Journal of Oral Medicine and Dental Research

Genesis-JOMDR-4(2)-46
Volume 4 | Issue 2
Open Access
ISSN: 2583-4061

Assessing Quantitative Light Induced Fluoresence (QLF-D) as a Motivational Tool for Removal of Interdental Plaque

Sheela Kumar Gujjari[1], Raghavendra Shanbhog[2], Kritika Banerjee[3], Swathi Vathsa[3]

[1]Professor and Head, Department of Periodontology, JSS Dental College & Hospital, Mysuru, Karnataka, India
[2]Reader, Department of of Pedodontics & Preventive Dentistry, JSS Dental College & Hospital, Mysuru, Karnataka, India
[3]PG Student, Department of Periodontology, JSS Dental College & Hospital, Mysuru, Karnataka, India

[*]**Corresponding author**: Sheela Kumar Gujjari, Professor and Head, Department of Periodontology, JSS Dental College & Hospital, Mysuru, Karnataka, India.

Citation: Gujjari SK, Shanbhog R, Banerjee K, Vathsa S. (2023) Assessing Quantitative Light Induced Fluoresence (QLF-D) as a Motivational Tool for Removal of Interdental Plaque. J Oral Med and Dent Res. 4(2):1-7.

Received: November 03, 2023 | **Published:** November 17, 2023

Abstract

The objective of this was to determine the effects of educational, preventive and motivational actions on plaque reduction using Quantitative Light- induced Fluorescence (QLF-D). 25 dental students were selected for this study, clinical indices, and QLF-D scores were recorded for all, after which they were divided into two groups. All the participants were given standardized toothbrushes and floss along with instructions to use them for three weeks; after said period, the participants reported to the clinic and clinical indices and QLF-D scores were recorded again. The data was collected and subjected to statistical analysis.

Research article | *Gujjari SK. J Oral Med and Dent Res. 2023, 4(2)-46.*
DOI: https://doi.org/10.52793/JOMDR.2023.4(2)-46

Statistically significant intragroup difference was noted in groups. When comparing the plaque reduction three weeks post intervention, the SPS score showed significant difference, whereas, the red fluorescence did not show any significant difference.

Keywords

Biofilm; Interdental plaque; Maintenance; Oral hygiene; Quantitative light- induced Fluorescence

Introduction

Dental plaque is a major aetiological factor for the pathogenesis of various dental diseases like dental caries and periodontal disease. Hence, an excellent standard of oral hygiene is required to reduce the risk of developing such diseases. Use of interdental aids is not common among populations, this could be attributed to an inability to visualize interdental plaque. For a clinician, assessing interdental plaque is a cumbersome process. Lange in 1986 developed the Approximal Plaque Index for the purpose of measuring the presence of interdental plaque, however, this index only indicates the presence or absence of plaque without providing any information on the amount of plaque accumulation. these are subjective methods of determining oral hygiene level by visual assessment and have low reliability.

To this end, Quantitative light-induced fluorescence (QLF) could be an alternative for plaque assessment and patient education. QLF is already being used for caries detection, and monitoring effects of oral hygiene but could also be useful for interdental plaque quantification. QLF is based on the fact, that plaque shows fluorescence in green, orange and red, if stimulated with light of specific wavelengths. The intensity of red fluorescence is due to synthesized endogenous porphyrins of oral bacteria and has been shown to correlate with age and thickness of the biofilm. Assessment of interdental plaque using QLF could be effective as patients will be able to visualize the presence of plaque in their mouth which would serve as a better educational guide, as compared to using only clinical indices. Hence, this study was carried out to evaluate QLF as a tool for assessing interdental plaque to improve the oral hygiene of dental undergraduate students.

Materials and method

Ethical approval of this study was obtained from the Institution Ethics Committee, JSS Academy of Higher Education and Research (21/2021). With a confidence level of 95%, margin of error of 5%, and a standard deviation of (obtained from previous literature), and considering a 10% drop out rate, the sample size was estimated to be 25. The participants were selected based on the following criteria; First year undergraduate dental students (convenience, least chances of drop outs, knowledge factor) with a habit of brushing twice daily, but do not use any interdental aids or chemical plaque control agents. Healthy individuals with all their permanent teeth, Individuals free from cavitated carious lesions, Individuals wearing any orthodontic or prosthodontic appliance, Individuals with chemotherapeuticagents use during the previous two weeks. Informed written consent was taken prior to their participation in the study. At the first session, O'Leary plaque index was measured to standardize the baseline plaque scores, after this

patient with similar plaque scores were selected for the trial. Baseline proximal surface plaque was collected in the morning from each sample as per following protocol, A disposable waxed floss (Curaden) was used to collect interdental plaque. A single-trained investigator collected the interdental plaque by flossing the area between the first and second molar in each of the four quadrants. First, the interdental plaque was taken from the distal surface of the first molar, and then from the mesial surface of the second molar using another floss. The floss was passed through the contact area and below the gingival margin as deeply as possible by wrapping each tooth in a C-shape. Each side of the molar was flossed twice in the same way. The floss was removed from the interdental area by sliding its end through the dental contact point to avoid disturbing the collected plaque on its middle part. White-light and fluorescence images of the collected interdental plaque on the floss were captured immediately using QLF-D (QLF-D Billuminator, Inspector Research System, the Netherlands). Plaque scores obtained from all four quadrants were added and their average was taken as the plaque score for individual subjects.

The distance between the floss and the light source was kept constant, and any external light was blocked. All images were captured under the same settings (shutter speed 1/30 s, aperture value 4.5, ISO speed 1600). To quantify the Red Fluoresence of plaque observed in the acquired fluorescence images, the image analysis software (proprietary software- C3 version 1.0.0.79) was used to calculate the area and intensity. An area of interest (AOI) was drawn around the boundary of the flossed area in the fluorescence image. The RF intensity was quantified by calculating the mean ratio of the red and green intensities (R/G ratio) of every pixel within the AOI. The RF area was obtained as a percentage by calculating the ratio of the number of RF pixels to the total number of the pixels within the AOI. A plaque fluorescence score was calculated by multiplying the fluorescence intensity (R/G value) and the fluorescence area (%), to represent the comprehensive fluorescence properties of the interdental plaque of each tooth.

The participants were given standardized compact head toothbrushes (Curaprox CS 5460), taught the Roll technique of toothbrushing using fluoridated toothpaste, along with that they were also given dental floss (Curaprox waxed dental floss), and were taught how to use the floss. These participants were given standard oral hygiene instructions. They were instructed to use them for a period of three weeks to allow them time to learn the use of dental floss. Then the participants were randomly divided into two groups using the lottery method. The difference between the 2 groups was that, the baseline QLF images obtained for evaluating interproximal plaque, was shown to Group 2 participants as a motivational tool. After the scheduled three weeks were over, the participants were recalled and the post-intervention QLF images were repeated.

Statistical Analysis

The values were tabulated in MS Excel for statistical analysis, which was done using the SPSS software version. Independent samples t-test was performed, and a p value < 0.05 was considered statistically significant.

		N	Mean	standard Deviation	Mean Difference	F value	Sig
SPS	Pre-intervention	25	4.24	0.88	1.88	4.654	0.036
	Post-intervention	25	2.36	1.15			
R30	Pre-intervention	25	16.16	19.05	13.95	31.036	0
	Post-intervention	25	2.22	2.23			
R60	Pre-intervention	25	10.28	16	9.596	31.639	0
	Post-intervention	25	0.69	0.61			
R120	Pre-intervention	25	7.18	12.74	6.71	29.788	0
	Post-intervention	25	0.47	0.467			

Table 1: Comparison of plaque scores in non-motivated group (Group 1).

		N	Mean	Standard Deviation	Mean Difference	F value	Sig
SPS	Pre-intervention	25	4.36	0.8602	3.12	4.99	0.03
	Post-intervention	25	1.24	0.7234			
R30	Pre-intervention	25	18.101	19.0044	17.1762	38.5	0
	Post-intervention	25	0.925	1.1955			
R60	Pre-intervention	25	12.07	17.1843	11.8609	44.35	0
	Post-intervention	25	0.209	0.3618			
R120	Pre-intervention	25	9.042	14.8374	8.8253	42.87	0
	Post-intervention	25	0.216	0.3908			

Table 2: Comparison of plaque scores in motivated group (Group 2).

		N	Mean	Standard Deviation	Mean Difference	F value	Sig
SPS	Non-motivated group	25	1.88	1.6911	-1.24	4.302	0.043
	Motivated group	25	3.12	1.1299			
R30	Non-motivated group	25	13.946	19.8645	-3.2295	0.035	0.852
	Motivated group	25	17.176	18.6776			
R60	Non-motivated group	25	9.596	16.2379	-2.268	0.2	0.657
	Motivated group	25	11.865	17.0392			
R120	Non-motivated group	25	6.709	12.8993	-2.2034	0.759	0.388
	Motivated group	25	8.913	14.8044			

Table 3: Intergroup comparison of plaque score reduction 3 weeks after intervention.

Results

Of all the participants enrolled in the study, none were excluded due to lack of compliance. The intragroup comparisons of both motivated and non-motivated groups showed statistically significant improvement in SPS, R30, R60, and R120 values from baseline to 3 weeks ($p<0.05$). The intergroup results showed that the motivated group showed statistically significant reduction in SPS values compared to non-motivated group ($p<0.05$) (Table 1,2). The R values also improved in motivated group compared to non- motivated group, but the difference was not statistically significant (Table 3).

Discussion

Plaque accumulation is one of the most important etiologic factors for dental caries and periodontal diseases. Controlling plaque accumulation can go a long way in improving gingival health, thereby preventing periodontal diseases and dental caries. Dental plaque displays red fluorescence when exposed with red light, this fluorescence is associated with the etiological changes during plaque maturation rather than with the characteristics of single microbial species. Increased thickness, age, maturation and cariogenicity of biofilms were found to be associated with higher intensities of red fluorescence in vitro. This fluorescence can be used as a visual aid for motivational purposes.

In the present study, first year undergraduates were chosen as the test participants, owing to their lack of knowledge of interdental aids, as was reported by Gupta et al. Those students were selected who were

not already using interdental aids, such students were educated and motivated towards regular use of interdental aids, following which, a statistically significant reduction in plaque scores was observed among the participants in both groups, after using dental floss along with toothbrush, this was in accordance with a study conducted by Muralidharan et al in 2019, on 60 adults, concluded that motivating people to use interdental aids, can provide statistically significant results in achieving interdental plaque control, compared to using toothbrushing alone. Berchier et al reached a similar conclusion when they conducted a systematic review to assess the adjunctive effect of flossing and toothbrushing, compared to toothbrushing alone.

When the post interventional plaque scores of both groups were compared, the group who were provided with visual motivation with the use of QLF-D had better plaque scores, though this difference was not statistically significant. This was similar to a study conducted by Akifusa et al, where they evaluated electric toothbrush with QLF-D applied visualisation in its head and compared the results with an electric toothbrush without QLF- D applied visualisation. The results of this study, brought them to the conclusion that brushing while looking at a monitor which depicts red-auto fluorescent dental plaque, improves efficacy of dental plaque removal, compared to brushing teeth without visualization.

Conclusion

Using this method of quantifying plaque, we can conclude that looking at an image that depicts red-fluorescent dental plaque using QLF-D system can act as motivational tool for regular use of dental floss, and help people in improving their oral hygiene practice, along with being used as a chairside tool on a regular basis to quantify proximal plaque.

References

1. Cugini M, Thompson M, Warren PR. (2006) Correlations Between Two Plaque Indices in Assessment of Toothbrush Effectiveness. J Contemp Dent Pract. 7(5):1-9.
2. Gennai, S, Nisi M, Perić M, Marhl U, Lzzetti R, et al. Interdental plaque reduction after the use of different devices in patients with periodontitis and interdental recession: A randomized clinical trial. Int J Dent Hygiene. 20(2):308– 17.
3. Guk HJ, Lee ES, Jung UW, Kim BI. (2020) Red fluorescence of Interdental plaque for screening of gingival health. Photodiagnosis Photodyn Ther. 29:101636.
4. Marks RG, Magnusson I, Taylor M, Clouser B, Maruniak J, et al, (1993) Evaluation of reliability and reproducibility of dental indices. J Clin Periodontol. 20(1):54-8.
5. van der Veen MH, de Josselin de Jong E. (2000) Application of quantitative light-induced fluorescence for assessing early caries lesions. Monogr Oral Sci. 17:144-62.
6. Kühnisch J, Heinrich-Weltzien R. (2004) Quantitative light-induced fluorescence (QLF)--a literature review. Int J Comput Dent. 7(4):325-38.
7. Veen MH, Thomas RZ, Huysmans MC, de Soet JJ. (2006) Red autofluorescence of dental plaque bacteria. Caries Res. 40(6):542-5.
8. Lennon AM, Buchalla W, Brune L, Zimmermann O, Gross U, et al. (2006) The ability of selected oral

microorganisms to emit red fluorescence. Caries Res. 40(1):2-5.

9. Gupta N, Arora SA, Chhina S, Chand J, Abrol S, et al. (2020) Knowledge, Attitude and Perceptions of Interdental Aids Usage Amongst Dental Students and Professionals: A Questionnaire Based Survey: National J Int Res Med.11(2):74–9.
10. Muralidharan S, Acharya A, Mallaiah P, Margabandhu S, Garale S, et al. (2019) Efficacy of dental floss as an adjunct to toothbrushing in dental plaque and gingivitis: An open labelled clinical non-experimental study. J Indian Assoc. 17:279-82.
11. Berchier CE, Slot DE, Haps S, Van der Weijden GA. (2008) The efficacy of dental floss in addition to a toothbrush on plaque and parameters of gingival inflammation: a systematic review. Int J Dent Hyg. 6(4):265-79.
12. Akifusa, S., Isobe, A., Kibata, K, Oyama H, Ariyoshi W, et al. (2020) Comparison of dental plaque reduction after use of electric toothbrushes with and without QLF-D-applied plaque visualization: a 1-week randomized controlled trial. BMC Oral Health. 20(1):4.