SHORT COMMUNICATION

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The effect of toothbrushing on secretion rate, pH and buffering capacity of saliva

Keywords: flow rate; pH; saliva; toothpaste

Removal of dental plaque by regular toothbrushing has a beneficial effect on oral health (1). Saliva is also important for the maintenance of oral health as it provides anti-microbial substances and mechanically clears the oral cavity through continuous flushing (2). Therefore, a low secretion rate of saliva is considered to be an important endogenous risk factor for the development of oral diseases (3, 4). Individuals with hyposalivation are advised to stimulate their saliva secretion, either by chewing or with gustatory stimuli. In this study, the effect of toothbrushing as an alternative mode of saliva stimulation is

investigated.

Eighty healthy volunteers (dental hygiene students and dental students) participated in this study, which was approved by the Medical Ethics Committee of the Vrije Universiteit of Amsterdam. Subjects were randomly distributed with regard to age, history of smoking, the use of oral contraceptives and other medication. All subjects were instructed to refrain from smoking, eating, drinking caffeine-containing beverages and toothbrushing at least 1 h prior to the experiment (5), which took place between 13.00 and 15.00 hours. Unstimulated whole saliva was collected in preweighed tubes for 2 min. Next, the volunteers brushed their teeth according to the Bass method for 2 min, using a new Lactona® IQ soft tip toothbrush (Enta-Lactona BV, Bergen op Zoom, The Netherlands), with either water (22 persons), Elmex[®] mentholfree toothpaste (29 persons), Elmex[®] anti-caries toothpaste (13 persons) (GABA Benelux, Almere, The Netherlands) or Parodontax[®] (16 persons)(GSK Consumer Healthcare BV, Zeist, The Netherlands). Immediately after toothbrushing, toothpaste with residual saliva was

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Fig. 1. Effect of toothbrushing on (A) secretion rate, (B) pH and (C) buffering capacity of saliva. Values are expressed as mean \pm SD. ^asignificantly different from baseline value before toothbrushing (P < 0.05); ^bsignificantly different from toothbrushing with water at the same time point (P < 0.05).

expectorated. Thereafter, collection of saliva was started. Saliva was collected without stimulation for 2 min at 0, 10, 30 and 60 min after toothbrushing.

The secretion rates were determined gravimetrically (1 g = 1 ml) and expressed as mg ml⁻¹. Salivary pH was measured with pH indicator strips (4.0–7.0 and 6.5–10.0, Merck, Darmstadt, Germany). Subsequently, equal volumes of 5 mM HCl and saliva were mixed and the final pH of this solution was used as an indication of the buffer capacity (titrated pH).

For statistical analysis, repeated measures multi-analysis of variance (MANOVA) was used, followed by paired *t*-tests or independent samples *t*-tests where appropriate (SPSS version 10.0: SPSS Inc, Chicago, IL, USA). Levels of significance were set at P < 0.05.

Toothbrushing induced transient changes in the salivary flow rate, pH and buffering capacity (Fig. 1). After brushing with water, the salivary secretion rate increased significantly for 60 min (Fig. 1a) suggesting toothbrushing mechanically stimulates saliva secretion. When compared with brushing with water, the secretion rates enhanced significantly after brushing with toothpastes, probably as a result of additional gustatory stimulation. The effect of Elmex[®] mentholfree on saliva secretion was as strong as the effect of the other toothpastes suggesting that this mild-tasting toothpaste provides already considerable gustatory stimulation. The effect of Elmex[®] anticaries on secretion rate was less prolonged than the other stimuli. Possibly, the menthol in Elmex[®] anti-caries causes a local anaesthetizing effect inhibiting saliva secretion (6).

In addition to an increase in salivary secretion rates after toothbrushing, a transient increase in salivary pH (Fig. 1b) and buffering capacity (Fig. 1c) was observed, but only Elmex[®] anti-caries showed a significant increase compared with saliva before toothbrushing.

Parodontax contained bicarbonate (HCO_3^-), which disturbed the measurements of pH and buffering capacity after brushing with this toothpaste. Increases in pH and buffering capacity result from the increased salivary flow rate. With an increase in the salivary flow rate there is less retention of bicarbonate (HCO_3^-) in the salivary ducts and consequently an increased concentration in saliva. This leads to both a higher pH and buffering capacity of saliva.

We conclude that one of the beneficial side effects of toothbrushing is an enhancement of the salivary flow rate what may result in increased oral clearance. This effect is independent of the gustatory stimulus of the toothpaste, as toothbrushing with water already results in a significant increase.

References

- Listgarten MA. The role of dental plaque in gingivitis and periodontitis. J Clin Periodontol 1988; 15: 485–487.
- 2 Nieuw Amerongen AV, Bolscher JGM, Veerman ECI. Salivary proteins: protective and diagnostic value in cariology? *Caries Res* 2004; 38: 247–253.
- 3 Dawes C. How much saliva is enough for avoidance of xerostomia? *Caries Res* 2004; **38:** 236–240.
- 4 Guggenheimer J, Moore PA. Xerostomia etiology, recognition and treatment. J Am Dent Assoc 2003; 134: 61–69.
- 5 Hoek GH, Brand HS, Veerman ECI, Nieuw Amerongen AV. Toothbrushing affects the protein composition of whole saliva. *Eur J Oral Sci* 2002; **110**: 480–481.
- 6 Eccles R. Menthol and related cooling compounds. J Pharm Pharmacol 1994; 46: 618–630.

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