



Interdental Plaque Detection: An Important Oral Health Concern

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Received Date: March 04, 2024; **Published Date:** March 08, 2024

Keywords: Oral Health; Periodontology; Teeth

Introduction

Health, a word which itself signify a biggest blessing to human being. According to the famous proverb "Health is wealth" it is clearly understood that no matter how much wealthy a human being is, all his or her wealth is useless, until the health is good [1]. Talking about health, so the word, health includes both the systemic health and oral health. It has been proven from various studies, that these two healths are interconnected with each other, as the changes in either one of them, do have an effect on the other [2]. Periodontology which is the specialized branch of dentistry deals with the structure around gingiva (gums) and the structures surrounding the gingiva (supporting structures). Two types of diseases gingivitis (inflammation of gingiva), and Periodontitis (extension of inflammation from gingiva into the supporting tissues) are of utmost concern as both these diseases signifies the poor oral health [3]. Talking about the etiopathogenesis of gingivitis and periodontitis, the sole etiological factor responsible for the causation of these two diseases is the plaque. Plaque can be defined as the structured, resilient, yellowish, grayish substance that adheres to the natural teeth, including fixed and removable prosthesis. This plaque consist of a microbial colony and this microbial colony, present in the plaque is responsible for the causation of characteristic features of gingivitis and periodontitis [4]. In India, as compared to the other developed countries, most of the people are not that much active in taking care of their oral health, as far as people do in taking the care of their systemic health [5]. Although this thought is also true that among these people only, some of them are not active in taking the care of both their systemic health, and oral health and as a result of negligence from these people, they put their lives at risk at the end [6]. One of the reason why most of the

people leads to the gingivitis or periodontitis is based upon the fact that these people do brush their teeth by toothbrush, but one of the biggest disadvantage of using the toothbrush is that, the toothbrush is unable to clean from the interdental area, and the plaque originates initially from the interdental area then spreading on the other tooth surfaces. So in able to stop the formation of plaque from the interdental area, and henceforth the gingivitis or periodontitis, interdental aids needs to be used by the people [7]. One of the reason, people are not habitual to the use of interdental aids is based upon the fact, that because of the tightness of tooth contacts, people are unable to visualize the plaque on the interdental area, as much as they can visualize the depositis on the labial or buccal surfaces [8]. From the clinician point of view sometimes it do happen, that when the patient comes after phase 1 therapy for reevaluation, the clinician finds still bleeding on probing is positive for some sites of the tooth ,despite the maintenance of good oral hygiene by the patient and a good phase 1 therapy by the clinician. In this case it can happen that plaque from the interdental area is not removed thoroughly during professional scaling because the clinician is unable to visualize the interdental plaque [9]. Henceforth some other diagnostic methods apart from a conventional diagnostic method needs to be developed so that the clinician can be able to visualize the plaque and can remove it thoroughly so that there will be the complete elimination of an etiologic factor and so is the elimination of gingivitis or periodontitis and the recognized interdental plaque should also be shown to the patient so that the patient can visualize the interdental plaque and can be motivated to use the interdental aids ,to maintain the effective oral hygiene from interdental area as well. Some of the enhanced methods were developed to aid in the conventional diagnostic method so that a proper treatment can be done. These methods are as follows [10].

Plaque Disclosing Agent

As mentioned, the plaque is the sole etiological factor for the causation of periodontal disease³ hence it becomes important from clinical point of view to identify the plaque [11]. Since the tooth morphology like the tightness of tooth contacts varies from individual to individual and in individual within the different areas of the mouth, so the possibility can do occur that plaque can be overlooked from some areas of the oral cavity, and out of them the most overlooked area can be the interdental area which is the primary centre of plaque accumulation [12]. The reason for this overlooked behaviour is due to the fact that the plaque is a colourless and a transparent substance that it contrasts with the colour of the tooth. Hence this overlooked behaviour can lead to further deterioration of the oral health because if plaque not visualized properly then it cannot be removed properly too [13]. Hence in order to deal with this overlooked behaviour, the concept of disclosing agents came into existence which have the capability to reveal plaque even from the inaccessible areas of the tooth surface. The first disclosing agent was invented in the year 1914 by Skinner who used iodine as the plaque revealing agent. Later on further modifications were made such as Bismarck brown solution, Gentian Violet, Two tone dyes in order to more clearly visualize the plaque [13]. Dental plaque has the capability to absorb the colour of the disclosing agent as a result of which there is a change in the colour of the plaque in contrast to the tooth surface and hence the plaque becomes visible easily from the inaccessible areas leading to the complete elimination of the plaque by the clinician and hence preventing the further deterioration of the oral health [13]. Later on it was discovered that plaque disclosing agent apart from revealing plaque from the inaccessible areas can be used for a variety of ways like [13]

1. To evaluate the oral hygiene efficiency
2. In plaque indices
3. Self evaluation by the patient so that the patient becomes motivated to remove the interdental plaque build up
4. Evaluation of the amount of biofilm during and after the periodontal surgeries.

Later on it was realized that the disclosing agents had certain drawbacks such as [13]

1. Apart from staining plaque, they also stain the soft debris and pellicle, hence cannot be said as plaque selective agent.
2. Also they can only reveal the area where the plaque is present but cannot reveal the thickness of the plaque because of which the old plaque and mature plaque cannot be visualized.

Plaque Indices

Initially, various plaque indices had been developed, which utilizes a numerical value based scale so that the extent of the surface area of the tooth covered by the plaque can be

measured [14]. The first plaque index was given in the year 1960 an index which was based upon the amount of the plaque which covered the vestibular area and the lingual surfaces of all the teeth, as well as upon the presence of extrinsic stains which cover the teeth was designed, and they called this index as an Oral Hygiene Index. But the drawback of this index was that they had included extrinsic stains into their index, but the decrease in stain intensity reflects only the aesthetics, and not the disease etiology and since the word good oral hygiene signifies that the oral cavity should be free from all the deposits which are responsible for the causation of gingivitis and periodontitis.¹⁵In the year 1962, Quigley and Hein, designed a plaque index, that measures only the labial surface of anterior teeth. But it is of a more common fact that plaque deposition on the anterior teeth mainly occurs on the lingual surface, hence taking this consideration, Turesky, Gilmore and Glickman modified the Quigley and Hein plaque index, by including both the labial and lingual surface gingival third into the index and measured the amount of plaque covering the gingival third into scores which ranged between 0 to 5 [14]. SP Ramjford in the year 1967 had given the periodontal disease index in which total six teeth were selected and after staining with Bismarck brown solution, the interproximal surface, the facial surface, and the lingual surface of these six teeth were examined, and given a score between 0 to 3. However this indices had certain drawbacks like [14].

- This index has considered color change in gingiva as an important diagnostic sign and not included bleeding on probing as the first and the foremost sign because from the previous studies it has been proven that the first obvious diagnostic sign of gingivitis is bleeding on probing, and not the color change.
- This index had considered cemento-enamel junction as its reference point for recording gingivitis but in some individuals who have abrasion or restorative procedures, this cemento-enamel junction can be lost.
- This index is truly based upon tactile sensation instead of direct viewing, hence expertise is required, therefore non expertise individuals cannot be able to record this index.

In the year 1964, Silness and Loe, give the plaque index which is the most widely used index in literature for the clinical studies. Plaque index is based upon the identification of the plaque and recording it on a numerical scale on the four surfaces of all the teeth. The disadvantage of the plaque index given by Silness and Loe is that plaque needs to be identified on the gingival margin and periodontal pocket, resulting in a great stress upon the examiner to record it on the four surfaces of all the teeth in both the arches. Hence because of the complexity of this plaque index, clinically it's quite not possible to record the plaque and hence a more simpler system needs to be designed through which the

clinician can easily identify and can record the plaque [15].

O'Leary, Drake and Naylor had given the plaque control record in the year 1972 which makes the use of plaque disclosant solution and an explorer, to record the presence of plaque on the 4 surfaces of each tooth. The advantage of this index is that it is the type of index in which presence of plaque can be easily visualized as it has not divided the tooth into the gingival third or middle just like the other previous indices. But the disadvantage of this index is based upon the fact that it has described a more complex procedure for recording the information about the plaque presence [15]. In the year 1974 the plaque control index was given which is based upon the concept of Davies used for identification and recording of the plaque at the dent gingival unit by means of either probe alone or a combination of probe and disclosant solution, but not by using the disclosing solution alone. This plaque control index based upon the concept of davies can be easily acceptable in a clinical practice, as it do have the following advantages such as [15].

1. It is based upon the numerical values hence the scoring criteria values can be compared from baseline to subsequent visits indicating the effectiveness or ineffectiveness of oral hygiene.
2. Since this index do had included the interproximal areas, and the highest score had been given to the presence of plaque at the interproximal area, hence this index had well explained the already proven fact that the plaque originates initially in the interproximal area, and hence it becomes utmost important concern to use interdental aids as mandatory as one uses a toothbrush to clean the labial ,lingual, incisal ,and occlusal surfaces.

Quantitative Light Induced Fluorescence Digital

Plaque the main etiological factor for the causation of gingivitis and periodontitis, when detected in the oral cavity indicates that the individual do have oral disease and holds the value of a clinical significance [16]. In the past, various methods have been used to identify the plaque so that to make an individual aware of their oral health and to prevent the systemic complications that can do arise from the poor oral health. Some of these methods such as plaque indices developed by various researchers are useful in detecting the oral disease in an individual; but all of these indices have their drawback like their method of recording plaque is complicated and often time consuming. So in order to overcome these limitations of the methods used in the past to detect plaque, the era of fluorescence devices came into existence in 1990. The first intraoral quantitative light induced fluorescence camera was developed by joslin de jong,in which the fluorescence image was captured using a CCD camera [17]. Later on the modification of this device was developed and was called as Quantitative Light Induced

Fluorescence Digital which was based upon the principle of using auto-fluorescence of the teeth in which the tooth suspicious of plaque when excited with blue visible light with a peak wavelength of 405 nm and in combination with a long pass filter, emits the red fluorescence, and this red fluorescence confirms the presence of plaque [18]. This Red fluorescence from the plaque is due to the porphyrins which is the metabolic product of microbe known as *Porphyromonas gingivalis*,and *Prevotella intermedia*. The greater the intensity of red fluorescence emitted by the plaque upon the exposure to the quantitative light induced fluorescence digital, it indicates that severe is the plaque thickness and the microbial pathogenicity present in the plaque and hereby indicating the need to maintain the effective cleanliness of the interdental area as well which also signify that why it becomes utmost concern to make an individual aware of their oral health as well as by the use of quantitative light induced fluorescence, clinicians can objectively visualize the dental plaque without the use of disclosing solution [19].

Conclusion

The interdental plaque accumulation is an important factor of concern as it indicates the gingival inflammation, and if the patient does not become aware then this inflammation can spread to the alveolar bone leading to the Periodontitis. Hence it becomes mandatory for an individual to clean the interdental area so that the plaque build-up can be prevented interdentally. From the clinician point of view, it becomes important to correctly diagnose the interdental plaque so that the clinician can do a proper treatment and to make a patient aware of the plaque build-up interdentally and the various consequences arises from it. The individual should be made to realize that both the oral health and the systemic health are the mirror of each other as the deterioration in oral health can lead to the systemic health deterioration just like the same way, the systemic health deterioration do have an effect on oral health. Hence it's an important thing to be realized by an individual that just like the individuals are concern about their systemic health, they should equally be concern about their oral health too and should take all those important measures which can maintain their oral health in a good state of mind just like their systemic health.

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