

## Effect of Disclosing Agents in Oral Hygiene

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### Abstract

**Introduction:** Dental caries and periodontal diseases are bacterial plaque-mediated oral health problems so disclosing agents have been recommended as auxiliaries in oral hygiene. **Objective:** The purpose of the present study was to assess the effect of disclosing agents in oral hygiene. **Methods:** A randomized double-blind crossover study was carried out using a 2% malachite green solution and criteria from Quigley & Hein (1962) index for effective comparison among 82 school children aged 11-13 years. First of all, adolescents were separated into thirteen groups. Seven groups were exposed to technique A (regular toothbrushing with disclosing agent and without dentifrice) and six groups to technique B (regular toothbrushing without disclosing agent or dentifrice). After three weeks, the subjects of technique A were exposed to technique B and vice-versa. Average plaque values were compared using Student's *t* test. **Results:** The groups showed no difference between techniques, but significant differences were shown in both groups between the first and second steps. **Conclusion:** The results of this study show that disclosing agents play no

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crucial role in oral hygiene improvement. Explanatory hypothesis related to motivational effects engendered by the participation of the subject in the study are discussed.

**Key words:** Preventive dentistry; dental plaque; disclosing agents.

## *Efecto de las sustancias reveladoras en la higiene oral*

### **Resumen**

**Introducción:** La caries dental y la enfermedad periodontal constituyen un problema de salud oral, cuyo factor común es la placa bacteriana. Se ha recomendado utilizar agentes detectores de placa como auxiliares de la higiene oral. **Objetivo:** El propósito de esta investigación fue evaluar el efecto de las sustancias reveladoras en la higiene oral. **Métodos:** Se llevó a cabo un estudio doble ciego, aleatorio y cruzado, utilizando una solución de verde malaquita al 2% y los criterios del índice de placa de Quigley & Hein (1962). En la primera etapa, se conformaron trece grupos, siete de ellos usaron la técnica A (cepillado habitual con detector de placa y sin crema dental), y los otros seis grupos usaron la técnica B (cepillado normal sin detector ni crema dental). En la segunda etapa, los escolares se intercambiaron en el uso de las técnicas. **Resultados:** No se encontraron diferencias significativas entre las técnicas empleadas. Se observaron diferencias significativas entre ambos grupos al cambiar de la primera a la segunda etapa. **Conclusión:** Los resultados de este estudio señalan que las sustancias reveladoras no juegan un papel crucial en la higiene oral. Se discuten algunas hipótesis explicativas relacionadas con los efectos motivacionales en los sujetos del estudio.

**Palabras clave:** Odontología preventiva; placa dental; detectores de placa.

### **Introduction**

Dental caries and periodontal diseases are both multifactorial oral health problems that have dental bacterial plaque as their main etiological agent. Dental plaque consists of densely packed bacteria found on the surface of teeth. It is embedded in plaque matrix, an amorphous material composed of extracellular carbohydrate polymers, synthesized by the bacteria, and of

macromolecules and other elements derived from saliva and crevicular fluid. In the presence of a number of different factors, microbial plaque can produce toxins and acid substances. Such metabolites can initiate a destruction process of the hard tissues of teeth, and elicit inflammatory reactions in the gums<sup>1,2</sup>.

Dental plaque control may be achieved by both mechanical and chemical means. Among the former, toothbrushes and dental floss are the most important<sup>3</sup>.

As dental plaque is the same color as teeth, its removal is difficult and complex. In order to neutralize this characteristic and help in oral hygiene, the use of disclosing agents has been recommended since the early twentieth century<sup>4,5</sup>. These are specific chemical coloring agents used to stain masses of dental plaque. Several chemical substances have been used to pigment microbial buildups, including iodine, bismarck brown, erythrosine, gentian violet, malachite green, methylene blue and basic fuchsin<sup>6</sup>.

The aim of the present study was to evaluate the effect of disclosing agents in oral hygiene.

## Methods

A randomized double-blind crossover experimental study was conducted. Study population included 82 adolescents aged 13-15 years from the same elementary/high school. Inclusion criteria were presence of complete dentition and dental plaque score  $\geq 1.4$  using the criteria adopted by Quigley and Hein<sup>7</sup>. Parents were clarified about survey characteristics and they authorized their children to participate by signing a specially made document, in accordance to Brazilian National Health Council Resolution 196/96.

In stage 1, study population was randomly divided into thirteen groups. Each group underwent an oral hygiene procedure. At the end of this stage, seven groups had been submitted to technique A (regular toothbrushing with disclosing agent and without dentifrice) and six groups to technique B (regular toothbrushing without disclosing agent or dentifrice). After having made techniques A and B, all patients had their teeth painted with 2% of green malachite.

The amount of dental plaque was measured using the criteria established by Quigley and Hein<sup>7</sup>. Vestibular and lingual surfaces of teeth 17, 16, 12, 21, 26, 27, 36, 37, 32, 41, 46, and 47 were observed instead of all the teeth as made by the previously mentioned authors. A score between 0 and 5 was attributed to each tooth according to Figure 1. The value of the plaque was obtained by dividing the sum of all scores by the 24 surfaces examined.

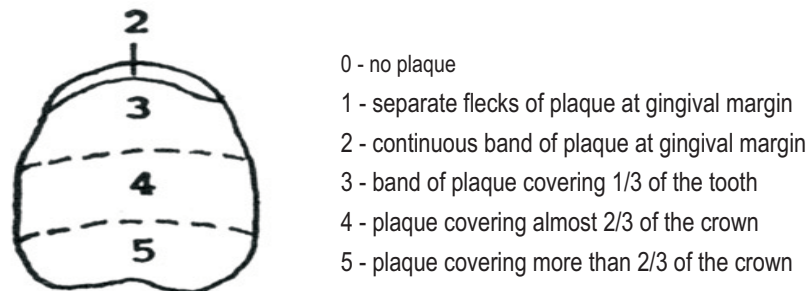


Figure 1. Criteria adopted: Quigley and Hein index (1962).

In stage 2, after three weeks, a crossover procedure was done and the participants who had undergone technique A were submitted to technique B, and vice-versa.

The dependent variable was controlled through the inclusion in the survey of adolescents of similar age and plaque removal patterns. Subjects were randomly separated into two groups, equally submitted to both techniques at alternate moments. The independent variable was controlled by means of the participation of two different researchers. Whereas the first researcher was responsible for applying the technique, the second one registered plaque values. In order to secure blindness concerning the technique applied to each subject, all children, following supervised oral hygiene, had their teeth colored by the first researcher and were forwarded to observation by the second researcher. This second observation took place in a room located on a different floor of the school building. Thus, it was not possible for the latter to identify any signs of the coloring solution, which could potentially have influenced the examination.

Although disclosing solutions stain very thin layers of plaque of doubtful clinical significance, and may therefore yield inflated plaque scores<sup>1</sup>, procedures carried out before the beginning of the present survey showed the greater feasibility of assessing the amount of plaque through the use of disclosing agents. The most accurate method for assessing the amount of plaque, involving its collection with a scaler, is not practical. Moreover, it was more important to ensure the blindness of the experiment.

Data obtained were entered in Microsoft Excel® v. 5.0 software, and plaque score measures and standard-deviations for each group in each stage were calculated. Means were compared using Student's *t* test one-sided, and adopting means difference equal to 0.2 and a 0.05 significance level in both stages. The sample size was estimated at 41 elements in order to determine type II error. At the stage one, test for two samples of similar variance was

used with  $\beta < 0.35$  (random error relative to sample size) and at the stage two, test for correlated sample was utilized with  $\beta < 0.20$ .

## Results

There were no statistically significant differences related to the use of disclosing agents in removing dental plaque. Tables 1 and 2 present a comparative analysis of the data obtained between groups I and II, and between the two different stages in the same study group.

Table 1 shows the absence of statistically significant differences in mean plaque value between experimental and control groups in both stages.

On the other hand (Table 2), the results showed a clear reduction on mean plaque values between stages 1 and 2 ( $p < 0.01$ ).

## Discussion

The present experiment compared the amount of dental plaque removed after the application of two different supervised oral hygiene techniques: technique A, which included the use of a 2% malachite green disclosing solution, and technique B, which did not.

An experiment that excludes all sources of error is not a simple task. It is essential to establish a design capable of verifying potential explanatory hypotheses. Experiments can test theories, but they are not capable, by themselves, of proving them<sup>8</sup>. A basic characteristic of experimental studies is the

**Table 1.** Dental plaque value by group in each step.

Group	Stage 1			Stage 2		
	n	means	SD±	n	means	SD±
Experimental	44	1.46	0.44	38	1.16	0.46
Control	38	1.41	0.47	44	1.22	0.44

**Table 2.** Dental plaque value according to the technique applied in each group.

Stage	Group II			Group I		
	n	means	SD±	n	means	SD±
1	38	1.41*	0.47	44	1.46*	0.44
2	38	1.16	0.46	44	1.22	0.44

\* $p < 0.01$ .

comparison of one or more groups. If two or more groups are different in relation to a third variable, this difference may explain the causal relationship observed.

The results obtained show that the plaque scores of both groups fell in stage 2, regardless of the use of a disclosing agent. Several studies have analyzed the effect of the use of such substances in oral hygiene, whereas some studies demonstrate a positive influence of disclosing agents on oral hygiene<sup>9-15</sup>. Others conclude that these agents play no crucial role in oral hygiene improvement<sup>16-22</sup>.

A review of these studies revealed a great variety of methodological procedures. Striking differences were observed in relation to both the characteristics of the population studied, age group, sample size, schooling, socioeconomic conditions, etc. and the techniques employed in each survey, especially study design, measuring instruments, and error prevention procedures. Several studies established control groups for result comparison<sup>12,16,17,19,22</sup> and adopted masking procedures for examiners,<sup>12,16,19,20</sup> but none of them employed a crossover design, since each subject had his own control.

In fact, the disclosing agents have provided means of evaluating the thoroughness of tooth cleansing<sup>2</sup>.

The characteristics of the present study allow us to assume that potential confusing factors been controlled. However, one cannot discard the possibility of interventions by certain variables connected to the phenomenon. Some studies have indicated that other factors may play a role in the relationship between disclosing agents and plaque removal, including aspects that can be found among the subjects of the present study. Plaque score improvement for all subjects in stage 2, regardless of the employment or not of a disclosing agent, may be ascribed to greater motivation for the achievement of efficient cleansing, since subjects knew ahead of time that their teeth would be examined after supervised oral hygiene, an aspect that was enforced by their experience in stage 1<sup>21</sup>.

The two-stage experiment of this study, which included observations of the effects of the independent variable on both groups, revealed that the supervision carried out by the researcher that applied the technique may have had a positive influence on the degree of motivation of the studied population. According to Friedman<sup>16</sup>, the sole contact between adolescents and the dentist, and the quality of the rapport established between them is often enough to change their behavior. These observations suggested that an adequate patient-dentist relationship may lead to reductions in dental plaque scores in the context of oral hygiene programs.

If motivation may be defined as the mobilization of internal forces that impulse the individual towards action<sup>23-25</sup>, an adequate patient-dentist rela-

tionship may be defined as that which is able to impulse both individuals toward the search for the satisfaction of common interests and needs.

Daly *et al.*<sup>26</sup> in an analysis of the results obtained in a survey, reported that improvements in plaque scores may be related to motivational effects resulting from study participation and anticipation of oral examinations.

It thus seems reasonable to conclude that the motivation generated by the quality of both, relationship and professional supervision of oral hygiene, may play a more relevant role in the efficacy of dental plaque removal than the use of a disclosing factor.

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