Salivary and microbial conditions in patients with orofacial discomfort complaints

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Secretion rate, pH, and buffer capacity of paraffin-stimulated saliva and the prevalence of salivary *Streptococcus mutans* and lactobacilli were examined in 98 consecutive patients (22 men, 76 women) referred for orofacial discomfort complaints related to 'oral galvanism'. The results of this investigation were compared with those of a group of 100 patients without symptoms and complaints. The patients with orofacial symptoms and complaints had significantly fewer teeth with amalgam fillings than patients without, despite equal mean number of teeth in the two groups. Most patients had normal secretion rate and pH of saliva but somewhat low values of salivary buffer capacity. Determination of saliva conductivity showed values within a normal reference interval but lower than those from a group of subjects without orofacial symptoms and complaints. The salivary levels of cariogenic bacteria were low. □ *Clinical symptoms; conductivity; lactobacilli; saliva;* Streptococcus mutans

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Oral symptoms in subjects with orofacial discomfort complaints often involve unpleasant metallic taste and burning sensations in the mouth, which have been supposed to be associated with electrochemical reactions between restorative materials (1). The use of different metal alloys in fillings and crowns may at contact create currents in the salivary milieu. However, higher currents or saliva concentrations of various metallic components in the oral cavity have not been found in persons with orofacial complaints when compared with persons without such symptoms (2). Furthermore, salivary secretion rate and buffer capacity are reported not to differ from what is considered normal in subjects with symptoms related to electrochemical reactions in the mouth (3). The aim of the present study is to report on salivary and microbial conditions in a group of patients examined for intraoral and/or distant symptoms that they related to 'oral galvanism' (1).

Materials and methods

Selected for the study were 98 out of 113 consecutive patients referred to the Department of Prosthetic Dentistry, University of Gothenburg, during the period 1979–81 with a tentative diagnosis of dental material allergy, 'oral galvanism', and other orofacial and distant complaints allegedly related to dental materials. Excluded were five patients who had complete dentures, one who was without symptoms at examination, and nine with symptoms related to esthetic and technical problems with removable partial dentures and bridge work and whose symptoms disappeared after adjustment. Each patient was questioned concerning complaints and symptoms and was clinically examined. In addition, 100 randomly selected patients, referred to the Department of Cariology for evaluation of the caries risk during 1982, were included for comparison. None of them had any symptoms of orofacial discomfort.

The clinical examination included the registration of the number of decayed, missing, and filled teeth, with special emphasis on metallic restorations. Stimulated whole saliva was collected after the subjects rinsed their mouth with water. Salivary flow was stimulated and plaque removed from the tooth surfaces by chewing a piece of paraffin

wax (1.5 g) for 5 min. The saliva was expectorated into a chilled graduated cylinder and the secretion rate estimated in milliliters per minute, with attention paid to salivary foam. One milliliter of saliva was withdrawn and transferred to a bottle containing VMG II transport medium (4). The collection cylinder was sealed with Parafilm®. The saliva and bacteriological samples were transported to the laboratory and processed within 2 h. The pH of the saliva was measured with a pH electrode. The buffer capacity was determined by the method of Ericsson (5). Three milliliters of 0.005 M HCl and one drop of octyl alcohol were added to 1 ml of saliva, and after aeration of the mixture for 20 min the final pH was determined electrometrically.

The saliva samples in VMG II were dispersed on a Whirlimixer for 30 sec and plated in 10-fold serial dilutions on mitis salivarius bacitracin (MSB) agar (6) and in Rogosa selective lactobacillus agar. The MSB agar plates were incubated for 48 h at 37°C in 5% CO_2 in nitrogen, and the Rogosa SL agar plates were incubated aerobically for 72 h at 37°C. Counts were made of colonies with morphology characteristics typical of *Streptococcus mutans* (7, 8) on MSB agar and lactobacilli in Rogosa SL agar. The number of colony-forming units (CFU) of *S. mutans* and lactobacilli per milliliter of saliva was calculated.

Salivary conductivity was determined in 13 randomly selected subjects from the test group (4 men and 9 women). Ten subjects (three men and seven women) consisting of students and staff members without orofacial symptoms participated as a comparison group. Saliva samples were collected as earlier described. One milliliter of saliva was diluted 1:100 and the conductivity determined with a CDM2E conductivity meter (Radiometer, Copenhagen). Differences between test and control subjects were examined for significance by an unpaired *t* test.

Results

Table 1 shows the age, sex distribution, and number of teeth and teeth with amalgam fillings. The mean age of the group with (OFC) and without (WOFC) orofacial discomfort complaints was 55 and 40 years, respectively. There was a predominance of women in the OFC group, whereas the sex distribution in the other group was more even. No difference was observed between the groups with regard to the number of teeth. The subjects in the WOFC group had significantly more teeth filled with amalgam ($p < 0.01$) than those in the OFC group (Table 1).

Table 1. Age, sex distribution, and number of teeth with amalgam fillings in patients with (OFC) and without (WOFC) orofacial discomfort complaints. Mean and range

	OFC	WOFC
Age, years	54.6 (24–81)*	39.8 (20–73)
No. of:		
Men	22	48
Women	76	52
Teeth	23.2 (3–29)	23.4 (4–28)
Teeth with amalgam fillings	6.8 (0–22)*	10.3 (0–22)

* Significantly different from the WOFC group; $p < 0.01$.

The results of the salivary tests are shown in Table 2. In both groups of subjects the mean secretion rate and pH were within normal reference intervals, whereas the buffer capacity in the OFC group showed a rather low final pH. Seventeen patients (17%) in the OFC group had secretion rate values below 0.7 ml/min versus eight subjects (8%) in the WOFC. The mean number of *S. mutans* and lactobacilli was low in both groups and rather similar except in the age interval 41–60 years, in which higher numbers of salivary *S. mutans* were observed in the asymptomatic group (WOFC) than in the OFC group. In subjects with orofacial symptoms *S. mutans* was not detected in 6 individuals, whereas 22 patients had more than 10^6 *S. mutans* per milliliter of saliva.

The subjects in the OFC group showed a lower saliva conductivity than the subjects without orofacial symptoms (Table 3). The difference between the groups was statistically significant ($p < 0.05$).

Table 2. Saliva secretion rate, buffer capacity, pH, and salivary number of *Streptococcus mutans* and lactobacilli in patients with (OFC) and without (WOFC) orofacial discomfort complaints. Mean and range

	OFC (n = 98)	WOFC (n = 100)
Secretion rate, ml/min	1.37 (0.0–4.50)	1.60 (0.12–5.80)
Buffer capacity, final pH	4.72 (2.74–7.93)	5.36 (2.47–7.85)
pH	7.18 (2.76–7.95)	7.28 (6.40–8.00)
No. of CFU × 10^3/ml		
S. mutans	22.7 (ND*–27,200)	31.7 (ND–13,200)
Lactobacilli	8.6 (ND–55,120)	12.9 (ND–27,600)

* ND = not detectable.

Discussion

All the patients referred for examination had orofacial discomfort and/or distant symptoms and complaints and related their sufferings to dental material used in restorative work. The most frequent symptoms intraorally were metal taste (50%), dryness (47%), and burning and smarting sensations, especially of the tongue (40%) (1). Since it was not possible to match each patient with orofacial symptoms for age, sex, and dental status with a true control patient, it was decided to use, for comparison, the data from a group of patients also referred to the Clinic but for evaluation of the caries risk. These subjects were without orofacial symptoms and were thought to have several restorative fillings. The lack of a true control group may be a limiting factor when evaluating the data. Comparisons with the present group of patients without symptoms should therefore be made with great caution.

Results from other studies (3, 9) have shown that patients with symptoms related to 'oral galvanism' often are more than 50 years old and are mostly women. The data reported in this study support these observations. The resemblance between our patients and those of Axell et al. (3) is striking, as the average age in both studies was 55 years, and 78% of our subjects and 87% of the subjects examined by Axell et al. were women. Compared with Swedish epidemiological data (10) the subjects with orofacial symptoms had more remaining teeth and fewer teeth with dental restorations than the average number found in this age group also when considering sex distribution. This observation may indicate that this group of OFC subjects had a more orally and tooth-oriented attitude. In the group without orofacial discomfort complaints, selected for comparison, the number of teeth and teeth with fillings were similar to the reported data for the 40-year-old age group (10, 11).

Table 3. Saliva conductivity (μohm^{-1}) in subjects with (OFC) and without (WOFC) orofacial discomfort complaints

	OFC (n = 13)	WOFC (n = 10)
Mean ± SD	34.6 ± 4.5	40.4 ± 7.6*
Range	30.2–39.1	32.8–48.0

* Significantly different from OFC group: $p < 0.05$.

In Table 4 the salivary data of secretion rate, buffer capacity, and pH of saliva are compared with corresponding values reported by Ericson (12) for a clinical group of nearly 600 persons and by Axell et al. (3) for a group of subjects with symptoms related to 'oral galvanism'. Whereas the salivary data in the subjects without symptoms were similar to those reported by Ericson (12), the group of subjects with orofacial symptoms had lower but normal secretion rate and a lower buffer capacity that was below the reference interval for 'normal' end-pH reported by Ericsson & Hardwick (13). This observation is in agreement with

Table 4. Mean values of secretion rate, buffer capacity, and pH for whole stimulated saliva in different studies

	No. of subjects	Secretion rate, ml/min	Buffer pH	pH
Ericson (12)	581	1.60	5.30	7.20
Axell et al. (3)	66	1.70	5.50	—
Present study:				
Without orofacial complaints	100	1.60	5.36	7.28
With orofacial complaints	98	1.37	4.72	7.18

the results of Lindahl (9), who found that around 80% of a group of subjects with 'oral galvanism' showed reduced buffer capacity in stimulated saliva, but it contrasts with the observation of Axell et al. (3), who reported a mean buffer pH value in stimulated saliva of 5.50. With regard to the fact that most of the subjects in the OFC group were women the secretion rate and buffer capacity for the OFC group are similar to the data of Heintze et al. (14) for women in the age group 45–59 years. Syrjänen et al. (15), who studied the concentration of some saliva electrolytes and organic compounds in patients with subjective oral symptoms resembling galvanic pain, found that total protein, sodium, chloride, and phosphate were significantly higher, whereas calcium and IgA were lower, than in a group of asymptomatic controls. These observations indicate that salivary constituents from the major salivary glands may be of importance for modulating the amount and character of salivary macromolecules adsorbed onto the teeth and metal restorations. Since the minor salivary glands may be a major source of certain salivary and potentially protective components (16, 17), secretions from these glands ought also to be examined in subjects with orofacial symptoms.

It has been suggested that metabolic products from acid-producing bacteria in plaque have an effect on the corrosion of amalgam restorations in the mouth (18). Both *S. mutans* and lactobacilli are favored by an aciduric environment and have the ability to produce acid at low pH. However, the mean number of these microorganisms in saliva was rather low and similar to the level observed in the group of subjects without orofacial symptoms, thus indicating that these cariogenic bacteria are not likely to contribute to the orofacial symptoms.

Determination of saliva conductivity in a subgroup of patients with orofacial symptoms showed lower values than those noted in the control group. This observation strongly indicates that the salivary ionic content was not elevated in the OFC group. Data presented by Nilner & Glantz (19), furthermore, indicate that the concentration of various metallic components in saliva was similar in persons with and without orofacial symptoms and metallic restorations.

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