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Comparison of two methods of dental prophylaxis: evaluation of arterial pressure and patient comfort in a clinical randomized controlled trial

Comparação entre dois métodos de profilaxia dental: avaliação da pressão arterial e conforto do paciente. Estudo clínico controlado e randomizado

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Resumo

Introdução: A quantidade de pacientes hipertensivos está aumentando e, a profilaxia com jato de bicarbonato de sódio é bastante empregada na prática clínica usando grande quantidade dessa substância em um período curto de tempo que poderia aumentar a pressão arterial. **Objetivo:** Foi avaliado a alteração da pressão arterial antes e após os dois métodos de profilaxia dental e obtido a opinião de conforto do paciente em relação a esses métodos. **Material e método:** Selecionou-se 20 pacientes, na faixa etária de 18 a 30 anos, que necessitavam de profilaxia para remoção de biofilme dental e foram submetidos aos três tipos diferentes de tratamento: jato de bicarbonato de sódio (G1), profilaxia convencional (G2), e controle (G3), em intervalos de um mês entre eles. Os pacientes foram divididos de forma randomizada. As aferições realizaram-se antes da profilaxia, imediatamente ao fim do procedimento, 15 e 30 minutos após o término do tratamento. O conforto do paciente foi medido por meio de uma Escala Analógica Visual (VAS) após o final de cada tratamento. Os dados foram analisados por meio de teste de Variância. **Resultado:** Houve diferença estatisticamente significante quanto ao conforto dos procedimentos, sendo G2 e G3 melhores que G1. Observou-se aumento da pressão arterial diastólica no grupo jato de bicarbonato de sódio imediatamente após a profilaxia. **Conclusão:** A profilaxia convencional é mais confortável do ponto de vista do paciente e não altera a pressão arterial.

Descritores: Profilaxia dentária; bicarbonato de sódio; pressão arterial; ensaio clínico.

Abstract

Introduction: The number of hypertensive patients is increasing and prophylaxis with bicarbonate jet are widely performed in clinical practice using large amounts of this substance in a short period of time, which may lead to increased arterial pressure. In the literature there are several studies that analyze the effect of sodium bicarbonate jet on the biofilm and dental structures, but not report the effect on arterial pressure. **Aim:** Evaluated the change in arterial pressure before and after two procedures of dental prophylaxis, jet baking soda application and conventional prophylaxis, and patient opinion of the comfort of each system was obtained. **Material and method:** We selected 20 patients aged 18 to 30 in need of prophylaxis to remove biofilm. The patients were placed into three different treatment groups: sodium bicarbonate jet (G1), conventional prophylaxis (G2) and control (G3), with a one month interval between treatments. Patients were divided into groups randomly. Measurements were performed immediately before and after the procedure, 15 and 30 minutes after the end of treatment. Patient comfort was measured using a Visual Analog Scale (VAS) at the end of each treatment. Data were analyzed by analysis of variance. **Result:** There was a statistically significant difference in the comfort of the procedures, with G2 and G3 being better than G1. Additionally, an increase in the diastolic blood pressure was observed in sodium bicarbonate jet group evaluated just after the procedure. **Conclusion:** The conventional prophylaxis is more comfortable from the patient stand point and does not alter arterial pressure.

Descriptors: Dental prophylaxis; bicarbonate sodium; arterial pressure; clinical trial.

INTRODUCTION

The role of bacterial biofilms in the etiology of inflammatory periodontal diseases and caries has been extensively demonstrated in the literature. Thus, biofilm removal and control are fundamental to the treatment of periodontal disease and the maintenance of oral health. Patients control biofilm formation by means of oral hygiene, but local factors or motor limitations hinder cleaning and necessitate professional cleaning to maintain the health of the oral tissues[1].

These methods of professional dental prophylaxis are used during initial therapy to instruct and motivate patients to maintain their own dental hygiene and also in periodontal supportive therapy. Until 1980, the dentists performed dental prophylaxis using rubber cups and brushes with an abrasive low speed motor. With the emergence of a new method consisting of a spray comprised of powder sodium bicarbonate, water and air, dental prophylaxis became more rapid and efficient[1-3].

Sodium bicarbonate is a nontoxic, water soluble abrasive that is considered ideal for intra-oral use. It has been used successfully in the removal of non-mineral stains caused by smoking, has been implemented indifferent components of dental implants and has been used safely in the cleaning of supragingival orthodontic devices[4,5]. However, it should be used with caution in areas of demineralized enamel because erosion of enamel prisms[6] may occur, resulting in the exposure of root surface dentin or significant substance removal[2,7-9], which is of particular interest in periodontal maintenance therapy because gingival recession is a common finding in post-periodontal treatment patients[10,11]. Sodium bicarbonate can so lead to substantial erosion or blunting of restorative materials, with the exception of ceramics, which seem to experience a less significant loss of substance[9,12-14]. Still, there is epithelial erosion and exposure of underlying connective tissue in the soft tissues around the tooth[3,15-19].

About the sodium bicarbonate air polisher's safety at systemic effect very little is discussed. Some studies[20-23]remarked about it contraindications and/or restrictions in use.

Contraindications regarding the use of sodium bicarbonate air polisher have already been discussed[21,22], especially when patients present medical history of needing a low sodium diet, hypertension, respiratory illness, infection diseases, renal insufficiency, Addison's disease, Cushing's disease, metabolic alkalosis and chronic use of certain medications, such as mineralocorticoid steroids, antidiuretics or potassium supplements[22].

The number of hypertensive patients is increasing[24] and prophylaxis with bicarbonate jet are widely performed in clinical practice using large amounts of this substance in a short period of time, which may lead to increased arterial due to the absorption of salt by the oral mucosa[20,23].

It is known that arterial pressure is regulated by a number of mechanisms that can be divided into short and long-term controls. The short-term mechanism is mediated by the sympathetic nervous system through the baroreceptor reflex, while the long-term mechanism involves the homeostasis of body fluid volume, i.e., the balance of intake and output of fluid and salt[25].

However, there is no scientific basis to evaluate the effect of the sodium bicarbonate jet in relation to arterial pressure even in healthy people and not in hypertensive subjects and, consequently, that would ensure your contraindication. According to Gutmann[20], more clinical research is needed to put light on the sodium bicarbonate oral absorption process and limited information has been published regarding its systemic effects absorption. Therefore, additional research about the safety of sodium bicarbonate air polisher is recommended. Furthermore, Snyder et al.[26] suggest performing a similar study in healthy human subjects and the results of research would provide a more scientific basis upon which to base recommendations regarding the use on certain medically compromised patients.

Thus, the aim of this study was to evaluate patient comfort and the change in arterial pressure before and after two methods of dental prophylaxis: a sodium bicarbonate jet system and conventional prophylaxis, in a clinical randomized controlled trial.

MATERIAL AND METHOD

This was a randomized split-plot trial that required the approval of the Research Ethics Committee (CEP ICT-UNESP) with protocol number 79874/2012.

The study included twenty (20) patients, seven (7) men and 13 (thirteen) women, from the clinic of Periodontics at ICT-UNESP, enrolled from September 2012 to November 2013.

Inclusion criteria were as follows: patient age of 18-30 years, the need for prophylaxis to remove biofilm and patient agreement to participate and signing of the consent form.

Exclusion criteria were as follows: patients with less than 20 teeth in the mouth; have shown no systemic diseases that alter arterial pressure and have no renal, respiratory, diabetes and lung problems.

Randomization and Blinding

All of the patients received three types of treatment with a one-month interval between treatments. Patients were assigned to treatment groups by random drawing. At the first appointment a lottery was held to determine which treatment would be done during that session. After 30 days, there was a second drawing to determine the second and third treatment steps. Blinding was not performed because the operator was also responsible for recording the measurements, and the patients were aware of which treatment they received.

Treatment

Sodium bicarbonate jet (G1)

The sodium bicarbonate jet application was directed to the cervical region to the distal incisor teeth approximately five (5) mm, at an angle of 45° to 90° relative to the long axis of the tooth, while avoiding the soft tissues. For each patient we used forty (40) grams of AIRON powder baking soda (Maringá, PR, Brazil) in the reservoir of the dental unit.

Conventional prophylaxis (G2)

For all teeth, we used a low angle against speed, with a brush dipped in Robson prophylactic paste, and applied to the entire buccal and lingual tooth surfaces.

Control (G3)

After the treatment was performed, the same pattern as described above for G1 was used, but with only jet pressurized water and without the sodium bicarbonate powder.

Parameters

Arterial Pressure (AP)

A single trained reviewer (CL) performed the calibrated measurement of BP using a mercury sphygmomanometer cylinder, 0-300 mmHg (Rio de Janeiro, RJ, Brazil), with the aid of a stethoscope. The measures of the arterial pressure were conducted at four time points: immediately before prophylaxis (T0 Baseline), immediately after prophylaxis (Ti), fifteen minutes after the end of prophylaxis (T15) and thirty minutes after the end of prophylaxis (T30).

Patient comfort

Patient comfort was obtained after the end of each treatment using the ten centimeter Visual Analogue Scale (VAS), on which 0 represents "very uncomfortable" and 10 represents "nothing uncomfortable".

Working time

The maximum time for each treatment was 10 minutes and was recorded only during the procedure (from the start of prophylaxis to its completion), excluding the steps of arterial pressure measurement.

Plaque Index (PI)

The plaque index was measured before and after prophylaxis to evaluate the effectiveness of each type of prophylaxis using the method advocated by O'Leary et al.[27].

Sample size

We used a population of 20 patients for this study. This sample size was determined by the following calculations. We considered a difference of 1 mmHg between the groups to be clinically relevant for the primary variable of arterial pressure. With a power of 80%, alpha = 0.05 and an expected standard deviation of 0.8 mmHg, a sample of 14 subjects per group would be necessary to achieve this purpose, using the analysis of variance. With a sample of 20 subjects per group, the study had a greater than 80% power to detect a difference of 1 mmHg in arterial pressure variation between groups.

Statistical methods

Data from each treatment was recorded in its own form and tabulated for statistical analysis. A descriptive analysis was performed using mean and standard deviation. Data distribution was evaluated by the Shapiro-Wilk test and analyzed by two-factor ANOVA for repeated measures. The significance level adopted was 5%.

RESULT

All selected participants followed the entire survey period through all three treatments. Demographic data collected from the sample are shown in Table 1.

The results in Table 2 show that among the treatment groups there were statistically significant differences in the comfort of the procedures as measured by the VAS scale, with G2 and G3 being considered more comfortable than G1. There was a statistically significant difference in the plaque index after the prophylaxis, between G1 and G3 and between G2 and G3. The G3 group also showed a statistically significant difference in operative time when compared to G1 and G2.

The variation of arterial pressure (AP) given in Table 3 showed no statistically significant changes at most times measured. In the intra-group analysis the group G1 had statistically significant difference at time Ti, which was higher than other times for diastolic pressure (D). In G2 and G3 there was no statistically significant difference in the intra-group analysis. The Figures 1 and 2 graphically represent the Table 3.

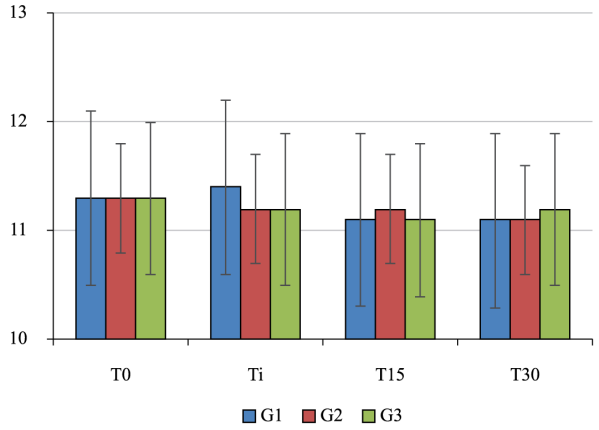

Figure 1. Graph of measurements of Systolic Arterial Pressure (SAP) in relation to groups and times.

Table 1. Demographic data expressed in percentage for sex and race, and mean and standard deviation for age

	Total		Men	Women
Sex (%)			35	65
Race (%)	Caucasian	85	85.7	84.6
	Asian	15	14.3	15.4
Age (years)	23.1 ± 1.39		22.6 ± 0.9	23.3 ± 1.53

Table 2. Mean and Standard Deviation of the groups G1, G2 and G3 for the variables time, comfort and IP

	G1		G2		G3	
Time (min)	9.1 ± 1.9†		9.6 ± 0.9†		8.5 ± 0.9	
Comfort (VAS)	7 ± 2.4		8.8 ± 1.4*		9.0 ± 0.9*	
IP (%)	I	F	I	F	I	F
	61.6 ± 20.4	13.5 ± 8.6*	60.0 ± 21.1	17.3 ± 10.6*	60.5 ± 20.9	59.8 ± 21.8

†statistically significant difference - intergroup evaluation: Variance Test. *statistically significant difference - intragroup evaluation: Variance Test.

Table 3. Mean and Standard Deviation of G1, G2 and G3 for the variable systolic (S) and diastolic (D)

	G1		G2		G3	
	S	D	S	D	S	D
T0	11.3 ± 1.0	6.9 ± 1.0	11.3 ± 0.5	7.0 ± 0.7	11.3 ± 0.9	6.8 ± 0.8
Ti	11.4 ± 0.8	7.4 ± 0.8*	11.2 ± 0.5	7.0 ± 0.7	11.2 ± 0.7	7.1 ± 0.7
T15	11.1 ± 0.8	6.9 ± 0.7	11.2 ± 0.6	6.9 ± 0.8	11.1 ± 0.7	6.9 ± 0.7
T30	11.1 ± 1.2	6.9 ± 1.0	11.1 ± 0.5	7.0 ± 0.7	11.2 ± 0.7	6.9 ± 0.9

*Statistically significant difference - intragroup evaluation.

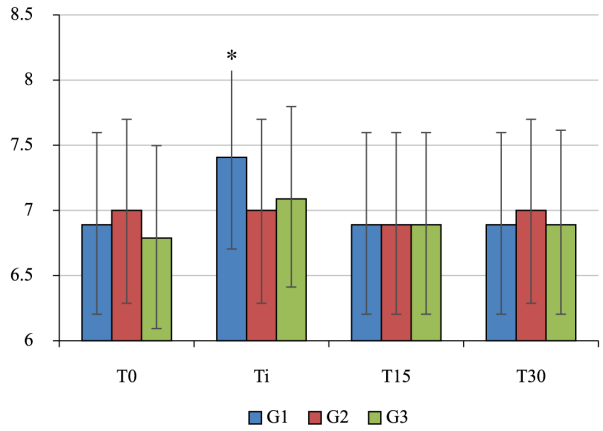

Figure 2. Graph of measurements of Diastolic Arterial Pressure (DAP) in relation to groups and times. (*) Statistically significant difference - intragroup evaluation.

DISCUSSION

Professional prophylactic methods are needed for the removal and control of biofilms in order to prevent dental caries and periodontal disease and to promote the long-term maintenance of teeth in the oral cavity.

The dentist is responsible for choosing the method of dental prophylaxis, with than evaluation of the method's efficiency and a consideration of patient needs being critical to making the correct selection.

In the present study, with regard to prophylactic efficiency, it was found that groups G1 and G2 were superior in the removal of biofilm compared to group G3, i.e., the final IP was lower when compared to G3. In 1988, Chambrone et al.[28] evaluated 100 patients and found that both the sodium bicarbonate jet and conventional prophylaxis had similar efficiency, which agrees with the current results. The observed difference between the groups G1 and G2 compared to G3 occurred because the removal of biofilm is performed mechanically and is often associated with the use of abrasives, such that using water alone would be insufficient to remove the biofilm. Although there wasn't a statistically significant difference between G1 and G2, on the plaque index indicates that G1 was slightly more effective than G2.

Some authors reported differences between the two prophylactic methods. To Saad et al.[29] the Robson rubber cup/brush acts more on the surface, while the bicarbonate jet technique would have more action in depth because it uses jets under controlled pressure, which are better for pit and fissure regions. Accordingly, Horning et al.[8] found that the jet of sodium bicarbonate has an advantageous ability to remove plaque from hard to reach areas, such as furcations and deep grooves.

In contrast, Kontturi-Narhi et al.[6] cited negative effects of the jet bicarbonate method, in particular when used near the gingival margin aspects. One patient reported sensitivity after bicarbonate jet application and an ulcerated area in the region of the upper molars, with improvements observed in three days. After analysis of the potential negative aspects mentioned above, the patient comfort results in the current study show that G2 and G3 are more comfortable than G1. After using the bicarbonate jet, the patient is covered superficially with baking soda that arises from the aerosol cloud formed during the procedure. Patients often report a burning sensation of the skin and lips, and a perception of an intense, uncomfortable salty taste in the mouth, regardless of whether the integrity of the gums or oral mucosa has been compromised. Likewise, Chambrone et al.[28] state that prophylaxis with the bicarbonate system caused more complaints of pain or discomfort. The present study corroborates these findings.

There was a statistically significant difference in the duration of procedure between the G1 and G2 compared to the G3 control group, which used only pressurized water. Thus, after the staining and obtaining the IP, the dye used on the teeth was removed more easily by the larger amount of water present during procedure. The presence of water made it difficult to visualize the biofilm giving the operator the impression that the biofilm had been removed. Thus, the procedure was completed before the time required for biofilm removal. This demonstrates the need to use the abrasive jet method, or Robson brush/rubber cup for conventional prophylaxis in order to eliminate the biofilm. The method of sodium bicarbonate jet was slightly faster compared to the conventional method, although there was no statistically significant difference.

Regarding the analysis of arterial pressure variation, there are only a few literature reports evaluating arterial pressure associated with the use of sodium bicarbonate jet. Snyder et al.[26] conducted a study in dogs and observed no significant changes in electrolyte concentrations or pH of arterial blood with sodium bicarbonate

jet, however, the same author states that this does not mean that absorption is not happening. The author also mentions that precautions were taken to limit the intake of sodium bicarbonate by using suction during the procedure. Suction was employed in the current study because it involved healthy humans and therefore was used in all treatments of G1 and G3. This study also reported that the amount of electrolyte was much lower than expected and that it was diluted and neutralized in the extra cellular volume by the self-buffering system of the blood. Rawson et al.[30] found in their study that there were significant changes in pH, pCO2 and bicarbonate concentration when using sodium bicarbonate jet. However, it was a study with only a single patient, the actual amount of change in these values was very small, and no statistical analysis was performed.

While these authors evaluated the level of sodium bicarbonate blood absorption, the current study was based on arterial pressure measured by a mercury column device used in clinical practice. The variation in arterial pressure showed a statistically significant difference within the group G1. This difference occurred only in Ti in diastolic pressure. We correlate this increase with the stress generated by the type of procedure because this group was considered the most uncomfortable according to the comfort scale used. However, the literature reports that under stress both arterial pressure increases. This finding maybe related to some absorption of sodium bicarbonate during the procedure, even with the use of the suction nozzle. Other similar studies need to be conducted in healthy humans and in hypertensive patients in order to provide a more scientific basis for the use of sodium bicarbonate jet in dental clinical practice.

CONCLUSION

Within the limits of this study, we can conclude that the methods of prophylaxis show no difference in the amount of plaque removed. However, conventional prophylaxis is most comfortable from the view point of the patient and does not alter arterial pressure.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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