

ORAL HEALTH PROMOTION EFFICIENCY IN THE CONTROL OF ORAL BIOFILM

Eficácia da promoção da saúde oral no controlo do biofilme bucal

Eficácia de la promoción de la salud oral en el control del biofilm dental

Original Article

ABSTRACT

Objective: To assess the efficacy of oral health instructions, particularly in the control of dental plaque, as well as assess the effectiveness of their reinforcement. **Methods:** A quasi-experimental study was conducted at the University Clinic of the Portuguese Catholic University (UCP) in Viseu-Portugal from January to June 2012. Three different assessments were performed with 30 participants using the O'Leary Plaque Index and a questionnaire on oral health behavior, with a one-month interval between each assessment. In the first assessment, all participants received the same instructions of oral hygiene and the O'Leary Plaque Index registration and the application of the questionnaire were performed; in the second assessment, a new registration of the O'Leary Index was made, but only the experimental group (n=16) received the reinforcement of oral health instructions, and in the third assessment, a new registration of the O'Leary Plaque Index was made for all the individuals (n=30). **Results:** Both control and experimental groups showed a decrease in the O'Leary Plaque Index, but the latter showed a more significant decrease in the last assessment: 38.19% (n=16) vs. 69.57% (n=14), $p < 0.05$. Regarding the frequency of toothbrushing, in the experimental group, 68.8% (n=11) brushed the teeth at least twice a day, while in the control group only 57.1% (n=8) performed the same frequency of toothbrushing. In this case, statistically significant differences were found between the two groups ($p < 0.05$). **Conclusion:** Oral health promotion through oral hygiene instruction was effective in improving oral health behaviors, and, consequently, the control of dental biofilm.

Descriptors: Biofilms; Toothbrushing; Motivation; Education.

RESUMO

Objetivo: Avaliar a eficácia das instruções de higiene oral, em particular no controlo do biofilme dentário, bem como avaliar a eficácia do reforço dessas instruções. **Métodos:** Realizou-se estudo quasi-experimental na Clínica Universitária da Universidade Católica Portuguesa (UCP) em Viseu-Portugal, desenvolvido entre janeiro e junho de 2012. Efetuou-se três avaliações a 30 indivíduos através do Índice de Placa de O'Leary e aplicação de questionário abordando o comportamento de saúde oral, com um mês de periodicidade entre cada medição. Na primeira avaliação, todos os indivíduos receberam as mesmas instruções de higiene oral, registo do Índice de Placa de O'Leary e aplicação do questionário. Na segunda avaliação, realizou-se um novo registo do índice a todos os indivíduos, mas apenas o grupo de intervenção (n=16) recebeu o reforço dessas instruções e na terceira avaliação executou-se um novo registo a todos os indivíduos (n=30). **Resultados:** Tanto o grupo de intervenção como o controlo apresentaram uma redução do índice, mas aquele mostrou uma redução mais importante na última avaliação realizada quando comparada a este: 38,19% (n=16) vs. 69,57% (n=14), respectivamente ($p < 0,05$). Relativamente à frequência de escovação dentária, no grupo de intervenção, 68,8% (n=11) escovavam pelo menos duas vezes por dia, enquanto no grupo de controlo apenas 57,1% (n=8) escovavam com a mesma frequência. Nesse caso, foram registadas diferenças significativas entre os dois grupos ($p < 0.05$). **Conclusão:** A promoção da saúde oral por meio de instruções de higiene demonstrou ser eficaz na melhoria dos comportamentos de saúde e, consequentemente, no controlo do biofilme dentário.

Descritores: Biofilmes; Escovação Dentária; Motivação; Educação.

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RESUMEN

Objetivo: Evaluar la eficacia de las instrucciones de higiene oral, en especial del control del biofilm dental así como evaluar la eficacia del refuerzo de dichas instrucciones. **Métodos:** Se realizó un estudio cuasi-experimental en la Clínica Universitaria de la Universidad Católica Portuguesa (UCP) de Viseu-Portugal, desarrollado entre enero y junio de 2012. Se realizó tres evaluaciones en 30 individuos a través del Índice de Placa de O'Leary y la aplicación del cuestionario incluyendo la conducta de salud oral con un mes de intervalo para cada medición. En la primera evaluación todos los individuos recibieron las mismas instrucciones de higiene oral, registro del Índice de Placa de O'Leary y la aplicación del cuestionario. En la segunda evaluación se realizó un nuevo registro del índice en todos los individuos pero solamente el grupo de intervención (n=16) recibió el refuerzo de esas instrucciones y en la tercera evaluación se hizo un nuevo registro de todos los individuos (n=30). **Resultados:** El grupo de intervención y el grupo control presentaron reducción del índice, pero el grupo de intervención mostro una reducción más importante en la última evaluación realizada al compararse al grupo control: el 38,19% (n=16) vs. el 69,57% (n=14), respectivamente ($p<0,05$). Respecto la frecuencia de cepillado dentario, en el grupo de intervención el 68,8% (n=11) cepillaban al menos dos veces al día mientras que en el grupo control solamente el 57,1% (n=8) cepillaban con la misma frecuencia. En ese caso, fueron registradas diferencias significativas entre los grupos ($p<0,05$). **Conclusión:** La promoción de la salud oral a través de instrucciones de higiene ha sido eficaz para la mejoría de conductas en salud y, por consiguiente, para el control del biofilm dental.

Descriptores: Biofilmes; Cepillado Dental; Motivación; Educación.

INTRODUCTION

The human body is host to millions of bacteria lifelong, but there is usually a peaceful coexistence. In the oral cavity, teeth provide a non-desquamative surface to colonize, allowing the development of bacterial deposits^(1,2). These bacterial deposits allow biofilm formation, which consists in the development of different phases, resulting in mature biofilm, in less than 24 hours. The non-removing of this plaque entails the development of different types of oral diseases^(3,4).

There are different methods for biofilm quantification, however, the most used are dental plaque revealer agents, since they allow the patient's education and motivation to improve the efficiency of biofilm control procedures⁽⁴⁾. However, the amount of biofilm does not assess the disease severity, so currently, biofilm rates are used as a measure for evaluating oral hygiene effectiveness⁽⁵⁾.

Epidemiological studies show a relationship between oral hygiene and dental biofilm formation; the mechanical control is recognized as the easiest way and the one with the best cost /benefit ratio⁽⁶⁻¹¹⁾. Biofilm mechanical control is important for oral health maintenance by preventing or delaying bacterial colonization of the gums⁽⁶⁾. However, envisaged that an intrinsic aspect for the success of this control is patient's motivation⁽⁵⁾. Brushing and using additional mechanical removal means, such as dental floss or interdental brush, allow adequate control when properly used. However, the brush's frequent use does not mean hygienization, because more important than quantity is the brushing technique quality⁽⁷⁾. Professionals should educate and motivate the patient⁽¹²⁾. Education aims to change patients' attitude toward oral hygiene, which is achieved through their assumption or change of perception. In order to achieve this change, it is essential to keep the patient continuously motivated^(8,12). Education for promoting oral health is very important to public health. Thus, this study tried to demonstrate the impact of oral health education in strengthening and controlling oral diseases among the population. Despite being an extremely important area, once is seeking primary prevention in a population, studies are scarce and limited. Therefore, developing new research is essential to its scientific knowledge growth.

The overall objective of this study was to assess the efficacy of oral hygiene instructions, especially in controlling dental biofilm, as well as the effectiveness of the reinforcement.

METHODS

We conducted a quasi-experimental study which assessed volunteer patients of UCP's University Clinic, Viseu, Portugal. It was carried out between January and June 2012. A quasi-experimental study consists in a study which the researcher may manipulate the intervention, but not in a randomly manner. Examples of quasi-experimental studies are certain field trials, some community based intervention trials and non-randomized clinical trials⁽¹³⁾.

Inclusion criteria in this study were: patients attending for the first time the UCP's University Clinic, with permanent dentition, not considering the presence or absence of the third molar. Exclusion criteria: edentulous patients or patients with fixed orthodontic appliances, as well as those who did not attend the revaluations.

The initial sample consisted of 40 volunteers, 18 female individuals (45%) and 22 male individuals (55%). This was a convenience sample, once the participants attended Preventive Dentistry appointments at UCP's University Clinic. From the initial sample, 10 volunteers have been excluded for not attending the reassessment, leading to a

sample of 30 individuals, including 13 female (43%) and 17 male volunteers (57%).

For this investigation, two groups were set up without randomized allocation: a control group with 14 individuals (without oral hygiene instructions reinforcement) and an experimental group with 16 individuals (with oral hygiene instructions reinforcement). Data collection was carried out in three different moments. The first one consisted of an initial O'Leary Plaque Index assessment, oral hygiene instructions and motivation in both groups and filling a questionnaire on oral health behaviors, prepared by the researchers in charge of this study.

The second consisted of a reassessment of the O'Leary Plaque Index, one month later in both groups, having oral hygiene instructions reinforcement and motivation only for the experimental group. The third moment included the assessment of O'Leary Plaque Index, two months after the first assessment and questionnaire completion for both groups.

In order to reduce bias, data collection was carried out by a single operator, who performed the intraoral observation and recorded it, helped participants filling the questionnaire, provided oral hygiene instructions and motivation for proper oral health behaviors.

Intervention protocol consisted of: 1) brief explanation and delivery of patient's informed consent; 2) liquid plaque revealer application (erythrosine 2%) in all tooth surfaces; 3) request to rinse his/her mouth in order to remove plaque revealer's excess 4) assessment of tooth four surfaces (mesial, distal, buccal, lingual / palatal) and registry on the diagram. This observation was performed in a clinical setting, which allowed the use of dental office lighting; 5) determining O'Leary Plate Index; 6) use of an hand mirror for patient's education, followed by oral hygiene instructions; 7) the patient fills out the questionnaire; and 8) instructions for reassessment after a month.

In this study, the quantitative variable was to determine the O'Leary Plaque Index. It consists on dental plaque revealer application in supragingival surfaces of teeth and dental assessment of its four surfaces (buccal, mesial,

distal, lingual / palatal). After the patient rinse to remove the excess of revealer, every surface except the occlusal surface, is evaluated depending on the presence / absence of staining and registered in the diagram. After each surface is scored, index is calculated by dividing the number of stained surfaces by the total number of surfaces, converting this value as percentage⁽⁵⁾.

As qualitative variables, we assessed oral health behaviors through a questionnaire applied in different assessment periods. The first was in the beginning of the study and the second in the end of it. This characterization was based on issues concerning oral hygiene practices, such as the number of daily brushing and use of dental floss.

Processing and data analysis were performed using the Statistical Package for Social Sciences (SPSS 18.0). Description of continuous variables was made using measures of central tendency (mean) and the prevalence was expressed in percentages. For comparison between the experimental group and the control group, it was used the T test for independent samples and ANOVA for intra-group comparison.

In order to carry out this study, it was requested approval by UCP's Health Sciences Department, Viseu, Portugal. The request for authorization to carry out the study was made in writing to all participants. Data gathered by the questionnaire was anonymous, voluntary and confidential, without any nominal reference to the participants.

RESULTS

There is a decrease in mean percentages of O'Leary Plaque Index when comparing the first assessment with the one performed after the first and second month, as shown in Table I.

Concerning the experimental group, there was a gradual decrease of the O'Leary Plaque Index, while in the control group there was a slight increase when compared the first and the second assessment (Table II). For the experimental group, O'Leary Plaque Index mean values were: Plaque Index 1, 75%; Plaque Index 2 (1 month) 53.88%; and Plaque

Table I – Register of O'Leary Plaque Index (PI) in the first assessment (PI1), after 1 month (PI2) and after 2 months (PI3). Viseu-Portugal, 2012.

Plaque Index	Mean (%)	Standard Deviation	p#
PI1	74.00	21.17	
PI2	63.79	24.92	<0.001
PI3	52.83	25.44	<0.019

#comparing with the first assessment (PI1)

Index 3 (2 months) 38.50%. In this group, there were statistically significant differences between the O'Leary Plaque Index registers performed ($p > 0.05$).

In the control group, the mean values obtained in O'Leary Plaque Index registration (Table II) were: Plaque Index 1 (0 months), 72.89%; Plaque Index 2 (1 month), 74.31%; and Plaque Index 3 (2 months), 69.57%. However, in this group, there were no statistically significant differences ($p > 0.05$).

Among female individuals, the mean values obtained in the O'Leary Plaque Index registration (Table III) were: Plaque Index 1 (initial assessment), 71.83%; Plaque Index 2 (1 month), 62.57%; and Plaque Index 3 (2 months), 49.62%. In this case, statistically significant differences were found between PI1 and PI3, as well as in PI2 and PI3. Among male individuals, the mean values obtained in O'Leary Plaque Index (Table IV) were: Plaque Index 1 (0 months), 75.77%; Plaque Index 2 (1 month), 64.68%; and Plaque Index 3 (2 months), 55.29%. Comparing the three male registers, we also noticed statistically significant differences between PI1 and PI3, and PI2 and PI3 ($p < 0.05$).

Concerning daily brushing initial data, 80% ($n=32$) brush their teeth once or twice a day. The estimated frequency in this study was higher among female (77.7%, $n=14$). It was also observed that only 10% ($n = 4$) do not brush their teeth, being 13.6% ($n=3$) male. At the end of the study, comparing the results, we conclude that all individuals started to brush their teeth at least once a day; there was a significant increase of individuals who began to brush them twice a day (63.3%, $n=19$), as well as an increase of participants that now perform three daily brushings (20%, $n=6$). However, it was found that in the experimental group 68.8% ($n=11$) brushed their teeth at least twice a day, while in the control group only 57.1% ($n=8$) brushed them with the same frequency. In this case, were recorded statistically significant differences between the two groups ($p=0.03$).

As for flossing, it was found that initially only 30% ($n=12$) of the surveyed used dental floss and female used it more (44.4%, $n=8$) than male individuals (18.2%, $n=4$). Comparing the final results, in the experimental group there was a significant increase of individuals using dental floss (75.0%, $n=12$) as compared to the control group (29.0%, $n=4$) ($p=0.02$).

Table II - Register of O'Leary Plaque Index (PI) in the first assessment (PI1), after 1 month (PI2) and after 2 months (PI3) in the experimental and control groups. Viseu-Portugal, 2012.

Plaque Index	Mean (%)	Standard Deviation	<i>p</i> #
Experimental Group			
PI1	75.00	21.18	
PI2	53.88	28.10	<0.001
PI3	38.19	17.84	<0.002
Control Group			
PI1	72.89	21.69	
PI2	74.31	15.91	>0.1
PI3	69.57	22.60	>0.05

#comparing with the first assessment (PI1)

Table III - Register of O'Leary Plaque Index (PI) in the first assessment (PI1), after 1 month (PI2) and after 2 months (PI3) concerning the variable gender. Viseu-Portugal, 2012.

Plaque Index	Mean (%)	Standard Deviation	p#
Female			
PI1	71.83	23.79	
PI2	62.57	21.18	0.002
PI3	49.62	25.63	0.013
Male			
PI1	75.77	19.16	
PI2	64.68	23.84	0.009
PI3	55.29	25.79	0.018

#comparing with the first assessment (PI1)

DISCUSSION

Regarding the oral health behaviors of the present sample, at first they were weak, however they can be changed by oral health promotion, through oral hygiene instructions and motivation. The final results suggest an overall improvement concerning oral health behaviors, with pronounced benefits in the experimental group compared to the control group.

These results agree with studies showing that strengthening and continued education of proper oral hygiene behaviors enables oral health improvement and increased frequency and motivation for tooth brushing^(14, 12).

In this case, it should be noted the sample's low flossing frequency, which meets the results of other studies conducted in Portugal^(15, 16).

Analyzing the O'Leary Plaque Index, the results show an improvement in mean values for all the individuals of the study sample, decreasing from an initial PI of 74% to 52.83% in the end. These results meet the ones from a Brazilian study, with a sample of 135 students from state and municipal public schools of a municipality in *Rio Grande do Sul*. In this research, we assessed the effectiveness of two motivational strategies regarding biofilm control and gingival bleeding. One involved a single motivation session (group A) and the other multiple motivation sessions (group B); in both groups there was a reduction of the indexes studied⁽¹⁷⁾.

In our study, female individuals have a lower initial PI compared to male individuals, which showed better oral hygiene habits. These results only confirm other studies

which point out that females have better oral hygiene than males^(18, 19).

When compared, there was a significant improvement in experimental group from an initial PI of 75% to a final PI of 38.19%, which can be justified by the constant reinforcement of oral health education during the study, having acquired better oral hygiene habits than reported in the control group^(17, 20-22). In the same study, the control group showed a less substantial improvement - an initial PI of 72.89% for a final PI of 69.57%. However, in this group, from the first to the second assessment, there was an increase of PI values (IP2=74.31%).

Previously, it has been shown that continuing dental motivation programmes benefits biofilm control. A similar study carried out in the 90's, with an experimental group and a control group using the O'Leary Plaque Index, concluded that continuing motivation programmes significantly decreases PI in the experimental group sample⁽²²⁾.

Regarding the importance of oral hygiene continuing reinforcement instructions, was observed that groups that attend multiple motivation sessions show significant biofilm and gingival bleeding reduction when compared to those that attend a single motivation session⁽¹⁷⁾.

Benefits of strengthening oral hygiene instruction corroborate previous works and must therefore be regarded as a tool for dentists in appointments, leading to oral health quality improvements among the community⁽²³⁾.

We recognize some limitations to this study, namely, reduced time available, which led to a small sample, which turned out the extrapolation of results to the target population

limited. Another limitation was the reliance on individuals to attend the three assessments, in specific moments. Failure in attending an assessment meant exclusion from the study, being the sample dependent of an uncontrolled variable.

CONCLUSION

Oral health promotion through education and motivation proved to be effective in improving health behaviors and therefore in controlling biofilm. Given this positive association, there is a significant improvement of these behaviors with continuing reinforcement education and motivation.

Through an oral health promotion programme, oral health behaviors are susceptible to positive changes; over the trial period, there was an improvement in both genders, although more pronounced among the female gender.

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