936	1.727	0.093
2	-0.063	0.102	-0.618	0.541
3	0.134	0.065	2.050	0.048*
4	-0.036	0.083	-0.433	0.668
5	2.816	6.620	0.425	0.673
6	1.715	0.521	3.292	0.002*

1: Gender, 2: Age, 3: Total Plaque Control Record Before, 4: Total Plaque Control Record After, 5: Use of hands, 6: Oral Health Behaviour, Dependent Variable: Oral Health Attitude, R Square = 0.430, Adjusted R Square = 0.332, *p<0.05 by Multiple linear regression analysis

The limitations of the present study include the following: First, the participants were selected by convenience sampling and the study used questionnaires and practical lesson records of clinical hygiene students. Therefore, there are difficulties in generalising the findings. Second, although the results were derived by a single-group pretest-posttest design using before and after comparisons during visits and re-visits by the participants, there were difficulties in testing the effect of Qraycam due to the absence of a control group, despite efforts to control the exogenous variables. If future studies can identify the interventional effect of Qraycam through a study design using experimental and control groups, then such differences could be presented more clearly. Studies to date have often focused on the validity and reliability of dental plaque and dental examinations using Qraycam. However, the present study is valuable in that it demonstrated the interventional effect of oral health education through Qraycam.

Conclusion

The objective of the present study was to identify the influence on the oral health education effect, attitudes, and behaviours through changes in PCR of the Qraycam use and non-use group. The study was conducted on 80 people who visited the 00 university for clinical dental hygiene practical training between May and August

2019. The participants understood the objectives and method of the study, had no systemic problems and were otherwise healthy, and consented to participate in the study. The findings were as follows:

1. In the Qraycam use group, a decrease in the left and right PCR showed statistically significant differences ($p<0.05$). The total PCR also showed statistically significant differences ($p<0.05$), with the right side showing greater changes in dental plaque.
2. In the Qraycam non-use group, a decrease in the left, right, and total PCR showed no statistically significant differences.
3. In the Qraycam use group, the biggest influencing factor on oral health attitude was oral health behaviour ($p<0.05$).

Through the present study, PCR decreased significantly in the Qraycam use group and appeared to influence the effect of oral health education, attitude, and behaviour. Accordingly, it is believed that the active use of Qraycam of community-based oral health activities and clinical dental hygiene would be helpful for oral health promotion.

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