Abrasives in snuff?

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The purpose of this study was to determine and calculate the inorganic contents of four brands of snuff. Visual inspection of wet snuff showed fairly large, yellow crystal-like particles. Scanning electron microscopy and X-ray dispersive (EDX) analyses were used to study both wet snuff and ashes of snuff, whereas light emission spectrography was used to determine elements in the ashes. The crystal-like particles did not dissolve in distilled water or in ethanol heated to 60°C. EDX analyses showed that most elements remained in the particles after washing. The total weight percentage of inorganic material in snuff was calculated after burning dried snuff until constant weight was obtained. The ashes of snuff did not contain any crystal-like particles but consisted of a small-grained amorphous mass. The following elements were detected: Ag, Al, Ba, Ca, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Na, P, Pb, Si, Sr, Ti, Va, and Zr. Other elements such as rare earths were not searched for. The weight percentage of inorganic elements ranged between 12.35 ± 0.69 and 20.95 ± 0.81. Provided snuff is used in the same manner as chewing tobacco, and some people admit to doing so, there is a risk that its relatively high contents of inorganic material and heavily soluble salts may be conducive to excessive abrasion of teeth and restorations. □ *Abrasion; in vitro study; tooth wear*

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Tobacco has been used in the form of snuff for the last 200 years in our part of the world. Originally, snuff was placed in the nose, but gradually, oral use of snuff has become the common mode of use. The consumption was at its highest around 1920, to be gradually reduced up to the 1960s, when it started increasing again to an annual level of about 5.5 kg/person using it—in Sweden about 800,000 individuals (1). Especially young people and people seriously engaged in sports have been heavy users. At the Norwegian College of Physical Education and Sports as many as 50% of the male students reported oral use of snuff regularly in 1986 (2).

Snuff is tobacco leaves that are dried, ground, and made into a damp, dark mass, to which are added aromatics and spices to give the various brands their particular flavor. Ammonia and potassium bicarbonate are usually also added to give the snuff a pH of 8.5–9.0. This causes quick uptake of nicotine in the blood. There is a saying that tobacco manufacturers add finely powdered glass to the snuff to ease nicotine uptake due to the fine glass particles making small cuts in the mucosa, whereby the nicotine is more easily absorbed.

The literature is replete with articles describing the ill effects of snuff, causing discoloration of the teeth, reflection of the periodontium from the teeth, and cancer in the mucous membranes of the oral cavity, the air passages, and the esophagus (1, 3–7). Snuff-dipping is also known to cause increased blood pressure and pulse rate, to lower the general muscle force, to reduce the mass of musculature, and to cause slower reflexes (8).

From the literature it seems that only one author (5) has related tobacco-chewing and snuff-dipping to the wear of teeth caused by the abrasives in the tobacco. In recent articles about the effects of snuff-dipping (1, 6–8) this aspect has not been mentioned.

In the clinic, however, patients displaying both localized and generalized signs of

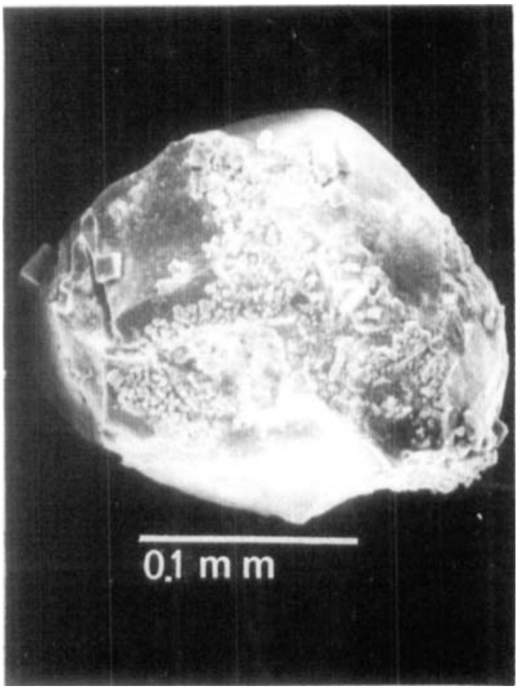

Fig. 3. Scanning electron microscope photograph of crystal-like particle in wet snuff (unwashed).

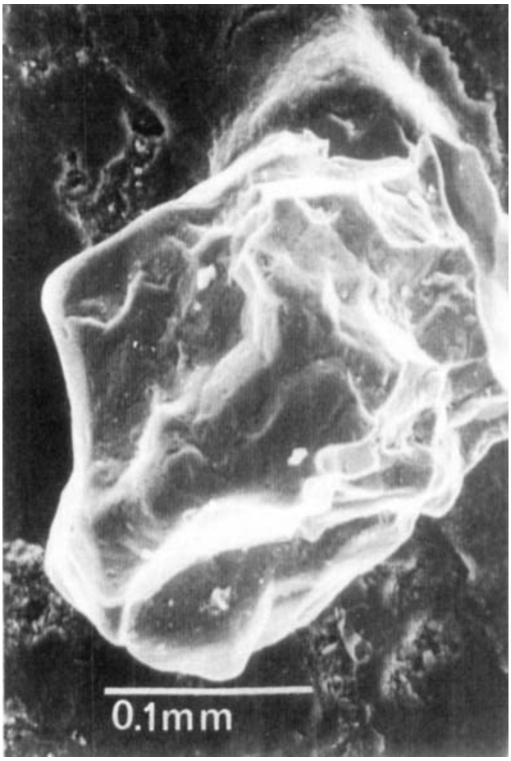

Fig. 4. Scanning electron microscope photograph of same particle after washing in distilled water and ethanol heated to 60°C.

excessive tooth wear (Figs. 1 and 2) often admit that they use snuff more or less like chewing gum and cannot keep it still under the lips or tongue or in the buccal vestibules unless it is delivered in small paper bags. When chewed, snuff feels gritty, and in cases of muscular hyperactivity, such as bruxism, there is a possibility that the inorganic contents of snuff may have an abrasive effect on teeth and restorations.

The purpose of this study was therefore to define and calculate the amount of inorganic contents in snuff, to ascertain whether such a hypothesis would receive support.

Materials and methods

Four boxes containing different brands of snuff were bought at a local tobacconist's. The four brands were 1) Svarta Bjørn, J. L. Tiedemanns Tobaksfabrik, Norway; 2) Ljunglöfs Ettan, Svenska Tobaks AB, Sweden; 3) Copenhagen Snuff, United States Tobacco Co., USA; and 4) Tiedemanns Grønn, J. L. Tiedemanns Tobaksfabrik, Norway.

Samples of the four brands were studied with the naked eye. Clearly visible crystal-like particles from the wet, amorphous mass of snuff were studied in the scanning electron microscope (SEM) and by X-ray dispersive analysis (EDX). The particles were examined before and after washing with distilled water and ethanol heated to 60°C.

To determine the contents of inorganic material, samples were treated by a method described in ISO standard 4049 (9). First, the weight of the snuff was established after drying for 5 h at 150°C. Thereafter the snuff was burned for 3 h at 550°C. After it had been washed with distilled water and sifted through an ash-free filter (589^2 Weissband

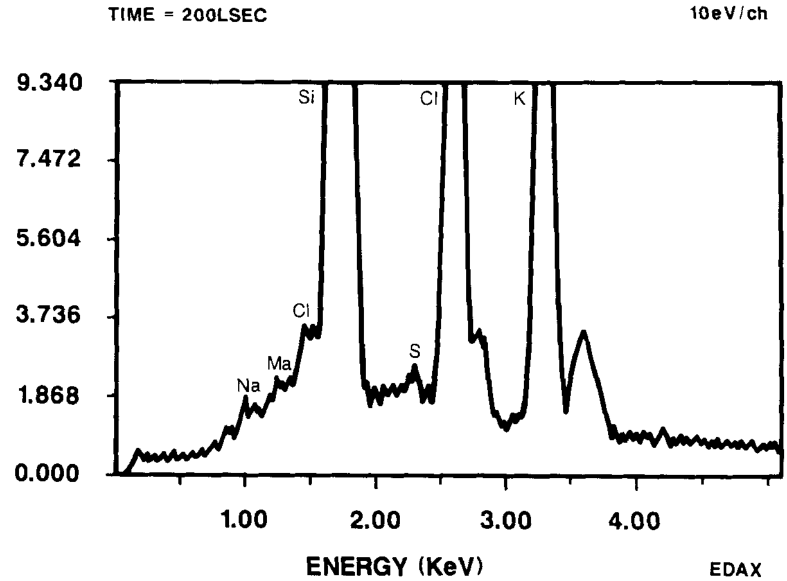

Fig. 5. X-ray dispersive analysis of elements in unwashed particle (same as in Fig. 3).

Rundfilter, Schleier & Schnell, FRG), burning was repeated at 550°C until constant weight had been obtained. A total of four burnouts were performed. The mean weight of the ashes and the standard deviations were calculated. The ashes were also studied in the SEM, by EDX analysis, and by light emission spectrography.

Findings

Particles were clearly visible in the SEM in the wet snuff (Figs. 3 and 4) before and after washing in distilled water and ethanol heated to 60°C. Dissolution of the particles did not take place. Their size did not change significantly. EDX analysis (Fig. 5) showed that

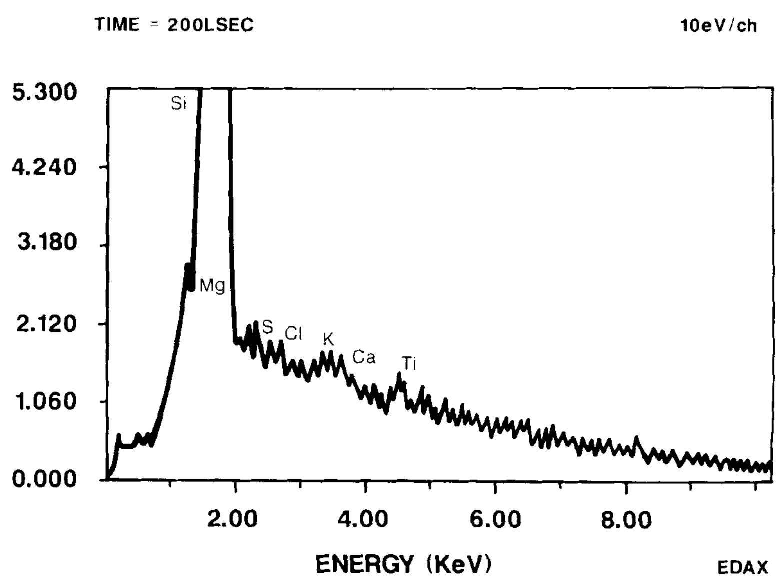

Fig. 6. X-ray dispersive analysis of elements in washed particle (same as in Fig. 4).

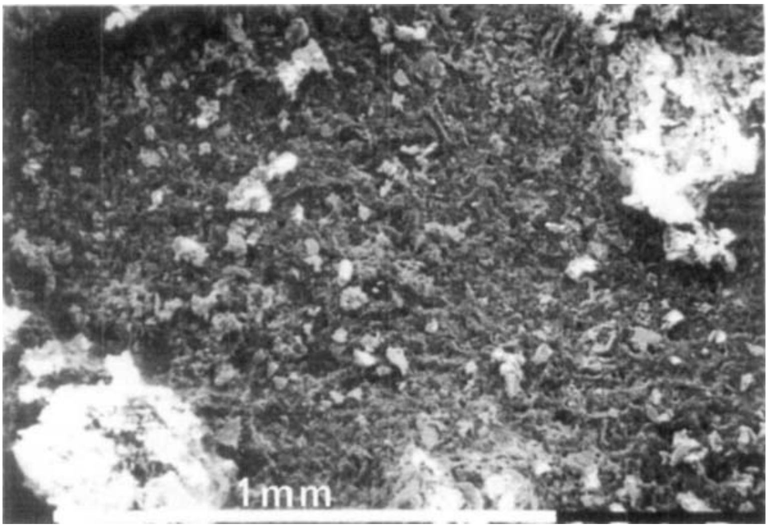

Fig. 7. Scanning electron microscope photograph of ashes of snuff.

the unwashed particles contained Na, Mg, Al, Si, S, Cl, and K. Washing led to a reduction in the amounts of Cl and K, but Ca and Ti were then visible on the graph (Fig. 6).

The weight of the ashes expressed as percentage of the weight of the dried snuff in the four samples is presented in Table 1. The range was from 12.35 ± 0.69 in sample 3 to 20.95 ± 0.81 in sample 4.

Inspection of the ashes of snuff showed that the samples were very inhomogeneous, as shown in the SEM (Fig. 7). The crystal-like particles previously seen in wet snuff were no longer visible. The ashes from samples 1, 2, and 4 looked about the same, containing coarse and fine particles, whereas those from sample 3 were mostly fine-grained.

Light emission spectrography showed that most particles of ashes consisted of different phases. Precise characterization of single particles was therefore not performed, but analyses of areas were carried out. Cl, K, and Na dominated in all the samples, but the exact amounts were difficult to establish (Table 2). In sample 4 the amounts of silisium and iron were probably somewhat higher than in the other three.

Table 1. Total weight percentage of inorganic material in snuff

Brand	x	SD
Svarta Björn	17.42	0.59
Lunglöfs Ettan	18.04	0.60
Copenhagen Snuff	12.35	0.69
Tiedemanns Grønn	20.95	0.81

Discussion

The samples were collected at random, and they should be representative for snuff

Table 2. Weight percentage of some elements in snuff

>20%	10–20%	5–10%	1–5%	0.01–0.1%	0.001–0.01%	<0.001%
Na, K	Ca	Fe	Mg, Si Al, P	Ti, Mn, Cu Sr, Zr, Ba Cr, Ni	B, Li, V, Ni	Ag, Pb

obtainable in Norway. The analytical methods are widely used and should be suitable for this type of investigation.

Snuff has recently received much attention as a health risk factor (1, 4–8). Little has been written about its effects on the oral hard tissues, except by Christen et al. (5). However, when considering the relatively large amounts of inorganic material in snuff, up to one-fifth of its dry weight, it is quite likely that, if used for chewing, snuff may well contribute to increased wear of teeth and restorations. Patients should therefore be informed about this possible ill effect too. The source of the inorganic substances would probably be, apart from the tobacco plant itself, the soil where it was grown and various impurities acquired during transportation and manufacturing. The presence of titanium, iron, and cobalt, for instance, might originate from the knives used in the milling procedure of the tobacco leaves.

Our findings do not lend support to the saying that finely powdered glass had been added to the snuff to facilitate the uptake of nicotine. Although silisium was present in various amounts, the contents were not greater than what could be expected to be from the soil. The crystal-like particles observed (Figs. 3 and 4) were probably heavily soluble salts. They contained large amounts of Cl and K, which were partly removed by washing. This finding and a total disintegration at 550°C would not likely happen if the particles were glass.

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In conclusion, provided snuff is used the same way as chewing tobacco and not left still against the oral mucosa, there is a possibility that its contents of inorganic material and heavily soluble salts may be conducive to excessive abrasion of the occlusal and incisal surfaces of teeth and restorations.

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