Protocol of Toothbrushing Based on Bioavailability of Fluoride in Toothpaste: A Systematic Review

Protocolo de Cepillado Basado en la Biodisponibilidad del Flúor en Dentífricos:
Una Revisión Sistemática

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MORENO-RADIC, V. & SANCHEZ GONZALEZ, J. Protocol of toothbrushing based on bioavailability of fluoride in toothpaste: a systematic review. *Int. J. Odontostomat.*, 10(3):433-441, 2016.

ABSTRACT: The objective of the study is to propose a protocol for the appropriate use of fluorides in dentifrices (Dt), based on its bioavailability in saliva (Bs) and / or plaque (Bp) through a systematic review (SR). SR of the literature from 2005 to 2015 in PubMed, Cochrane and SciELO. Inclusion criteria: clinical studies in vivo, Spanish and English, made only with Dt that measured Bs and Bp. The results were evaluated in relation to: 1) Concentration of fluoride in Dt, 2) Brushing time with Dt, 3) Frequency of brushing, 4) Rinse post-brushing and 5) Amount of Dt on the brush. Twelve (12) studies were selected. 1) Bs increases 241 % when using a 5000 ppm of Dt compared to 1450 ppm. 2) Bs is increased by 55 % by increasing the duration of brushing 40 s to 120 s 3) Bp increases by 68 % when brushing 3 times a day compared to 2 times. 4) Not rinsing or rinsing with <10 ml for <10 s increases Bs to 270 % compared to rinses higher volume / time. 5) By increasing the amount of Dt of 0.5 g to 1.5 g, Bs increases up to 266 %. The use of 1.5 g of Dt $\geq$ 1450 ppm of fluoride for $\geq$ 120 s, 3 times a day is recommended and once brushing is complete avoiding oral rinse with water or non fluoride mouthwash .

KEY WORDS: saliva, plaque, dentifrice, calculus, caries treatment, dental public health.

INTRODUCTION

Despite continuous efforts in dentistry to prevent dental caries, 17 % of 2 year olds were found to have obvious dental decay affecting their primary teeth and gradually increasing to nearly 100 % in the adult population according to the Ministry of Health in Chile (MINSAL 2010). There are several prevention systems available, however, the use of fluoride (F) still remains the most effective caries prevention tool, with overwhelming evidence of anti-cariogenic effect.

F is a preventive element that due to its protective action of enamel and dentin helps prevent demineralization, promotes remineralization, and reduces bacterial activity in dental plaque; but to achieve these effects constant contact with tooth structure is required. (Pacuar *et al.* 2007).

Among the methods of self-administration of fluoride dentifrice (Dt) is considered the most effective intervention for prevention, both for its proven clinical

action as well as for its social acceptability (Marinho *et al.*, 2003). A recent Cochrane review concluded that higher relative caries preventive effects were associated with increased Dt fluoride concentrations (Walsh *et al.*, 2010), but the effectiveness depends on bioavailability of the active ingredient (fluorine), which may vary according to the concentration of fluoride Dt, amount, frequency and duration of brushing, and rinsing protocol post-brushing (Parnell & O'Mullane, 2013).

By analyzing the frequency of daily brushing according to the study by Koerber *et al.* (2005) in children 5° and 8° grade, 47 % brush their teeth 1-2 times a day, 42 % more than 2 times daily, and 11 % less than 1 time per day, indicating that there is still a lack of knowledge or habit in relation to the frequency of daily brushing and actual preventive effect on caries lesions. About a third of the studies observed by Macgregor & Rugg-Gunn (1985) indicated that the average brushing time was <56 s, while two-thirds

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reported a brushing time ≥ 56 s and 70 s. The best estimate of the real time appears to vary between 30 to 60 seconds (Van der Weijden *et al.*, 1993). As for post-brushing rinses, most people rinse with potable water as final part of the oral hygiene routine, generally practiced subconsciously (Parnell & O'Mullane).

Currently there is no protocol for tooth brushing associated with increased bioavailability of fluoride, thereby achieving greater efficacy against the appearance of carious lesions. Therefore, the aim of this article is to conduct a systematic review of studies on bioavailability in saliva and plaque using fluoride Dt by variations of tooth brushing in order to establish a protocol for brushing greater benefits for oral hygiene.

MATERIAL AND METHOD

Type of study: Narrative review based on a systematic search of the literature on tooth brushing with fluoride dentifrice considering factors aimed at increasing the bioavailability of fluoride.

Search Date: May 2015

Studies: Clinical studies, meta-analyzes and systematic reviews.

Information sources: structured search in different sources of bibliographic information (tertiary, secondary and primary), with the following structure results:

1. Source of tertiary information (Cochrane Library Plus). Preferred Search Advanced Search, and used the following keywords Medical Subject Headings (MeSH): "fluoride concentration" or

- "dentifrice Saliva" and their equivalents in Spanish.
2. Sources of secondary information (PubMed and SciELO): (MeSH) "fluoride" or "fluorides" and "toothpaste" or "toothpastes" and "attention" or "concentration". "Fluorides" or "fluoride" and "dentifrices" or "dentifrice" and "salivary" and "level". "Salivary" and "fluorides" or "fluoride" and "level" and their equivalents in Spanish.
3. Sources of primary information: review of relevant in each of the items selected in the previous literature search.

Screening and Selection criteria: The inclusion and exclusion criteria are shown in detail in Table I.

Step 1: Titles and abstracts were reviewed by 2 authors (VM. and J.S.) and selected for further review if they met the inclusion criteria (304 potential eligible articles), considering the selection criteria established, reviewed and excluded articles that did not reach the minimum quality threshold for its design according to the Spanish version "Critical Appraisal Skills Program" (CASPe).

Step 2: Abstracts were independently reviewed by 2 authors (VM. and J.S.) and selected per their consensus according to the same inclusion criteria used in step 1. If consensus was not reached, the abstract was set aside for further evaluation.

Step 3: Full-text articles of abstracts selected in step 2 were retrieved and reviewed by 1 author (V.M.). Inclusion was based on the consensus between 2 investigators (VM. and J.S). The reference lists of all articles selected in step 3 were reviewed, and the full texts of potentially interesting studies were examined.

Data Extraction. Data extraction was conducted independently by 2 reviewers (V.M and J.S) using a data extraction form.

Table I. Inclusion and Exclusion Criteria.

Inclusion criteria
Studies using only Dentifrices, with measurement of fluoride concentration in plaque and saliva.
• Spanish and English.   • Studies in humans.   • Articles and reviews published between 2005 - 2015.
Exclusion criteria
• Exclude measurements made using other fluoride sources as tablets, rinses, solutions, etc.   • Exclude studies in languages other than English or Spanish.   • Exclude studies conducted over 10 years ago.

The information extracted from each article is shown in detail in Table II. In brief, these included authors, country, years of study, sample size, number of participant, and grouped according to study variable 1) Concentration of fluoride in Dt, 2) time brushing with Dt, 3) frequency of brushing, 4) Rinse post-brushing and 5) amount of dt on the brush.

RESULTS

In total, 304 study reports were identified from database searches. Only 25 articles were eligible for full-text retrieval. Of these, 13 articles were excluded for the reasons presented in the flow diagram (Fig. 1). Table II shows scientific articles selected for the systematic review, classified according to the variables studied.

The studies analyzed were conducted in the following countries: United States, Sweden, England, the Netherlands (Amsterdam), India and Brazil.

The articles were longitudinal observational experimental studies.

The sample size of the studies was highly variable, ranging from 12 to 51 participants, with a range comprising between 4 and 65 years.

Concentration Dt regarding Bp and Bs.

Five scientific articles analyzed this variable, within which different concentrations of fluoride in Dt were used.

Creeth *et al.* (2013) compared fluoride concentrations of 250 ppm with 1150 ppm, noting that Bs increase 5,13 times by using Dt of 1150 ppm vs 250 ppm.

Nordstrom *et al.*, evaluated fluoride concentrations of 1450 ppm and 5000 ppm, where Bs increased 3,14 times, while the Bp achieved an increase of 37 % using concentration of 5000 ppm compared to 1450 ppm. The same concentrations were used by Nordström & Birkhed (2013), finding a 59 % increase in Bp. Although lower fluoride concentrations were used, similar results were found in the Nagpal & Damle (2007) report. Finally, Campos *et al.*, (2015) points out that there is only an increase in Bs after brushing teeth with Dt, but also that there is a decrease divided into two phases: the first phase occurs a rapid decline of fluoride present in the mouth in first 10 minutes, and then a second phase of gradual decline,

Fig. 1 Flow Diagram of systematic review of the literature.

Table II Characteristics of the Included Studies and Summary of the Study Results on Bioavailability of fluoride in saliva and plaque.

Baseline Assessment of Bs and Bp	Sample size	Age	Year	Country	Results
Brushing time	48	4 y 5	2013	USA	Newby E. A randomised clinical study to evaluate the effect of brushing duration on fluoride levels in dental biofilm fluid and saliva in children aged 4-5 years Bp increases in 37% when brushing 120 sec instead of 40 sec Bs increases in 54% when brushing 120 sec instead of 40 sec
Amount of Dt on the brush	42	18 a 65	2013	USA	Creeth J. The effect of dentifrice quantity and toothbrushing behaviour on oral delivery and retention of fluoride in vivo. Bs increases in 217% by using 1.5 gr vs 0.5 gr of Dt
Rinse post-brushing					Bs increases in 74% with rinsing once with 10 ml of water / 10 sec instead of 3 times
Brushing time					Bs increases 68% when brushing 180 sec instead of 45 sec
Concentration of fluoride					Bs increased in 413% when using Dt concentrations of 1150 ppm vs 250 ppm
					Bs increased in 413% when using a 'massage' method on fluoride retention and pH drop in plaque.
Concentration of fluoride in Dt	16	23 a 38	2013	Sweden	Nordström A. Effect of a third application of toothpastes (1450 and 5000 ppm F), including a 'massage' method on fluoride retention and pH drop in plaque. Bp increases in 37% using Dt concentration of 5000 ppm instead of 1450ppm Bs increases 4.13 times when using Dt concentrations of 5000 ppm vs 1450 ppm
Frequency of brushing					Bp and Bs increased 50% and 37% respectively when brushing 2 times+ finger massage vs brushing 2 times only Bs and Bp increases in 11% and 68% respectively when brushing 3 times a day vs 2 times a day
Rinse post-brushing	23	12 a 47	2009	England	R.M. D. Effect of rinsing with mouthwashes after brushing with a fluoridated toothpaste on salivary fluoride concentration Bs increased in 73% with water rinses of 10 ml/5 sec vs mouthwash unfluorinated 20 ml/30
Concentration of fluoride	26	19 a 35	2007	Sweden	Birkhed AN. Fluoride retention in proximal plaque and saliva using two NaF dentifrices containing 5,000 and 1,450 ppm F with and without water rinsing Bp increases in 59% when using Dt concentrations of 5000 ppm vs 1450 ppm Bs and Bp increased in 51% and 30% respectively with no post-brushing rinse vs post brushing water rinse of 10 ml/10 sec do it 3 times
Rinse post-brushing	30	19 a 34	2006	Amsterdam	Heijnsbroek M. Increased salivary fluoride concentrations after post-brush fluoride rinsing not reflected in dental plaque No significant results
Amount of Dt on the brush	51	25 a 65	2006	England	Zero D. The effect of brushing time and dentifrice quantity on fluoride delivery in vivo and enamel surface microhardness in situ Bs increased in 266% when using 1.5 g vs 0.5 gr of Dt
Brushing time					Bs increased in 28% to brushing for 180 sec instead of 30 sec
Concentration of fluoride in Dt	20	5 y 6	2007	India	Di N. Comparison of salivary fluoride levels following use of dentifrices containing different concentrations of fluoride. Bs increased in 85% when using Dt concentrations of 500 ppm vs 1000 ppm
Frequency of brushing	31	19 a 27	2013	Brasil	Cavalcante DC. Fluoride retention in saliva and in dental biofilm after different home-use fluoride treatments Bp increased in 10.2% when brushing 3 times vs 2 times a day Bp increased in 11.8% when brushing 2 times + rinse, instead of brushing 2 times a day only
Concentration of fluoride in Dt	12	Average 21.3	2015	Brasil	Glauber Campos Vale PFC. Salivary Fluoride Levels after Use of High-Fluoride Dentifrice. There are two stages of decrease in the bioavailability of fluoride in the mouth a first stage of rapid decline, and a second stage of gradual decline.

which is attributed to a union of fluoride to oral surfaces, which must first dissociate into a free solution before disposal.

All results show a direct positive relationship between the concentration of fluoride in Dt and bioavailability of fluoride in saliva and plaque.

Brushing time in relation to Bioavailability in saliva and / or Bp. Three scientific articles analyzed this variable, considering different brushing times (30, 45, 60, 120 and 180 seconds).

Newby *et al.* (2013), found that brushing for 120 s bioavailability increases by 56 % and 3 %, respectively in saliva and plaque, compared to 40 s brushings. Moreover, in the study by Zero *et al.* (2010) the Bs increase by 28 % when brushing 180 seconds compared to 30 seconds. Finally Creeth *et al.* finding that Bs increases by 47 % when brushing for 120 seconds instead of 30 seconds and an increase in Bs 68.7 % compared brushing 180 seconds instead of 45 seconds.

All authors conclude that there is a direct positive relationship between increased brushing time and increased Bs and Bp.

Frequency of brushing in relation to B and Bp. Two scientific articles analyzed this variable, comparing brushing with Dt twice a day against brushing twice a day plus a third fluoride exposure, either by Dt-brush, Dt oral massage using the finger or fluoride mouthwash.

Nordström & Birkhed found an increase of 50 % and 37 % in Bp and Bs respectively by using two brushings a day with Dt plus a third exposure by oral Dt-massage using the finger, compared to only brushing with Dt twice a day. Furthermore brushing the teeth three times daily the Bp and Bs increased 68 % and 11 % respectively, compared with brushing twice a day. Similar results are found in the report by Souza *et al.* (2014) where Bp increases 10.2 % when brushing with Dt three times a day versus twice a day; and Bp increases 11. 8% when brushing twice a day plus a third exposure of fluoride with fluoride mouthwash, compared with two daily brushings.

Both articles conclude that there is a direct positive relationship between the administration of fluoride (Dt-brush, oral Dt-massage using the finger, mouth rinse) and increased Bp-Bs, regardless of how it is performed.

Rinse post brushing relative to Bs and Bp. Four articles analyzing the presence or absence of post brushing rinse relative to Bs and Bp, also including other variables: liquid used (water, fluoride mouth rinse, non fluoridated mouthwash), amount of liquid and rinse time.

Heijnsbroek *et al.* (2006), conducted different protocols post brushing rinse; (1) 30 second rinse with 10 ml of water; (2) spit out excess toothpaste without rinsing; (3) 30 second rinse with 10 ml of fluoridated mouthwash. The results were not significant.

(Nordström & Birkhed) observed that Bs and Bp increases 51 % and 30 % respectively when excess of Dt is spit, compared to rinsed for 10 seconds with 10 ml of water repeating this process 3 times.

Creeth *et al.* compares performing post brushing rinse once to doing it three times. Rinses were made for 10 seconds with 10 ml of water. An increase of 74 % in Bs was found when rinsing once compared to repeating it 3 times.

Bs is higher while the post brushing rinse is performed for periods of less than 5 seconds and 10 ml volumes according to the results obtained by Duckworth *et al.* (2009).

According to the authors, the increased bioavailability of fluoride in the mouth in plaque and saliva is achieved when excess of Dt is spit out without rinsing, followed by rinsing post brushing with volumes less than 10 ml, for less than 5 seconds time and if possible with fluoridated mouthwash repeating this process once.

Amount of Dt on the brush in relation to Bp and Bs. Two scientific articles analyzed the relation between amount of Dt and Bs, which used 0.5 g and 1.5 g of fluoridated Dt.

Creeth *et al.*, found that Bs increase by 217 % when brushing with 1.5 g of Dt compared with 0.5 g. Similar data is mentioned in the study of Zero *et al.* where Bs increases by 266 % when using 1.5 g compared to 0.5 g

No scientific articles that measured and analyzed Bp were found.

According the data mentioned above, there is a direct positive relationship between the amount of Dt and Bs, but it is unknown whether this pattern is similar in Bp.

DISCUSSION

There is currently an interest in implementing different strategies of motivation and education in the population in order to reduce and prevent oral disease.

Based on the strategies related to dental hygiene it has been seen that there are different manageable variables in brushing technique. All these variables attempt to modify the substantivity of fluoride in the mouth, because of fluoride is available in saliva with concentrations greater than 100 ppm can react with the calcium of the tooth surface and plate adhered to the tooth to form calcium fluoride, acting finally as a reservoir of fluoride that can dissolve and release the ion involved in remineralization and demineralization of the caries process (MINSAL, 2010).

Currently the protocols of daily brushing recommend a duration of 2 minutes, 2 times a day with toothpaste fluoride 1450 ppm, which would be the most massive traded concentration (Colgate), but does not take into account the amount of toothpaste used, post brushing rinse, or the actual effectiveness by increasing the concentration of fluoride in the toothpaste.

In this SR, regarding the relationship between the concentration of fluoride in Dt and Bs-Bp, despite that different studies generated variations in the time of brushing, amount of Dt used and embodiment of rinse post brushing, there was always an increase in fluoride concentration found in saliva and plaque, by increasing the concentration of fluoride in Dt.

By increasing about 5 times the concentration of fluoride in Dt of 250 ppm to 1150 ppm, the concentration of fluoride in saliva was 80% higher. It could be useful for tooth brushing protocol in children with teeth still in formation, where the recommended fluoride concentrations are expected not to exceed 1100 ppm in order to prevent fluorosis (Walsh *et al.*).

Nordstrom (Nordstrom *et al.*, 2013) used fluoride concentrations 1450 and 5000 ppm and similar results were obtained. Regarding measurements in plate, the bioavailability of fluoride was increased 37 %.

While initial fluoride concentrations were higher in saliva than those obtained in plate it is important to consider that this increase has low substantivity in time, due to self-cleaning that is continuously generated in the mouth with food, liquids and the same salivary

glands secretion, this gain tends to drop within a few hours, whereas in the plate, this substantivity usually remains in a constant state due to its ability to act as a reservoir of fluoride.

Therefore, within the tooth brushing protocol using Dt 1450 ppm must be considered for patients with low cariogenic risk and higher concentrations of 2500 ppm or 5000 ppm for patients with high risk of decay or patients with difficulty to carry out proper hygiene.

Regarding the positive relationship between brushing time and Bp -Bs, authors indicated that it is due to the amount of Dt retained between the bristles of the toothbrush post brushing, since about 30 % is deposited on the brush with brushing 30 seconds while a 3 minute brushing retained only 10 %. Therefore the least Dt remains deposited on the brush, the greater the distribution of Dt into the oral cavity.

It is necessary to note that 3 minutes of brushing is often not a duration that can be carried out routinely by most patients because it is considered a very long duration. In a brushing of 2 minutes, despite the low bioavailability compared to 3 minutes, there is a gain in the Bs of 47 % versus a 45 seconds brush, so it can be recommended (Creeth *et al.*).

Regarding the relationship between the frequency of brushing and Bs-Bp, all authors (Nordström & Birkhed; Souza *et al.*) agree that there is a direct positive association between a third dose of fluoride mouth and Bs -Bp, either with a toothbrush or a finger massage using Dt.

According to the results obtained by Nordstrom *et al.* (2013), higher bioavailability saliva is obtained by performing brushing 2 times plus finger massage with Dt compared to 3 times brushings, possibly because the Dt does not remain within the bristles of the toothbrush, but rather is deposited completely within the oral cavity. Nonetheless based on the results obtained in plaque, the difference is not significant, and it could be that this reservoir of fluoride appears to have a saturation level regarding the acquisition of fluoride.

In Souza *et al.* study measurements of fluoride bioavailability were performed 8 hours after the addition of fluorine, either post-brushing or the use of mouthwash. The results showed that a third brushing or a third incorporation of fluorine by mouthwash, could generate a greater protective benefit, especially as the

results obtained in plaque, since in saliva as presenting a constant salivary clearance results are insignificant. This point is important to consider in a remineralizing or preventive therapy for caries lesions because often people do not have a toothbrush and a finger massage using Dt could suffice to acquire the protective effects.

Thus, different types of hygiene can be proposed to adapt to the capabilities of each patient in order to achieve a similar protective effect. Therefore, a third brushing, mouthwash or toothpaste using finger massage is beneficial for incorporating fluorine.

Regarding post-brushing rinse in relation to Bs-Bp, fluoride levels in mouth change between different patients according to the post brushing rinse protocol being performed, being able to affect the bioavailability positively or negatively.

The study by Heijnsbroek *et al.* (2006), compares different post brushing rinse protocols; (1) rinsed for 30 seconds with 10 ml of water; (2) without rinsing; (3) rinsed for 30 seconds with 10 ml of fluorinated mouthwash. The results of bioavailability in saliva showed no significant differences. This can be explained by the fact that fluoride in the mouth measurements were taken 6 hours after brushing, having a salivary clearance during this time.

In the remaining three studies (Nordström & Birkhed; Duckworth *et al.*; Creeth *et al.*) a direct association between not performing post-brushing, rinsing or rinsing with fluoride mouthwash and increased bioavailability of fluoride in saliva and plaque was found.

Most studies conclude that it is more beneficial to perform a rinse once with water with volumes <10 ml for short periods not exceeding 10 seconds. Performing a rinse is desired and should be used preferably with concentrations greater than 225 ppm. Nevertheless higher concentrations of fluoride in the mouth are obtained by avoiding post-brushing rinse, but it should be considered that many patients do not feel comfortable maintaining the remaining toothpaste and have the need to remove it with a mouth rinse. This increase of bioavailability could have negative effects due to the toxicity of fluoride, specifically in Dt of high concentrations as 5000 ppm, because 5 % to 10 % of Dt could be ingested during tooth brushing, especially when avoiding post brushing water rinse (Sjögren & Birkhed, 1994).

Nevertheless these Dt are recommended for high-risk patients, such as patients with active caries lesions, orthodontic treatment, motor or neurological disabilities, hyposalivation, radiation, and consumption of drugs that alter salivary flow, etc.

For this reason it is important to assess the actual effect of post brushing rinse-off because it might increase the bioavailability of fluoride, resembling the concentrations obtained by using high concentration Dt.

Regarding the amount of Dt during tooth brushing, all authors found a direct positive association to increase the amount of Dt in relation to Bs-Bp.

This increase in Bs can be up 3.66 times higher when using Dt of 1.5 g vs 0.5 g, therefore it would seem to have a true protective effect.

Although measurements with higher amounts to 1.5 g of fluorinated Dt were not performed, any amount higher than this is thought not to necessarily have a beneficial effect, possibly because any excess will be eliminated eventually at time of expectoration.

It would be interesting to consider for future research, the effects of active agents such as calcium citrate or sodium trimetaphosphate on the bioavailability of fluoride, and how these could be considered in the protocol of oral hygiene, since tooth surface fluoride concentration increases faster when using AmF vs NaF.

Although the main strength is the design of the study, a SR based on CASPEE standards ensuring systematic work, we must also consider some limitations. Study limitations are conditioned mainly by the quality and heterogeneity of the studies, therefore it is not possible to reach a consensus but it is possible to compare the different results.

CONCLUSION

A more specific oral hygiene protocol is proposed for the patients in order to achieve a higher anti cariogenic effect.

Thus after the collection of information available in the electronic database it can relate the bioavailability of fluoride with toothbrushing, considering that the most important factor is the concentration of fluoride, followed

by amount of Dt used, post brushing rinse protocol and finally brushing time.

Therefore the proposed protocol considers; (1) concentrations of fluoride Dt $\geq$ 1450 ppm, (2) duration of brushing of 2 minutes or more, (3) brushing frequency 3 times a day or incorporating a third administration of fluoride with mouthwashes fluorinated or Dt without using brush, (4) amount of Dt of 1.5 g, (5) avoiding oral rinse with water post-brushing, or doing it with mouthwash or water but with 10 ml for 5 seconds and only once.

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RESUMEN: El objetivo de este estudio es proponer un protocolo para el uso adecuado de fluoruros en dentífricos (Dt), basado en su biodisponibilidad en saliva (Bs) y/o placa (Bp) mediante una revisión sistemática (RS). RS de la literatura 2005- 2015 en PubMed, Cochrane y SciELO. Criterios de inclusión: estudios clínicos in vivo, español e inglés, realizados únicamente con Dt que midieran Bs y Bp. Los resultados fueron evaluados en relación a: 1) Concentración de flúor en el Dt, 2) Tiempo de cepillado con Dt, 3) Frecuencia de cepillado, 4) Enjuague post-cepillado y 5) Cantidad de Dt en el cepillo. Fueron seleccionados 12 estudios. 1) La Bs aumenta en un 241 % al utilizar un Dt de 5000 ppm en comparación con un 1450 ppm. 2) Bs aumenta en un 55 % al aumentar la duración del cepillado de 40 s a 120 s, 3) La Bp aumenta en un 68 % al cepillarse 3 veces al día en comparación a 2 veces. 4) No enjuagarse o enjuagues de <10 ml por <10 s puede aumentar la Bs hasta en un 270 % en comparación a enjuagues con mayor volumen/tiempo. 5) Al aumentar la cantidad de Dt de 0,5 g a 1,5 g, la Bs aumenta hasta en un 266 %. Se recomienda utilizar 1,5 g de Dt $\geq$ 1450 ppm de flúor por $\geq$ 120 s, 3 veces al día, y evitar enjuague oral con agua o colutorios sin flúor una vez finalizado el cepillado.

PALABRAS CLAVE: saliva, placa, dentífricos, calculo, tratamiento caries, salud dental public.

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Received: 20-06-2016

Accepted: 11-10-2016