

Sodium lauryl sulfate and recurrent aphthous ulcers

A preliminary study

Bente Brokstad Herlofson and Pal Barkvoll

Department of Oral Surgery and Oral Medicine. Dental Faculty, University of Oslo, Oslo, Norway

Herlofson BB, Barkvoll P. Sodium lauryl sulfate and recurrent aphthous ulcers. A preliminary study. *Acta Odontol Scand* 1994; 52: 257-259. Oslo. ISSN 0001-6357.

Sodium lauryl sulfite (SLS), a synthetic detergent commonly used in dentifrices, is an effective denaturant. The aim of the present study was to investigate the effect of SLS in patients with recurrent aphthous ulcers (RAU). Ten patients with multiple minor RAU participated in the study. The mean incidence of RAU was 17.8 during a 3-month period before the study. The patients used a dentifrice containing 1.2% SLS for a test period of 3 months followed by a dentifrice without SLS for the same time period. The results showed a statistically significant decrease in the number of aphthous ulcers from 14.3 after using the SLS-containing dentifrice to 5.1 ulcers after brushing with the SLS-free dentifrice ($p < 0.05$). It is suggested that the denaturing effect of SLS on the oral mucin layer, with exposure of the underlying epithelium, induces an increased incidence of RAU. *Ž Dentifrice: oral mucosa: recurrent aphthous ulcers*

Bente Brokstad Herlofson, Department of Oral Surgery and Oral Medicine. Dental Faculty, University of Oslo, 1109 Blindern. N-0317 Oslo, Norway

Recurrent aphthous ulcers (RAU) are characterized by the development of painful, recurring solitary or multiple necrotizing ulcerations of the non-keratinized oral mucosa and is of unknown etiology.

Different treatments have been tried, including steroids (1), antibiotics (2), chlorhexidine (3,4), and an enzyme-containing toothpaste (5,6). In the latter case a significant decrease in the frequency of RAU was reported (6) when the patients brushed with the toothpaste containing the enzymes amyloglucosidase and glucose oxidase. In 1983 Donatsky et al. (5) recommended use of toothpaste with the same composition for patients with RAU, even though their study did not demonstrate any convincing reducing effect on RAU after comparing the enzymes toothpaste with a placebo paste without the enzymes. The enzyme-containing toothpaste did not contain sodium lauryl sulfate (SLS), which is present in almost all other types of toothpastes (7). This ingredient was not taken into consideration in the above-mentioned studies. Barkvoll & Rolla (8) then reported in 1989 a decreased number of oral ulcers in patients with allergic stomatitis after use of an SLS-free test dentifrice compared with a control with the detergent. The aim of the present study was to examine the effect of SLS-containing toothpaste in patients with multiple minor RAU.

Patients and methods

^a In this study, 10 volunteers (8 women, 2 men; mean age, 21.5 years; range, 13-35 years) were included, all presenting with multiple RAU. They were all

healthy individuals with no systemic drug consumption and showed healthy gingival conditions. Blood screening was carried out, and no abnormalities in hemoglobin sedimentation rate, differential leukocyte count, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin concentration, protein electrophoresis, total protein, immunoglobulins, vitamin B₁₂, iron, and serum folate were found in any of the test subjects. Before the start of the study the patients recorded in a diary the number of ulcers occurring in a 3-month period during which the participants used their regular toothpaste, which contained SLS. The mean incidence of RAU in each patient in this prestudy period was 17.8 ulcers. Before start of the study a 1-week washout period, during which the patients brushed with a surfactant-free paste, was performed. Two different dentifrices were used in the study. They included the same basis formula with 0.1% fluoride and differed only in detergent content. One contained 1.2% SLS, and the other was surfactant-free, serving as a control.

The patients were randomly allocated to one of the test toothpastes for the first 3 experimental months, succeeded by the 1-week washout period during which the participants brushed with the surfactant-free paste. Then the patients changed to the other toothpaste for another 3-month period. Both pastes, which were coded to ensure a double-blind design, were used by all participants.

The patients were shown pictures of RAU and given written information based on the clinical signs of RAU described by Gayford & Haskel (9). During

Table 1. The number of aphthous ulcers in the pre-study and in the two experimental periods in each subject during the trial

| Subject no. | Pre-study | Toothpaste 1* | Toothpaste 2† |
|-------------|-----------|---------------|---------------|
| 1 | 23 | 5 | 16 |
| 2 | 19 | 2 | 14 |
| 3 | 13 | 4 | 12 |
| 4 | 24 | 10 | 11 |
| 5 | 29 | 12 | 28 |
| 6 | 25 | 3 | 17 |
| 7 | 15 | 4 | 12 |
| 8 | 18 | 9 | 16 |
| 9 | 7 | 1 | 10 |
| 10 | 5 | 1 | 7 |
| Mean | 17.8 | 5.1 | 14.3 |
| SEM | 2.5 | 1.2 | 1.8 |

* Without sodium lauryl sulfate.

† With sodium lauryl sulfate.

the study the participants registered the number of aphthous ulcers in a standard diary. Each patient was examined by visual inspection of the oral mucosa, and the diaries were examined at least every 2nd week by the clinical examiner. If any doubt arose with regard to diagnosing the ulcers in the meantime, the patients were instructed to contact the examiner. The participants were instructed not to change diet, lifestyle, or smoking habits (three smokers) during the trial.

Statistics

The Wilcoxon matched-pairs ranking test was used to analyze the data of this study. P values below 0.05 were considered significant.

Results

The number aphthous ulcers, with mean and standard error of the mean (SEM), in the pre-study and the two experimental periods in each participant is listed in Table 1. The difference between the pre-study period and the SLS-containing period was not statistically significant. Brushing with an SLS-free dentifrice reduced the number of aphthous ulcers significantly, compared with ulcer frequency both in the pre-study and in the SLS experimental period ($p < 0.05$). All 10 patients benefited from using the detergent-free toothpaste. The sequence of treatment did not have any significant effect on the study.

Discussion

This study has examined the effect of an SLS-containing dentifrice on the frequency of RAU. The results showed a significant reduction in numbers of ulcers when the patients used and SLS-free toothpaste for 3 months. The mean reduction was about 70% compared with the pre-study period during which the subjects brushed with their regular dentifrice. Compared with the experimental period in which patients used a toothpaste containing 1.2% SLS, the reduction was 60%.

The reasons for these results are not clear, but it appears likely that SLS may denature the mucosal mucin layer. Mucins are principal organic constituents of mucus, the visco-elastic material that covers all mucosal surfaces, and evidence suggests that mucins play an integral role in non-immune protection of the mucosal surfaces (10). The oral epithelium may then be more exposed and vulnerable to exogenous irritating agents and allergens, and in RAU patients the incidence of ulcers may increase. Furthermore, it is possible that SLS may increase the mucosal permeability to other compounds and agents and that this may play a role in the pathogenicity of RAU.

The data from our study may be compared with the data of Hoogendoorn & Scholtes (11) and Koch (6), who used an SLS-free enzyme-containing toothpaste and found a reduction in the frequency of the RAU, although these authors did not consider the role of SLS in their papers. SLS is a strong denaturing substance and has the potential to denature the enzymes (12) included in the toothpaste tested by these authors; its addition was therefore probably avoided for this reason. The results observed by Hoogendoorn & Scholtes (11), Koch (6), and Donatsky et al. (5) may in fact be explained in terms of the lack of SLS rather than the presence of enzymes. It may be suggested that the denaturing effect of SLS on the oral mucosal layer induces an increased incidence of RAU. A more comprehensive study is necessary before any final conclusion can be drawn concerning the role of SLS in toothpaste in the etiology of RAU.

Received for publication 22 November 1993

Accepted 24 January 1994

References

- Lozada F, Silverman S, Migliorati C. Adverse side effects associated with prednisone in the treatment of patients with oral inflammatory ulcerative disease. *J Am Dent Assoc* 1984; 109: 269-70.

2. Henricsson V, Axell T. Treatment of recurrent aphthous ulcers with Aureomycin mouth rinse or Zendium™ dentifrice. *Acta Odontol Scand* 1985; 43: 47-52.
3. Matthew RW, Scully CM, Levers BGH. Clinical evaluation of benzydamine, chlorhexidine, and placebo mouthwashes in the management of recurrent aphthous stomatitis. *Oral Surg Oral Med Oral Pathol* 1987; 63: 189-91.
4. Hunter L, Addy M. Chlorhexidine gluconate mouthwash in the management of minor aphthous ulceration. *Br Dent J* 1987; 162: 106-10.
5. Donatsky O, Worsaaac N, Schiødt M, Johnsen T. Effect of Zendium toothpaste on recurrent aphthous stomatitis. *Scand J Dent Res* 1983; 91: 376-80.
6. Koch G. Effekten af enzymtandpasta på recidiverende afters. Forebyggelse af tandsygdomme. *Akzo Dent Res* 1981; 3-14.
7. Wells FV, Lubowe II. *Cosmetics and the skin*. New York: Reinhold Publishing Corp. 1964.
8. Barkvoll P, Rolla G. Possible effects of sodium lauryl sulfate (SLS) on the oral mucosa [abstract]. *J Dent Res* 1989; 68: 991.
9. Gayford JJ, Haskell R editors. *Clinical oral medicine*. Bristol: John Wright & Sons Ltd. 1979: 1-11.
10. Taback LA, Levine MJ, Mandel ID, Ellison SA. Role of salivary mucins in the protection of the oral cavity. *J Oral Pathol* 1982; 11: 1-17.
11. Hoogendoorn I-L, Scholtes W. De invloed van de activering van het lactoperooxidaase in het speeksel bij het ontstaan van caries en chronisch recidiverende aphthen (1). *Ned Tijdschr Tandheelkd* 1979; 86: 362.
12. Tsutsumi M, Oyama Y, Suda I, Wantanabe T. Action of some detergents on succinate dehydrogenase of *E. coli* in vivo. *Bacterial Abst* 1982; 17: 3081-117.