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A PERTINENT APPROACH OF DENTAL PLAQUE DETECTION, FLUORESCENCE PLAQUE DETECTING SYSTEM Vs DISCLOSING AGENT – A COMPARATIVE QUESTIONNAIRE STUDY

Periodontology

Veena C. Kalburgi Professor & Head Of The Department, Department Of Periodontology, People's College Of Dental Science And Research Centre, Bhopal, Madhya Pradesh, India.

N. Sai Sri Harsha* Post Graduate, Department Of Periodontology, People's College Of Dental Science And Research Centre, Bhopal, Madhya Pradesh, India. *Corresponding author

Priyanka Deshmukh Post Graduate, Department Of Oral Medicine And Radiology, People's College Of Dental Science And Research Centre, Bhopal, Madhya Pradesh, India.

Anushri Gupta Post Graduate, Department Of Periodontology, People's College Of Dental Science And Research Centre, Bhopal, Madhya Pradesh, India.

Nida Malik Post Graduate, Department Of Periodontology, People's College Of Dental Science And Research Centre, Bhopal, Madhya Pradesh, India.

Swapnil Thakur Senior Lecturer, Department Of Periodontology, People's Dental Academy, Bhopal, Madhya Pradesh, India.

ABSTRACT

OBJECTIVE: The purpose of this study is to find out whether the newly arising plaque detecting techniques are better over the traditional technique i.e disclosing agents and check their efficacy

METHOD: A Comparative Study has been conducted with using the new flouroscent plaque detecting device and the traditional old method using disclosing agent. A sample size of 520 under graduate students were taken and plaque has been examined using Q scan plus and disclosing agent. Then a questionnaire has been prepared based on the ideal properties of plaque detection and asked the subjects to fill after the examination.

RESULTS: The clinical assessment and statistical analysis using chi-square test , by using fluorescent plaque detection technique showed higher grades in every positive aspect that a disclosing agent should primarily have compared to old traditional technique using disclosing solution.

CONCLUSION: It can be concluded that fluorescent plaque detection technique is superior to disclosing solution in every aspect and its very easy to use, without any residual stains, faster and also known to have higher specificity according to this study based on the responses. There is no question of allergic reactions using this technique.

KEYWORDS

Dental Plaque, Fluorescence Plaque Detection, Porphyrin, Disclosing Solution.

1. INTRODUCTION

Now a days, people are aware and showing much concern towards their oral health, which is a good sign but the methods we are following for the maintenance and detecting the oral health conditions are becoming older. Many new devices and new methods have been introduced for ease of use; people can check and maintain their oral health at their home easily without the need of consulting a dentist. We conducted a study on the new plaque detecting devices with a questionnaire on the basis of its effectiveness over the older methods i.e. disclosing agent by examining the dental plaque of the undergraduate students using both the methods consecutively at the same time. It might be the first comparative study that is made to find out the effectiveness of various plaque disclosing methods and also to create awareness among upcoming dentists (bds undergraduate students) about the newer methods of disclosing plaque.

1.1. BACKGROUND

Dental plaque is the community of microorganisms found on a tooth surface as a biofilm, embedded in a matrix of polymers of host and bacterial origin.[1-2] it is a sticky, colorless or pale yellow film that can be observed on the teeth and the prosthesis. It forms on the teeth continuously; the only way to get rid of this plaque is by using proper brushing technique, floss and mouth rinses.

Plaque is the root cause of many oral health issues, bacteria present in plaque produce acids that can harm enamel, dentin and also inflames pulp. Plaque deposition leads to inflammation of gums called gingivitis which can further lead to periodontitis if left untreated. Plaque can cause bad breath or halitosis, and if not removed regularly, it can be calcified into calculus-tightly adhering to tooth surface, which can only be removed with help of dental professionals. Bleeding sites serve as entry ways for pathogens into blood streams[9], which may lead to conditions like stroke, cardiovascular and coronary artery diseases, atherosclerosis, endocarditis, and respiratory diseases like pneumonia[8]. So there is a significant prophylactic value in detection and removal of plaque.

Many forms of disclosing agents are available, but new technologies are introduced which makes the process easier and faster. Plaque in oral cavity can be detected by fluorescence, and it has been studied that this florescence is produced by porphyrins that are present in certain bacteria. New plaque detecting devices are designed on the basis of this florescent property of porphyrins. Porphyrins are the group of macromolecules with the basic structure of porphine, a tetrapyrrolic ring linked by methine bridges involved in the biosynthesis of several biological molecules such as heme and chlorophyll[10]. Porphyrins acts as pigments that are fluorescent with characterstic bands of absorbance between wavelength 390 - 425nm, a strong soret band in the wavelength of 380-500nm, and weaker Q bands in the wavelength of 500-750nm.[11]

Dental Plaque can be observed as red fluorescence when teeth are illuminated with blue spectral light. Many studies have been stated that red fluorescence is because of the obligate anaerobic bacteria presence in the dental plaque *Ex; porphyromonas gingivalis, prevotella intermedia, prevotella melaninogenica*. Porphyrins can be also used for detection of carious activity, in photodynamic therapy which is a non invasive cancer treatment and also in many other fields[11]. Overall, porphyrin shows the presence of bacterial activity in the specified area and can be used as diagnostic tool of detecting plaque. Many researches were been made and many advancements have came into this field, Q SCAN PLUS is one among them which is used for detection of plaque given by the Q-Ray™ System (Inspektor Research Systems, Amsterdam, The Netherlands) which is a multimodal oral imaging platform which selectively targets plaque, caries, and white spots.

In this device the blue spectral light is focused on the teeth with the wavelength of 405nm then the porphyrins present in that specific area rapidly absorbs the light with the strong soret band present and red

fluorescence is emitted back which can be clearly visible through the filter present in the device. One can easily access the oral cavity, bacterial activity and the specified areas that are needed to be cleaned and maintained.

Figure 1

Moving on to the traditional old method of plaque detection, i.e. disclosing agent. According to Wilkins (1959), a disclosing agent is a selective dye in solution, tablet, or lozenge form used to visualize and identify dental biofilm on the surfaces of the teeth.[6] it causes staining of bacterial plaque that can be an aid for patients to develop an efficient system of plaque removal.[7]

Disclosing solution can change the colour of dental plaque, in contrast with the white tooth surface. It has the ability to retain a dye which is used for disclosing purpose. Because of the polarity difference between the components of the plaque and the dyes, reaction takes place. The dye particles are bound to the surface by electrostatic interaction to proteins and hydrogen bonds to polysaccharides in the dental plaque.[3] Gallagher et al (1977) carried out in-vivo and in vitro studies to find out the mechanism of Two-tone disclosing agent.

Ideal properties that a disclosing solution should have are[4]

- Contrasting colour
- Ability to withstand colour after rinsing,
- Taste should not be unpleasant
- Should not irritate mucosa
- Diffusibility

Disclosing agent is applied on patients tooth surface using a cotton swab or a cotton pellet then the patient will be asked to thoroughly rinse off the mouth. After rinsing we can clearly observe some staining in the area of the presence of plaque. Clean tooth surface don't absorb the solution and when pellicle and bacterial plaque are present, disclosing agent will get absorbed and area gets stained. And in the case of two tone disclosing agent 2 colours are observed red colour stains indicate the newly formed plaque and blue colour stains indicate older and thicker plaque. These solutions and even other disclosing agents were heavily in use and gave good results but also rarely have some adverse reactions. Plaque disclosing tablet contain PLAKSEE-MD(10mg aryabhishek and propyl paraben) has reported to cause allergic reaction in individuals suffering from eczema.[5]

Considering all the factors many researches were made and newer methods of plaque detection came into existence using the fluorescent property of the porphyrin. Now for evaluating the efficacy of this newly introduced technique over the older one, a study is conducted using both the techniques consecutively on the subject and the results are been prepared based on the patient feedback.

Figure 2

2. MATERIALS AND METHODS

A study was conducted on the undergraduates in People's college of dental science and research center & People's dental academy, Bhopal, Madhya Pradesh. The purpose of the study is to compare the efficiency of different plaque detecting methods which was conducted on sample size of 520 participants. A questionnaire was prepared about plaque disclosing agent /device and was distributed among all the participants. The participants were examined using both the methods consecutively.

Each participant was examined first with the help of Q scan plus and they were asked to observe plaque in the area of red fluorescence emitted on the teeth. Then after a while, participant is examined with help of disclosing solution, and again asked them to observe the area of the tooth that get stained i.e. plaque which is disclosed. After examination with both methods, participants are asked to fill the questionnaire forms.

2.1. PROCEDURE

Firstly, all the participants have been explained what is going to be done and their role in the study then after, procedure has been started. Participants mouth was retracted using retractor, their teeth are exposed to the light emitted by Q SCAN PLUS and then participants were asked to observe their teeth in the mirror by holding the device. The area where the red fluorescence is emitted depicts the presence of plaque. Then again after the detection of plaque with Q SCAN PLUS, it is done using the disclosing agent. Participant's mouth was retracted using retractor, and the area of teeth where the disclosing solution has to be applied was thoroughly dried, then disclosing solution is applied on the teeth using a cotton pellet or a swab and participant is asked to rinse their mouth thoroughly removing the retractor and again retractor is placed back, then participant is asked to observe their teeth in the mirror again. The area where teeth gets stained depicts the presence of plaque. After the participant has observed the condition of their oral cavity and plaque status using both the methods of plaque detection they were asked to fill the questionnaire forms based on their experience

Figure 3: 1st row label as disclosing agent & 2nd row label as q scan plus

2.2. QUESTIONNAIRE FORM

DEPARTMENT OF PERIODONTICS

AWARENESS REGARDING DETECTION OF DENTAL PLAQUE

QUESTIONNAIRE

1st year UG ☐ *2nd year UG* ☐

3rd year UG ☐ *4th year UG* ☐

Please tick the appropriate box

	Q SCAN PLUS	DISCLOSING SOLUTION
1. Which is more comfortable to use?		
2. Which of the following gives faster results?		
3. High specificity in detection of dental plaque is seen in?		
4. Ease of use		
5. Do you observe any stains remains on the teeth after the use?		
6. Any allergic reactions are seen with…….		

CONSENT

I have been explained in my own language about the investigations & treatment procedures to be performed on myself. I willingly give my consent for any investigation to be done. I am fully aware and accept that the investigation and procedure will be carried out by the students and trainee doctors under proper supervision. I also give consent for publication of my photographs, clinical data, videographs, radiographs etc. at any scientific platform in intrest of advancement of scientific knowledge and skill.

Signature of the patient

3. RESULTS

Frequency distribution of participant's given data about plaque detection agents

Table 1

QUESTIONS	DISCLOSING SOLUTION		Q SCAN	
Comfortable to use	22	4.2%	498	95.8%
Faster results	12	2.3%	508	97.7%
High specificity in plaque detection	118	22.7%	402	77.3%
Ease of use	24	4.6%	496	95.4%
Any stain remain on the teeth after use of	506	97.3%	14	2.7%
Any allergies seen with	8	1.5%	0	0%

4. DISCUSSION

Whole procedure has been done and every participant was examined twice using both the methods and based on their response to the given questionnaire, statistically results were analysed. We can easily see the opinion of most of the participants to each question asked, through the graphs. Based on the results obtained, most(95.8%) of the participants favoured Q scan in terms of ***comfort*** and few(4.2%) stated that disclosing solution was comfortable . For the second question based on quicker results, 97.7% of the participants said that Q scan gave ***faster results*** and only (2.3%) favored for disclosing solution. ***Specificity*** in plaque detection was higher for Q scan (77.3%) as reported by the study participants and comparatively to the other questions asked about disclosing agent many(22.7%) of the participants were positive about the specificity seen by disclosing solution. For the next question, ***ease of use***, 95.4% of the study participants reported that Q scan was easy to use and only 4.6% favoured disclosing solution. Most of the participants (97.3%) reported that ***stains reain after the use*** of disclosing solution whereas only 2.7% participants reported the same for Q scan. No allergies were reported by participants for Q scan whereas 1.5% reported ***allergy*** with disclosing agent. Overall, most of the participants gave favourable reporting for Q Scan in comparison to disclosing solution in all the positive properties that a disclosing agent should have. In the case of residual stains, most of the participants reported disclosing agent shows residual stains. Allergies or irritation is very rarely reported and only in the case of disclosing solution.

5.CONCLUSION

It can be clearly concluded that, Q scan plus is superior to disclosing solution in every aspect and there is no question of allergic reaction through Q scan plus because the light that is used for plaque disclosal is blue spectral visible light with a wavelength of 405nm which is completely harmless to the tissues.

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