

Oral mucosal changes and associated factors among male industrial workers with or without access to subsidized dental care

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Oral mucosal changes and associated factors were studied among male industrial workers in southern Finland. Two groups, with or without access to an employer-provided dental benefit scheme, were compared. A multiple-choice questionnaire followed by clinical examinations was completed by 325 (81%) subsidized workers and 174 (69%) controls. In both groups 52% of the subjects had some oral mucosal change, and there were no significant differences between the groups in the location distribution of the changes. Smoking was significantly associated with redness of the oral mucosa ($p < 0.001$), coating ($p < 0.001$), and leukoplakia ($p < 0.01$), whereas denture wearing was associated with ulcers ($p < 0.05$), hyperplasia ($p < 0.001$), and redness ($p < 0.001$). Among denture wearers non-acceptable dentures were significantly associated with hyperplasia ($p < 0.001$). The subsidized group had better dentures, although this did not significantly benefit their oral mucosal status. □ *Denture; oral mucosa; subsidization; tobacco use*

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Studies in industrialized countries have routinely associated a wide range of oral mucosal changes with behavioral and individual factors such as poor oral health care habits, tobacco or alcohol consumption, and the wearing of removable dentures (1–9). Although most oral mucosal lesions are benign and largely symptomless, leukoplakia and oral lichen planus have consistently featured in epidemiologic studies, primarily because of their potential for malignant transformation (10, 11).

In the Nordic countries and England (12), denture stomatitis was the commonest condition to affect the palatal mucosa in about 50% of individuals with complete or removable partial dentures. Denture irritation hyperplasia was present in about 12%, whereas traumatic ulcers caused by dentures with overextended or unbalanced occlusion were seen in about 5%. A Finnish study found 56% of removable dentures to be objectively non-acceptable (13), and other studies have also exposed the poor condition of existing dentures (14–16). Changes in the oral mucosa associated with the wearing of removable dentures tend to represent acute or chronic reactions to microbial denture plaque and are more likely in the presence of a faulty denture (12).

Most epidemiologic studies of the oral mucosa have been limited to one or two selected changes with a similar clinical appearance or presumed etiology. Only a few investigators have attempted to document the full spectrum of lesions in non-institutionalized populations (10). To date, no previous study on subsidization has investigated the association between subsidized dental care and oral mucosal conditions, as they have mainly

focused on the impact of subsidization on caries and periodontal disease (17–21).

The aims of the present study were, first, to investigate the prevalence of different oral mucosal changes and, secondly, to analyze the associations between observed changes, wearing of dentures, condition of dentures, tobacco use, and oral health care behavior among male industrial workers in southern Finland with or without an employer-provided dental benefit scheme.

Materials and methods

All male workers, born before 1956 (age, 38–65 years), at an oil refinery in southern Finland (Neste Ltd., Porvoo, Finland) were invited to participate in the present study. The control group was formed on the same basis from industrial workers at three other companies in the same area (Enso Gutzeit Ltd. Tolkinen Saw Mill, Porvoo, Finland; Ensto Ltd., Porvoo, Finland; and Norpe Ltd., Porvoo, Finland). These companies are located in an area of Finland with a dentist to population ratio of about 1:1100 (22).

The oil-refining company (Neste Ltd.) provides comprehensive occupational health services to its employees, including subsidized dental care since 1965 (23). Neste has had a dental clinic at its occupational health centre in Porvoo since 1978, but the employees are free to attend any dental clinic. The entire costs of all dental treatment are paid directly to dentists from the employees' sickness fund. In the case of a new prosthesis only, the employee repays 25% of the costs to

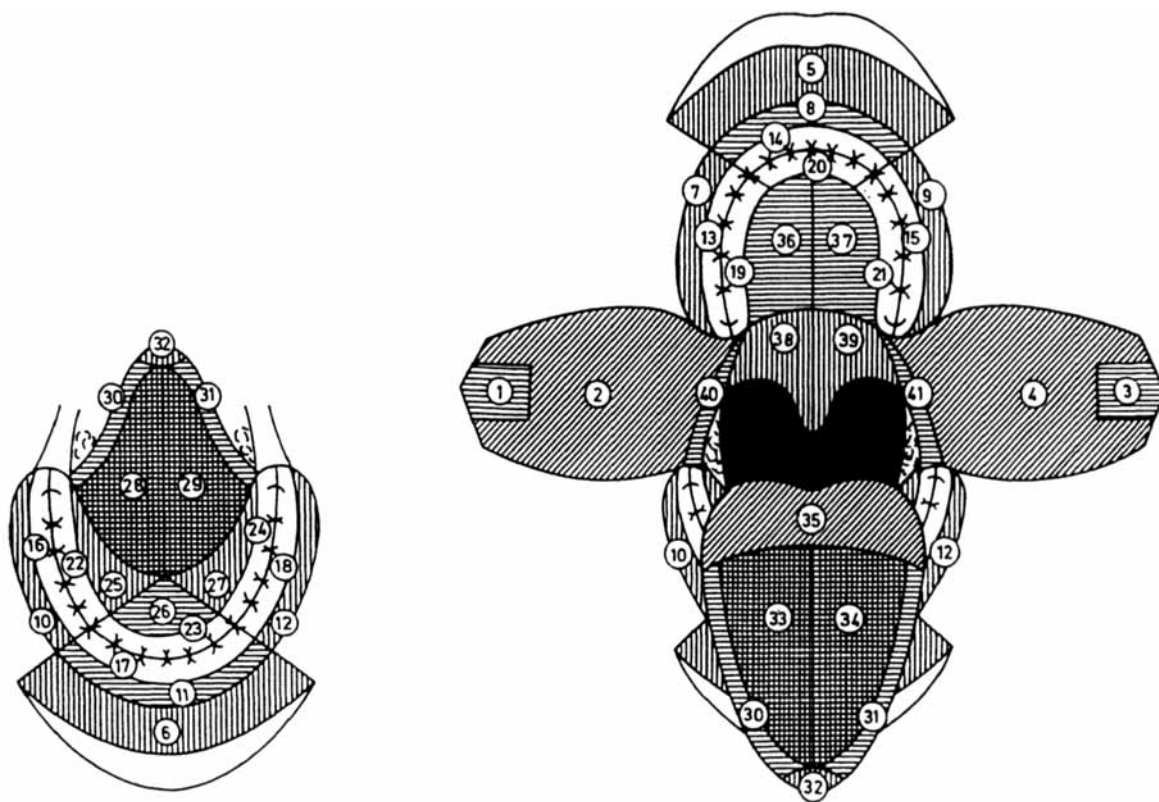


Fig. 1. Regional division of the oral mucosa with location codes suggested by Roed-Petersen & Renstrup (25).

the fund over the following 6-month period. It is compulsory for refinery workers to be contributing members of the sickness fund, which costs employees 1% of their gross wages. Unlike some similar schemes, new workers are not required to undergo dental rehabilitation before membership. Dental visits are allowed during working hours.

The employees of the control group have to finance dental treatment without any reimbursement from their employer or other third party. They also have to make dental visits outside working hours.

The subsidized workers totalled 403, and the controls 254. In February 1994 an offer of a dental check-up free-of-charge was sent to all subjects, together with a multiple-choice questionnaire covering the following aspects for this study: 1) age; 2) education; 3) current employment in years; 4) time since last dental visit; 5) frequency of tooth and denture brushing; and 6) use of tobacco (cigarettes, cigars, pipe, and snuff). Subjects who had stopped using tobacco during the past 6 months were classified as smokers.

Altogether, 325 (81%) responding subjects of the subsidized group and 174 (69%) controls were examined at their workplaces by one of the authors (J. Ahlberg) during a 3-month period from March to June

1994, using a mobile dental unit with conventional lighting and compressed air flow.

Oral mucosal changes were recorded on pretyped forms designed for the study, and WHO ICD-DA labels were applied in clinical classifications (24). A topographic system suggested by Roed-Petersen & Renstrup (25) (Fig. 1) was used for location registration of observed changes. The changes of interest were leukoplakia, oral lichen planus, hyperplasia, ulcers, coatings, and redness of the oral mucosa. White patches or plaque that could not be scraped off or attributed to any physical or chemical causative agent except the use of tobacco were recorded as leukoplakia (26). White lesions were categorized as oral lichen planus only when accompanied by Wickham's striae. Frictive whitish changes, other mucosal injuries, and denture stomatitis were categorized in accordance with their clinical expressions as hyperplasia, ulcers, or redness. Fordyce's condition and lingual varicosities were excluded from analyses.

The retention and stability of complete and partial denture(s) were evaluated by means of a modification of the classification by Norheim & Valderhaug (15): retention was rated as good when a denture was not dislodged by deviating it buccally, labially, and frontally

Table 1. Prevalence of oral mucosal changes distributed on the basis of diagnosis and the most commonly affected locations

Change	Subsidized group, <i>n</i> = 325		Control group, <i>n</i> = 174	
	Subjects, %	Most common location	Subjects, %	Most common location
Leukoplakia	6	Alveolar ridge	8	Buccal mucosa
Lichenoid	2	Buccal mucosa	2	Buccal mucosa
Hyperplasia	9	Alveolar ridge	9	Alveolar ridge
Ulcer	11	Alveolar ridge	9	Alveolar ridge
Coating	15	Tongue dorsum	18	Tongue dorsum
Redness	30	Soft palate	29	Soft palate

All differences between the study groups are statistically non-significant.

with a forefinger or by trying to pull it off with moderate force, and as satisfactory when not dislodged by moderate opening of the mouth. Stability was rated as good when a denture was not dislodged when pushed and rotated with moderate force against the supporting tissues, and as satisfactory when not dislodged when biting a cotton roll with moderate force. Good or satisfactory denture conditions were categorized as acceptable, and other conditions as non-acceptable. When a denture had non-acceptable retention or stability but was assessed to be adjustable, it was determined to need repair. When a denture was not adjustable, it was determined to need replacement.

Student's *t* test was used for statistical analyses for group means and the chi-square test for proportions. Logistic regression models were fitted to investigate the effects of the background variables on the probability of any oral mucosal change among the study groups and among denture wearers separately (27). Odds ratios (OR) were calculated as:

$$OR = e^{\beta},$$

where β is the logistic regression coefficient. The

corresponding 95% confidence intervals (CI) were calculated as:

$$95\% \text{ CI} = e^{\beta \pm 1.96 (\text{SE})}.$$

Results

In both groups 52% of subjects had some oral mucosal change. The mean number of affected locations was 2.7 (SD, 1.8) in the subsidized group and 3.1 (SD, 2.2) in the control group. The modal number of affected locations was two: in 18% of the subsidized group and 17% of the control group. Less than 3% of all subjects had five or more affected locations.

Redness of the oral mucosa was seen in about one-third of all subjects and was the most commonly observed condition. Leukoplakia was registered in 5.5% of the subsidized group and 8.1% of the control group, whereas about 2% of subjects in both groups had lichenoid lesions. The differences between the two groups in the prevalence of the oral mucosal changes were non-significant (Table 1).

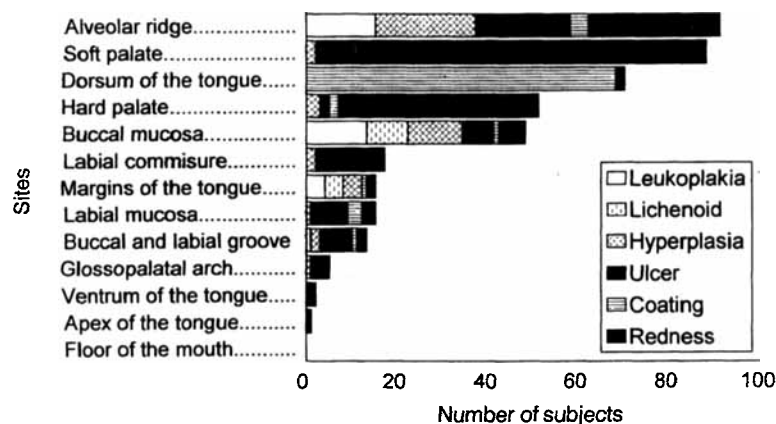


Fig. 2. Prevalence and location of observed oral mucosal changes among all subjects, *n* = 499.

Table 2. Background data of the study populations

	Refinery, <i>n</i> = 325 (%)	Control, <i>n</i> = 174 (%)	<i>p</i> <
Denture wearer	35	29	NS
Non-acceptable denture(s)	11	18	0.05
Smoker	42	30	0.05
Dental visit ≤2 years	91	79	0.001
Dental visit ≤1 year	62	60	NS
Toothbrushing ≥1 per day	82	83	NS
Mean age (SD)	46(6)	47(6)	NS

The alveolar ridges, soft palate, and dorsum of the tongue were the commonest locations affected. Only a few subjects had changes in the glossopalatal arches or ventrum or apex of the tongue, and there were none in the mouth floor. Redness was mainly located in the soft and hard palates and glossopalatal arches, whereas coating was almost solely on the dorsum of the tongue. There was a wide range of changes located in the buccal mucosa and margins of the tongue (Fig. 2).

About one-third of subjects in both groups had a denture(s). An acceptable denture(s) was registered significantly more often ($p < 0.001$) in men of the subsidized group (Table 2), among whom 21% of upper and 30% of lower dentures needed repair, compared with 35% and 37%, respectively, in the control group. However, in the subsidized group only 9% of the upper jaw dentures, compared with 29% in the control group, were assessed to need replacement ($p < 0.001$). Ten per cent of lower dentures in the subsidized group and 37% in the control group needed replacement ($p < 0.01$).

According to the logistic regression models, smoking, denture wearing, and a non-acceptable denture condition were significantly positively associated with the probability of any oral mucosal change. The dental benefit scheme was a non-significant factor when the effects of other independent variables were simultaneously controlled for (Table 3).

More detailed analyses showed smoking to be significantly associated with redness of the oral mucosa ($p < 0.001$), coating ($p < 0.001$), and leukoplakia ($p < 0.01$). Denture wearing was associated with ulcers ($p < 0.05$) and significantly with hyperplasia ($p < 0.001$) and redness ($p < 0.001$). Among denture wearers a non-acceptable denture condition was significantly associated with hyperplasia ($p < 0.001$).

Discussion

Since the Primary Health Act of 1972, Finnish municipalities have been obliged to organize free-of-charge dental care for all children and adolescents under 19 years. Additionally, some costs of dental

Table 3. The regression coefficients of the studied background variables on the probability of any oral mucosal change (figures for denture wearers in parentheses). Logistic regression

	β	SE	OR	95% CI
Wearing of denture	0.786	0.21	2.2	1.5–3.3
Non-acceptable denture	(0.826)	(0.39)	(2.3)	(1.1–4.9)
Smoking	0.927	0.20	2.5	1.7–3.8
	(0.703)	(0.37)	(2.0)	(1.0–4.2)
Dental visit ≤2 years	−0.143	0.30	0.9	0.5–1.6
	(−0.765)	(0.51)	(0.5)	(0.2–1.3)
Tooth brushing ≥1 day	−0.374	0.25	0.7	0.4–1.1
	(−0.327)	(0.51)	(0.7)	(0.3–2.0)
Dental benefit scheme	−0.130	0.20	0.9	0.6–1.3
	(0.472)	(0.65)	(1.6)	(0.5–5.7)
Constant	0.005	0.345		
	(0.602)	(0.65)		

OR = odds ratio; CI = confidence interval.

Total, *n* = 499; total denture wearers, *n* = 163.

treatment are reimbursed to young adults using private dental services through the National Sickness Insurance scheme; this extension of subsidization was introduced in 1986. Finns born before 1956, such as the subjects in our study, have not been eligible for any nationwide subsidized dental care in their adulthood. Although some Finnish municipalities may be able to organize subsidized dental care for all their citizens, most urban-dwelling adults are obliged to use private practice. Some employers operate dental care schemes for their employees or subsidize dental care by contributing to employees' sickness funds. However, employer-provided dental benefit schemes represent a minor part of the Finnish dental health care system.

The subsidized employees work in three shifts, and there were difficulties in rearranging an appointment if a subject was off duty for some unexpected reason during the 2-week examination period. In spite of this, the rate of participation was satisfactory. Some of the controls had to use non-working hours to attend the examination, which explains the higher proportion of dropouts in this group. The two study groups were similar in age, education, and socioeconomic status, but only refinery employees had access to subsidized dental care.

The significantly better condition of the refinery workers' dentures may well be because adjustment of their dentures costs them nothing. However, better dentures did not benefit their oral mucosal status. Wearing a denture was a strong independent determinant of any oral mucosal change. Drawing on the CDA recommendations for assessing clinical quality and professional performance (28), and also in the light of present results, it may be concluded that fixed restorations should be preferred when possible.

In the definition most widely accepted today, leukoplakia refers to a whitish patch of the mucosa or plaque that cannot be characterized clinically or

pathologically as any other disease and is not associated with any physical or chemical causative agent except the use of tobacco (26, 29). Axell (30) showed in a study of 20,333 Swedish adults that the prevalence of leukoplakia can range between 0.7% and 24.8% in the same population just by varying the clinical criteria. Nevertheless, the studied prevalences of leukoplakia have ranged from about 1% to 5% (10, 31). Under field conditions, which usually allow only a brief visual examination of the mouth, differential diagnosis can sometimes become an arbitrary matter. In this study grayish areas with indistinct boundaries blending into normal mucosa, and frictive white changes that might have had a microbial or mechanical etiology were sometimes wrongly categorized as leukoplakia. The prevalence figures here may therefore not be directly comparable with those from more comprehensive investigations including ancillary procedures such as cytology and histopathology.

In this study the proportion of regular tobacco users accorded with the figure for regular smokers among Finnish male industrial workers in general (32). Selling snuff is prohibited by law in Finland, and our study confirms that its use is also very rare. The independent negative effect of the use of tobacco on the oral mucosa is supported by several earlier findings (3, 26, 33) and underscores the value of dentists asking about patients' tobacco use and systematically checking the oral mucosal status of tobacco users as thoroughly as the caries or periodontal status. Dentists should be encouraged to contribute to anti-smoking programs (34).

On the basis of our study, wearing a removable denture independently predicts oral mucosal changes, although their diagnosis and location indicate that they are unlikely to have malignant potential. Tobacco users should be continuously monitored.

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