

On Fluoridation of Chewing Sticks (Miswaks) with Respect to Dental Caries

Akademisk avhandling

som för avläggande av odontologie doktorsexamen kommer att offentligens försvaras
i hörsal Arvid Carlsson, Academicum, Medicinaregatan 3, Göteborg,
fredagen den 16 April 2010, kl. 13.00

av

Hosam Baeshen
DDS

Fakultetopponent:
Professor Bjørn Øgaard
Department of Orthodontics
University of Oslo, Norway

Avhandlingen är av sammanläggningstyp och baseras på följande fyra delarbeten:

- I. Baeshen H, Kjellberg H, Lingström P, Birkhed D. Uptake and release of fluoride from fluoride-impregnated chewing sticks (Miswaks) in vitro and in vivo. *Caries Res* 2008;42:363–368.
- II. Baeshen H, Birkhed D. Release of fluoride from fresh and old fluoride-impregnated chewing sticks (Miswaks) in vitro and oral retention in vivo. *Oral Health Prev Dent*;2010;1:93-99.
- III. Baeshen H, Kjellberg H, Birkhed D. Oral fluoride retention in orthodontic patients with and without fixed appliances after using different fluoridated home-care products. *Acta Odontol Scand* 2010, in press.
- IV. Baeshen H, Lingström P, Birkhed D. Effect of fluoridated Miswaks (chewing sticks) on white spot lesions in post-orthodontic patients evaluated by DIAGNOdent pen and ICDAS II. *Am J Orthod Dentofacial Orthop* 2010, accepted.

Gothenburg 2010

Abstract

On Fluoridation of Chewing Sticks (Miswaks) with Respect to Dental Caries

Hosam Baeshen, Department of Cariology, Institute of Odontology, Sahlgrenska Academy, University of Gothenburg, Box 450, SE-405 30 Gothenburg, Sweden

The chewing stick known as a “Miswak” is a natural toothbrush that is widely used for cleaning the teeth. It has been used for thousands of years in Asia, Africa and the Middle East. The aim of this thesis was to evaluate the Miswak as a vehicle for fluoride delivery in the oral cavity. *In vitro* studies showed that both fresh and old Miswaks take up fluoride, which can even reach the pulp of the stick. *In vivo*, the fluoride release from Miswaks impregnated in 0.5% NaF was rapid and was estimated to be around 0.4 mg. A large variation in fluoride release was observed between Miswaks purchased from different stores. This variation may depend on differences in wood properties or the fact that some stores sell fresh Miswaks, while others sell older types. Based on *in vivo* data, it is recommended to use fresh Miswaks impregnated in 0.1% NaF or a maximum of 0.5% NaF on daily basis. The mean salivary fluoride concentration for Miswaks impregnated in 0.1-0.3% NaF produced about the same fluoride level in saliva as toothpaste containing 0.32% NaF.

The fluoride concentrations at the various sites in the oral cavity were higher before than after debonding in orthodontic patients. Moreover, products with a high fluoride content (toothpaste, solution and Miswaks) resulted in higher fluoride retention than the corresponding products with a lower fluoride content. In whole saliva, the highest area under the curve (AUC) values were found in patients using 0.2% NaF rinsing solution, followed by 1.1% NaF toothpaste ($p < 0.05$). The mean fluoride concentration in approximal saliva was higher for Miswaks impregnated in 0.5% NaF compared with other fluoridated products ($p < 0.001$). Consequently, presence of fixed orthodontic appliances appears to increase the oral fluoride retention for all the tested home-care fluoride products.

The treatment effect of fluoridated Miswaks was evaluated on white spot lesions (WSL) in healthy adolescents with a minimum of 4 WSL after completing the orthodontic treatment. They participated in a double-blind, randomised, longitudinal trial, lasting for 6 weeks, and were divided into two groups using: 1) fluoridated Miswaks impregnated in 0.5% NaF (test group, $n=19$) and 2) non-fluoridated Miswaks (control group, $n=18$). A custom-made mouth tray, covering half the dentition in the upper jaw, was used while brushing with the Miswaks 5 times/day. The lesions were scored at baseline and 2, 4 and 6 weeks after debonding. The DIAGNodent readings and the International Caries Detection and Assessment System (ICDAS II) index of the WSL decreased in the test group on the uncovered side of the dentition but not on the covered side, during the 6-week trial ($p < 0.0001$). This indicates that the frequent use of fluoridated Miswaks had a remineralising effect on WSL.

In conclusion, NaF-impregnated Miswaks produced a rapid release of fluoride *in vitro*, as well as *in vivo*, and may be an interesting vehicle for home-care use for caries prevention in countries where they are frequently used.

Key words: Approximal area, caries lesions, chewing stick (Miswak), fluoride, fluoride retention, fluoride solution, fluoride toothpaste, impregnation, orthodontic patients, saliva, *Salvadora Persica*

ISBN 978-91-628-8039-2

Correspondence to: drbaeshen@me.com