

Occurrence of oral mucosal lesions, the influence of tobacco habits and an estimate of treatment time in an adult Swedish population

Lars Salonen¹, Tony Axéll² and Lef Helldén¹

Department of Periodontology and Oral Medicine, N. Älvsborg County Hospital, The Vänersborg Clinics, Vänersborg, and ²Department of Oral Surgery and Oral Medicine, Faculty of Dentistry, Lund University, Malmö, Sweden

Salonen L, Axéll T, Helldén L: Occurrence of oral mucosal lesions, the influence of tobacco habits and an estimate of treatment time in an adult Swedish population. *J Oral Pathol Med* 1990; 19: 170–6.

A randomly selected sample of adult subjects living in a Swedish county was examined for the presence of oral mucosal lesions. Nine hundred twenty (920, 95%) of the selected sample of 967 subjects, comprising approximately 0.75% of the total adult population, were examined: lesions were registered in 596 of the 920. The registered prevalence levels were very similar to earlier reported data from Sweden. Further, the relationship between tobacco habits and mucosal lesions was analyzed and the time needed for treatment of the lesions was estimated. A positive correlation could be demonstrated between tobacco use and leukoplakia, frictional white lesion, coated tongue, hairy tongue and excessive melanin pigmentation, while a negative correlation was observed for geographic tongue and aphthous ulcers. Approximately 70% of the lesions were associated with local irritants (e.g. dentures, tobacco, cheek and lip biting etc.). The estimated mean time required for registration and management of oral mucosal lesions in the studied group of adults was 24 min per individual.

Key words: leukoplakia; mouth diseases; oral mucosal lesions; prevalence; treatment; tobacco habits

Lars Salonen, Department of Periodontology and Oral Medicine, N. Älvsborg County Hospital, The Vänersborg Clinics, Vänersborg, S-462 26 Sweden.

Accepted for publication January 10, 1990.

According to recent epidemiologic reports, oral health has improved in Sweden (1, 2) as well as in most other industrialized western countries (3, 4) during the last decade. Most of these reports have dealt primarily with periodontal disease and/or caries. This is also reflected in programs aimed at improving oral health in larger populations. Thus, in the WHO/FDI program for global oral health by the year 2000 (5), the main, and almost exclusive, interest is focused on periodontal disease and caries. To date, no study appears to have registered the total oral health care needs for a given population. It has been urged that an oral health survey should include all aspects of oral disease (6). Diseases of the oral mucous membranes comprise one of those aspects. Epidemiologic data on oral mucosal lesions are relatively sparse. Thus, from Sweden, for example, only one thorough study

has been reported concerning the prevalence of oral mucosal lesions in a general population (7).

The first aim of the present study,

which is part of a major comprehensive cross-sectional survey of the total oral health status in a randomly selected sample of adults, was to assess the prev-

Table 1. Number of subjects randomly selected for the present study and number and percentage of "non-participants". The table also present distribution of edentulous and dentate participants as well as dentate participants with removable dentures.

Age group	Randomly selected subjects (n)		Non-participants		Participants (n)				
	Men	Women	(n)	%	Total	Edentulous	Dentate	Dentate + denture	
20–29	82	76	2	1	81	75	0	156	0
30–39	97	93	6	3	93	91	1	183	4
40–49	77	72	7	5	75	67	3	139	16
50–59	68	66	7	5	61	66	17	110	31
60–69	68	69	12	8	61	64	30	95	32
70–79	50	56	5	5	46	55	58	43	18
≥ 80	35	58	8	9	32	53	60	25	13
Total	477	490	47	5	449	471	169*	751	114
	967				920		920		

* Two subjects did not use any denture.

absence of different oral mucosal lesions. Since tobacco habits have been reported to play an important role in etiology, pathogenesis and clinical appearance of many oral mucosal lesions (8), the second aim of the study was to analyze the relationship between observed lesions and tobacco habits.

Epidemiologic surveys of oral mucosal lesions have so far almost exclusively focused on prevalence levels, while little information is available regarding treatment needs and resources required for management of the lesions. Therefore, a third aim was to estimate the time needed for treatment and follow-up controls.

Material and methods

Selection of participants, stratification and participation rate – The survey was undertaken during the period November 1983–December 1984 in the Northern Medical Care District of Älvsborg county, located in the southwestern Sweden. At the time the participants were selected for the study, the total population in the district comprised about 168,000 inhabitants, of whom 122,886 were 20 yr and over. The district includes rural areas, villages and three cities of medium size (11,000–42,000 inhabitants). Before the sample selection, the adult population had been stratified with respect to location of residence, sex and age (intervals: "20–29"; "30–39"; ..., "> 79 yr of age"). From each age stratum, 0.75% of the inhabitants was randomly selected to participate in the study. Due to the relatively low number of individuals in the oldest stratum (> 79 yr), 1.5% were selected from this group. According to the method described, 967 individuals were selected for participation (Table 1). Clinical examination was carried out on 920 of them, corresponding to a participation rate of 95.1%. For a more detailed description of the geographical area, sampling procedure and "drop outs", see HELLDÉN *et al.* (9).

Clinical examination – The majority of participants (849 or 92%) were examined in modern dental clinics equipped with excellent illumination. For physical or mental reasons, 71 participants (8%) were examined in institutions or in their homes. A portable halogen light with fiber optics was used to obtain sufficient illumination during these examinations.

The oral mucosa, the vermillion border of the lips and the perioral skin was methodically examined. Tissue changes

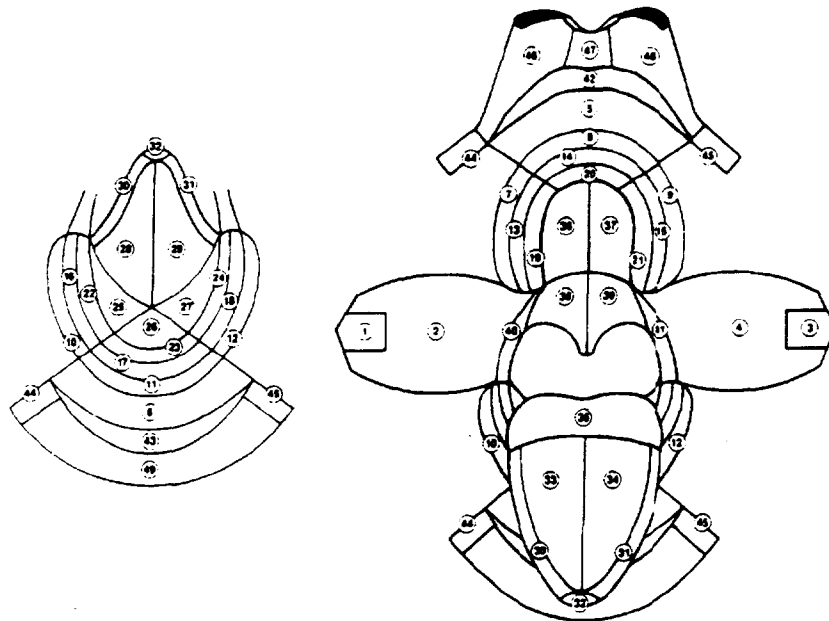


Fig. 1. Topographic codes according to ROED-PEDERSEN & RENSTRUP (13) with eight additional locations (Nos. 42–49) suggested by AXÉLL (7).

were recorded on pretyped forms designed by AXÉLL (7). The diagnostic labels and criteria were in accordance with WHO, ICD-DA (10) and with those modifications and complementary additions suggested by AXÉLL (7, 11) and AXÉLL *et al.* (12). All clinical examinations were performed by one of the authors (LS). Before the start of the study, the examiner had been familiarized with the AXÉLL diagnostic criteria.

A slight modification of the topographical system suggested by ROED-PEDERSEN & RENSTRUP (13) was used for location registration of observed lesions (Fig. 1). In the present paper the location distribution of the observed lesions will only be used for presentation of lesions occurring among users vs. non-users of tobacco.

Tobacco habits – Prior to the clinical examination, each participant answered

Table 2A. Tobacco habits among participants. Due to incomplete information from two subjects results are based on answers from 918 subjects of whom 23 reported "mixed habits".

Habit	Men (n = 448)		Women (n = 470)		Total (n = 918)	
	(n)	%	(n)	%	(n)	%
Cigarette smoking	121	27.0	100	21.3	221	24.1
≤ 15 cig./day	54	12.1	62	13.2	116	12.6
> 15 cig./day	67	15.0	38	8.1	105	11.4
Pipe smoking	39	8.7	–	–	39	4.2
≤ 50 gram/week	10	2.2	–	–	10	1.1
> 50 gram/week	29	6.5	–	–	29	3.2
Snuff dipping	79	17.6	–	–	79	8.6
No tobacco habit	232	51.8	370	78.7	602	65.6

Table 2B. Distribution of subjects with either exclusively one habit or "mixed habits".

Habit	Men (n = 448)		Women (n = 470)		Total (n = 918)	
	(n)	%	(n)	%	(n)	%
Cigarette smoking	103	23.0	100	21.3	203	22.1
Pipe smoking	32	7.1	–	–	32	3.5
Snuff dipping	58	12.9	–	–	58	6.3
Cigarette/Pipe	2	0.4	–	–	2	0.2
Cigarette/Snuff	16	3.6	–	–	16	1.7
Pipe/Snuff	5	1.1	–	–	5	0.5

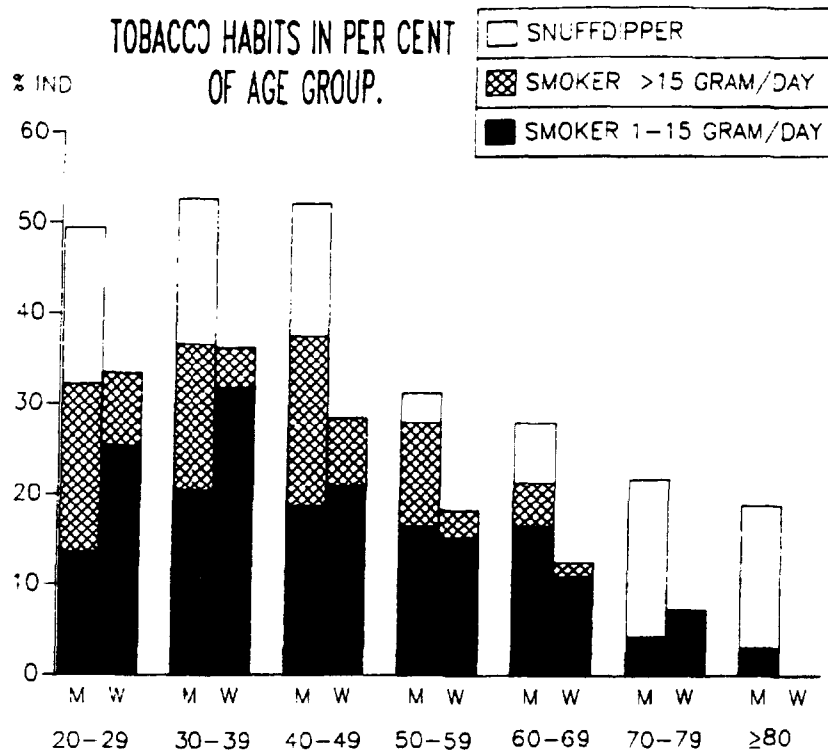


Fig. 2. Percentage distribution of tobacco habits in different age groups and gender (M: men; W: women). One cigarette = 1 g pipe tobacco. Twenty-one men reported both snuff and smoking habits.

a standardized questionnaire on present tobacco smoking and/or snuff habits. Consumption is shown in Tables 2A, B, and Fig. 2. Answers from two subjects were incomplete. Therefore, presentation is based on answers from 918.

Removable dentures – Distribution of removable dentures among the participants is given in Table 1. A more detailed presentation is given by HELLDÉN *et al.* (9).

Photographic documentation – All observed mucosal lesions were photographed in color (Camera: Medical-Nikkor F3; 120 mm; Nikon, Japan. Film: Kodachrome 64, Kodak). Approximately 2000 photos were taken. Photographic documentation of very high quality, sufficient for the diagnostic procedure, was obtained.

Diagnostic procedures – According to the criteria described earlier, each observed mucosal lesion was given a *preliminary diagnosis* at the time of clinical examination. The *final diagnosis* was based on the anamnestic information, the initial preliminary diagnosis and observations from the clinical photos projected on a wall screen. All three authors participated in establishing the final diagnosis. The preliminary diagnoses were adjusted in less than 10% of the cases. The

final diagnostic procedure was repeated after two months. There was a more than 98% diagnostic agreement between the two registrations and the last was used as the final diagnosis. Biopsies for histologic analysis were taken from 14 lesions.

None of the histologic descriptions contradicted the clinical diagnoses.

Principles for estimation of "treatment time" based on a standard modality for a specific diagnosis – In order to calculate the time needed for treatment of the observed oral mucosal and circumoral skin lesions, a menu of "treatment procedures" was made up. Each procedure was given a code number and an estimated "standard treatment time" (Table 3). A "standard treatment procedure package" for each diagnosis was also made up, based on the authors' clinical experience (Table 6).

"Individual" estimate of treatment need and time – In addition to the "standard treatment" assigned to each specific diagnosis (Table 6) and the calculated "standard treatment time" for each treatment procedure presented in Table 3, individual treatment time estimates were also made. Suggested treatment and treatment time for each lesion were then based on individual anamnestic information and the observations from the clinical photos, which showed location, extension and morphology. Even if, in principle, the same treatment was used for the different diagnoses as described in Table 6, it was possible to make individual modifications. This was useful for those lesions which could show a wide range of clinical manifestations and, especially, for cases when one subject showed more than one lesion. It is obvious that the time required for treatment of, for example, three lesions

Table 3. Treatment procedures and estimated "standard" times (min) needed. Examples of procedures are given.

Code	Label	Time	Example(s)
11	Examination	5	Examination of oral soft tissues. Registration of lesion(s).
21	Reduction or elimination of trauma	15	Removal of dental plaque. Simple adjustment of filling(s) or denture(s).
22	Reduction or elimination of trauma	60	Change of filling(s)/crown(s). Reconditioning of denture(s).
23	Reduction or elimination of trauma	180	Extensive change of filling(s), crown(s), bridge(s). New dentures.
31	Topical treatment with drugs	15	One prescription for alleviation e.g. antiviral drug for herpes labialis.
32	Topical treatment with drugs	30	Prescription of more than one drug and due instruction e.g. antimycotic drugs for denture stomatitis and angular cheilitis.
33	Topical treatment with drugs	60	Complicated treatment and instruction e.g. steroid treatment in splints.
41	Surgery	15	Cryosurgery of simple hemangioma.
42	Surgery	45	Excision of nodules, hyperplasias and tumors.
43	Surgery	60	More extensive excision e.g. leukoplakia.
101	Information	15	Information on tobacco habits and association with soft tissue lesions.
102	Biopsy, oral	30	Incisional biopsy, smears, cultivation and referral of specimen.
103	Laboratory tests	15	Referral for blood tests.
104	Photo	15	Color photograph of lesion.
105	Follow up	15	Follow up of treatment modality.

Table 4. Prevalence of oral mucosal lesions in present study and, for comparison, the "AXÉLL study" of 1976 (7). Prevalence figures have been weighted due to higher sampling fraction in oldest age group.

Diagnosis	Present study						AXÉLL study		
	Men		Women		Total		Men %	Women %	Total %
	n	%	n	%	n	%			
<i>Infections</i>									
Zoster	—	—	1	0.2	1	0.1	<0.1	—	<0.1
Herpes labialis	1	0.2	4	0.9	5	0.6	2.9	3.2	3.1
Intraoral herpes	2	0.5	1	0.2	3	0.3	0.3	0.4	0.3
FEH	1	0.2	1	0.2	2	0.2	0.1	0.1	0.1
Candidiasis ¹	2	0.5	2	0.5	4	0.5	0.5	0.6	0.6
Angular cheilitis	8	1.8	13	2.9	21	2.4	3.0	4.6	3.8
<i>Ulcers</i>									
Aphthous ulcer	12	2.7	5	1.1	17	1.9	1.9	2.1	2.0
Traumatic ulcer	36	8.3	38	7.9	74	8.0	4.3	4.3	4.3
Lip fissure	3	0.7	1	0.2	4	0.5	0.9	0.2	0.3
<i>Whitish lesions</i>									
Leukoplakia	12	2.8	5	1.1	17	1.9	6.1	1.2	3.6
Frictional whitish lesion	18	4.1	22	4.9	40	4.6	6.3	4.7	5.5
Smoker's palate	24	5.5	3	0.7	27	3.1	2.1	0.1	1.1
Cheek and lip biting	12	2.7	11	2.5	23	2.6	4.9	5.5	5.1
Snuff dipper's lesion	63	14.5	—	—	63	7.2	15.9	0.2	8.0
Lichen planus	5	1.1	16	3.6	21	2.4	1.6	2.2	1.9
<i>Denture related lesions</i>									
Flabby ridge	14	3.2	23	5.1	37	4.2	5.5	11.5	8.6
Denture hyperplasia	11	2.5	22	4.3	33	3.4	2.3	4.4	3.4
Denture stomatitis	44	9.7	74	15.3	118	12.5	12.3	19.7	16.0
<i>Tongue lesions</i>									
Glossitis, unspecified	1	0.2	2	0.5	3	0.3	0.1	0.6	0.3
Geographic tongue	24	5.5	26	5.8	50	5.6	8.6	8.2	8.5
Median rhomboid glossitis	2	0.5	—	—	2	0.2	1.8	1.0	1.4
Coated tongue	8	1.8	3	0.7	11	1.6	2.4	1.4	1.9
Hairy tongue	2	0.5	2	0.5	4	0.5	0.8	0.3	0.6
Atrophic tongue, unspecified	1	0.2	3	0.7	4	0.5	0.6	1.0	0.8
Plicated tongue	20	4.6	13	2.9	33	3.8	5.9	7.0	6.5
<i>Pigmentations</i>									
Excessive melanin pigmentation ²	36	8.3	22	4.9	58	6.6	10.5	9.4	9.9
Amalgam tattoo	27	6.2	28	6.3	55	6.3	5.4	11.0	8.2
<i>Tumors and tumorlike lesions</i>									
Mucocoele	1	0.2	1	0.2	2	0.2	0.1	0.1	0.1
Fibroepithelial polyp	44	10.2	38	8.6	82	9.3	3.0	3.5	3.3
Pal. papillomatosis	3	0.7	—	—	3	0.3	0.1	—	0.1
Gingival fibromatosis	12	2.7	8	1.8	20	2.3	0.2	0.2	0.2
Hemangioma ³	15	3.5	10	2.3	25	2.8	0.1	0.1	0.1
Papilloma	1	0.2	2	0.5	3	0.3	0.1	0.1	0.1

¹ Superinfection of other lesions such as denture stomatitis, leukoplakia, angular cheilitis, median rhomboid glossitis or lichen planus not included.

² 44 subjects were smokers. Thus, 4.8% had smoker's melanosis: 7.1% (32) men and 2.5% (12) women. 4.0% among non-smokers and 17.6% among smokers showed melanin pigmentation.

³ Several varicose lesions included.

present in the same mouth is less than that required for same number of lesions present in three different subjects. It is also obvious that the treatment approach and time required for a leukoplakia located in the floor of the mouth differs from that for one in the buccal mucosa. The purpose of the "individual" evaluation of the oral mucosal lesions was to get more realistic or valid information about the treatment needs, procedures and times required, and to assess differences between a "standardized" and an "individualized"

method for estimating treatment need, expressed by time.

Statistical analysis — Differences were tested for statistical significance by means of Chi-square tests with Yate's correction or Fisher's exact test. *P*-values lower than 0.05 were considered statistically significant.

Results

The prevalence of oral mucosal lesions observed in the present epidemiologic study is presented in Table 4. For com-

parison, the table also presents corresponding prevalence figures reported by AXÉLL (7) from his survey of 20,333 subjects, randomly selected from a general Swedish population 15 yr and older. The diagnostic criteria were largely the same in both studies.

Prevalence differences between men and women were observed for certain tobacco-associated lesions (smoker's palate, excessive melanin pigmentation, snuff dipper's lesion) and for denture-related lesions. Tobacco-related lesions were more prevalent among men, and denture-related lesions more prevalent among women. The relative occurrence of lesions among subjects with various tobacco habits is presented in Table 5. The numbers represent the total number of affected locations/sites (Fig. 1). However, tongue lesions (plicated, geographic, coated and hairy tongue) and palatal denture stomatitis lesions were registered as present in only one location. The frequency figures (%) are, thus, related to the total number of affected locations in each "habit group". This means that the figures do not correspond to an absolute prevalence, but reflect indirectly a combination of prevalence and extension of the lesions. Smokers compared with non-tobacco users demonstrated significantly higher prevalence levels for leukoplakia, frictional white lesions, coated tongue, hairy tongue and excessive melanin pigmentation. Geographic tongue was significantly less prevalent among smokers. A negative relationship, though not statistically significant, was found between tobacco smoking and aphthous ulcers, as well as plicated tongue.

The accumulated calculated time required for registration and treatment of different mucosal lesions according to the "standardized" system (Table 3) is presented in Table 6, which also gives the percentages of total treatment time required for management of each diagnosis. The majority of lesions could be associated with some form of local irritant or use of tobacco. Thus, the management of traumatic ulcer, frictional white lesion, smoker's palate, cheek and lip biting, snuff dipper's lesion, flabby ridges, denture hyperplasia and denture stomatitis accounted for about 70% of the total treatment time. The calculated total treatment time based on the estimated "standard time" for the various diagnoses was 34,975 min (583 h), corresponding to a mean treatment time per subject of 38 min. When treatment and treatment time were based on an "indi-

Table 5. Number and frequency (%) of affected locations distributed according to diagnosis and tobacco habits. Frequency is expressed as $n/n_1 \times 100$.

Lesion	No tobacco habit ($n_1 = 602$)		Smokers ($n_1 = 235$)		Snuff ($n_1 = 58$)		Mixed ($n_1 = 23$)		Total ($n_1 = 918$)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<i>Infections</i>										
Herpes labialis	5	0.8	3	1.3	0	—	0	—	8	0.9
Angular cheilitis	21	3.5	8	3.4	0	—	0	—	29	3.2
<i>Ulcers</i>										
Aphthous ulcer	15	2.5	2	0.9	1	1.7	1	4.3	19	2.1
Lip fissure	1	0.2	4	1.7	0	—	0	—	5	0.5
<i>Whitish lesions</i>										
Leukoplakia	5	0.8	32	13.6	0	—	0	—	37	4.0
Frictional whitish lesion	27	4.5	24	10.2	2	3.4	1	4.3	54	5.9
Smoker's palate	0	—	31	13.2	0	—	4	17.4	35	3.8
Cheek and lip biting	24	4.0	14	6.0	5	8.6	0	—	43	4.7
Snuff dipper's lesion	0	—	5	2.1	92	158.6	29	126.1	126	13.7
Lichen planus	30	5.0	16	6.8	0	—	0	—	46	5.0
<i>Denture related lesions</i>										
Flabby ridge	28	4.7	14	6.0	7	12.1	0	—	49	5.3
Denture hyperplasia	40	6.6	7	3.0	4	6.9	1	4.3	52	5.7
Denture stomatitis	111	18.4	33	14.0	6	10.3	1	4.3	151	16.4
<i>Tongue lesions</i>										
Geographic tongue	41	6.8	4	1.7	4	6.9	1	4.3	50	5.4
Coated tongue	3	0.5	8	3.4	0	—	0	—	11	1.2
Hairy tongue	0	—	4	1.7	0	—	0	—	4	0.4
Plicated tongue	23	3.8	4	1.7	5	8.6	1	4.3	33	3.6
<i>Pigmentations</i>										
Excessive melanin pigmentation	29	4.8	80	34.0	8	13.8	3	13.0	120	13.1
Amalgam tattoo	43	7.2	15	6.4	2	3.4	1	4.3	61	6.6
<i>Tumors and tumorlike lesion</i>										
Fibroepithelial polyp	56	9.3	14	6.0	10	17.2	1	4.3	81	8.8
Gingival fibromatosis	27	4.5	14	6.0	0	—	0	—	41	4.5

vidual' evaluation of each lesion, the total time for treatment of all observed lesions was 22,335 min (372 h.; Table 7). This corresponds to a mean treatment time per subject of 24 min, i.e. a time reduction compared with the "standard" calculated time of approximately 35%. The accumulated time required for the various management procedures given in Table 7 indicates that about 25% of the treatment/management time was estimated for "reduction or elimination of trauma" (Codes 21, 22, 23). A considerable reduction of time for "topical treatment with drugs" (Codes 31, 32, 33), as well as "follow-up" procedures (Code 105), appeared when the lesions were "individually evaluated". A slight increase of treatment/management time, however, was noted for "biopsies and laboratory tests" (Codes 102, 103).

Discussion

The prevalence of different oral mucosal lesions found in this study (Table 4) is in close agreement with previous find-

ings (7). It should be emphasized that the prevalence of oral mucosal lesions was very similar in two independent cross-sectional epidemiologic surveys using the same diagnostic criteria and undertaken in two different populations in different parts of Sweden. It should also be observed that prevalence standard errors in the AXÉLL study (7) were very small due to the large number of participants and the high participation rate (89.7%). Participation in the present study was as high as 95.1%. For prevalence figures of 1% and 5%, 95% confidence intervals could be calculated of 0.4–1.6% and 3.4–6.4%, respectively. Thus, large prevalence differences could not be explained by unreliable or invalid data. Some differences may be explained by a) the higher prevalence of removable dentures reported from the AXÉLL study (20) as a logical explanation for the larger number of denture-related lesions; b) lower cigarette consumption registered among the participants in the present study may explain the lower prevalence of leukoplakia, since leukoplakia has been shown to be strongly related to tobacco smoking (12,

21); c) the prevalence difference of herpes labialis may be a seasonal effect (22); and d) the high prevalence of "traumatic ulcers", a diagnosis which includes "traumatic ulcerative gingival lesions" (23), may possibly be related to changed toothbrushing in the last 10 yr.

The higher prevalence of tobacco-related lesions among men than women is logical, as tobacco consumption was more frequent among men (Table 2A, Fig. 2). Since no woman used pipe or snuff the differences were of course especially obvious for such lesions as smoker's palate and snuff dipper's lesion. Women demonstrated more "denture related lesions" than men (24.7% vs 15.4%; Table 4) which was logical as removable dentures were significantly more frequent among women in this study (31% vs. 24.7%; 9).

One interesting observation was the significantly higher prevalence of geographic tongue lesions among non-smokers. The validity of this finding is supported by the presence of a higher prevalence of plicated tongue in the same group, as there is probably a genetically associated coexistence of these lesions (24). This association with tobacco smoking has not been observed before and should be confirmed before any further speculation is offered.

Accurate cross-sectional and longitudinal data on the prevalence and development of disease are fundamental for the planning of regional, national or international treatment strategies and for estimating treatment resources needed. In addition to accurate prevalence and incidence data, two other factors have to be known in order to estimate the treatment resources required for a given population: 1) the type of treatment procedure(s) indicated for a specific diagnosis and 2) the time needed for each procedure. Attempts have been made to create "treatment need index" systems for different dental and oral disease categories. Examples of such index systems are the PTNS-index (14) and the CPITN-index (15) suggested for periodontal disease. To our knowledge, no such index has previously been presented for oral mucosal lesions. Thus, the "treatment/management time index" presented in this paper seems to be the first published index of its kind. This index should be interpreted as a model for a rough estimation of treatment time and resources required. The system can easily be adapted to variations in the choice of treatment modalities or to

Table 6. Suggested treatment procedures (See Table 3) and accumulated treatment time for different lesions. The Table also present percentage part of total treatment time calculated for each diagnosis.

Diagnosis	Treatment procedures. Code(s)	Total time for treatment (min)	Per cent of total treatment time
Zoster	11, 101	20	<0.1
Herpes labialis	31, 101	150	0.4
Intraoral herpes	11, 101	60	0.2
FEH	102, 104	90	0.3
Candidiasis	31, 102, 103, 104, 105	360	1.0
Angular cheilitis	32, 103, 104, 105	1575	4.6
Aphthous ulcer	31	255	0.8
Traumatic ulcer	21, 104, 105	3195	9.4
Lip fissure	31, 42, 104, 105	360	1.1
Leukoplakia		885	2.6
Homogeneous			
Tobacco-associated	101, 104, 105		
Idiopathic	101, 102, 104, 105		
Non-homogeneous			
Tobacco-associated	101, 102, 104, 105		
Frictional white lesion	21, 104, 105	1800	5.3
Smoker's palate	11, 101	540	1.6
Cheek and lip biting	11, 101	460	1.4
Snuff dipper's lesion	11, 101, 104	2205	6.5
Lichen planus		3030	8.9
White forms	21, 32, 102, 104, 105		
Red forms	22, 33, 102, 104, 105		
Flabby ridge	22, 42	3885	11.5
Denture hyperplasia	22, 42	3150	9.3
Denture stomatitis	21, 32, 101, 105	8250	24.3
Glossitis, unspecified	11, 103	60	0.2
Geographic tongue	11	250	0.7
Median rhomboid glossitis	11	10	<0.1
Coated tongue	11	55	0.2
Hairy tongue	11, 101	80	0.2
Atrophy of tongue papillae	11	20	<0.1
Plicated tongue	11	165	0.5
Excessive melanin pigmentation	11	290	0.9
Amalgam tattoo	11	275	0.8
Mucocoele	42, 102	150	0.4
Fibroepithelial polyp	11	410	1.2
Palatal papillomatosis	42	135	0.4
Gingival fibromatosis	43, 105	1500	4.4
Hemangioma	11	125	0.4
Papilloma	102, 104	135	0.4
Total		33925	100

varying opinions about time for required procedures. Thus, the suggested model is very flexible. The basis for the time calculations presented in this study (Tables 3, 6) was the authors' opinion, based on their clinical experience of the most common type of treatment procedure(s) for each type of lesion (diagnosis), as well as on their opinion about average treatment time.

As expected, a difference was found between the total "standard" and "individual" treatment times. Over-all treatment time reduction was approximately 35% when the lesions were judged individually (Table 7). The wide variation in severity and extension of different oral mucosal lesions with the same diagnosis, as well as management differences

due to the location of the lesion, for example, may explain the differences between "standard" and "individual" treatment times. For instance, the time required for treatment of an extended homogeneous leukoplakia located to the floor of the mouth, including excision, exceeds the time required for treating a similar leukoplakia located in the buccal mucosa. The results from the "individual" treatment time estimate, based on careful inspection of each lesion from clinical photos, as well as on information obtained from the clinical records, should be considered more valid for the common clinical situation than a "standard" estimate. It is the authors' opinion that the observed relation (3:2) between estimated "standard"

and "individual" treatment time probably is the same, irrespective of different opinions about treatment procedure(s) or treatment time required for the individual lesions. It seems therefore realistic to recommend an average reduction of treatment/management time for oral mucosal lesions by approximately 30-40% if it is based on "standard" time and "standard" treatment procedure(s).

The estimated average time of 24 min for management of mucosal lesions corresponds to a total treatment/management time of approximately 50,000 h for the entire adult population in the region studied. This "total management time" is very high and the level of ambition presented in this study can be questioned. The estimated 24 min for management of oral mucosal lesions found in this study can be compared with the estimated average dental treatment need in various elderly Swedish populations which has been reported to vary from less than 2 h to more than 11 h (16-19). It is the authors' opinion that the oral mucous membranes should be examined systematically and methodically and that all observed changes should be documented as thoroughly and as strictly as caries and periodontal disease. It is also our opinion that many non-symptomatic lesions which often have been left untreated, e.g. denture stomatitis, should be treated.

A remarkable finding was that approximately 70% of the estimated total treatment time was assigned for management of lesions associated with local irritants (Table 6). Thus, the denture related diagnoses "flabby ridges", "denture hyperplasia" and "denture stomatitis" comprised 46.3% of the total management time, tobacco related diagnoses ("smoker's palate", "snuff dipper's lesion") comprised 7.8% and "traumatic ulcers", "frictional white lesions" and "cheek and lip biting" comprised 15.9%. It should be observed that only 25% (Table 7) of the treatment time for those lesions was assigned to direct "trauma elimination" procedures (codes 21, 22, 23).

Based on an expected future reduction of the prevalence of removable dentures and a possible reduction of tobacco consumption, there may exist a potential for a reduction of the need for treatment of oral mucosal lesions. However, the number of lesions associated with dental restoration materials (e.g. lichenoid reactions) may increase since it seems plausible that people in the fu-

Table 7. Comparison between "standard" calculated and individually evaluated number of procedures (Codes: see Table 3) needed for treatment management of lesions observed in present survey. The Table also demonstrates differences in total treatment times and percentage distribution of treatment modalities between the two methods of estimating treatment management time.

Treatment procedure Code	Standard calculation			Individual calculation		
	No. of treatment procedures <i>n</i>	Total time Min	Time %	No. of treatment procedures <i>n</i>	Total time Min	Time %
11	524	2620	7.7	495	2475	11.1
21	231	3465	10.2	44	660	3.0
22	73	4680	13.8	67	4020	18.0
23	—	—	—	7	1260	5.6
31	30	45	0.1	21	315	1.4
32	141	4230	12.5	45	1350	6.0
33	11	660	2.0	2	120	0.5
41	—	—	—	59	885	4.0
42	75	3420	10.1	58	2610	11.7
43	20	1200	3.5	10	600	2.7
101	253	3795	11.2	171	2565	11.5
102	35	1080	3.2	39	1155	5.2
103	23	420	1.2	44	1275	5.7
104	245	3690	10.9	116	1740	7.8
105	303	4620	13.6	87	1305	5.8
Total		34925	100		22335	100

ture will retain their own teeth longer and the total number of dental restorations (1) will most probably increase.

Acknowledgments – The authors want to express their gratitude to HILDING BJÖRN for valuable advice and help with the analysis of data. For skillful clinical assistance and secretarial help we also want to thank Mrs. IRENE GUSTAVSSON and Mrs. BRITT-MARIE MALM. The study was supported by grants from Älvsborg County Council and Swedish Tobacco Co.

References

- HUGOSON A, KOCH G, BERGENDAHL T, *et al.* Oral health of individuals aged 3–80 years in Jönköping, Sweden, in 1973 and 1983. II. A review of clinical and radiographic findings. *Swed Dent J* 1986; 10: 175–94.
- LAURELL L, HOLM G, HEDIN M. Tandhälsan hos vuxna i Gävleborgs län. *Tandläkartidningen* 1983; 75: 759–77.
- FDI/WHO. Changing patterns of oral health and implications for oral health manpower. Part I. Report of a working group convened jointly by the Fédération Dentaire Internationale and the World Health Organization. *Int Dent J* 1985; 35: 235–51.
- Oral health of United States adults: The national survey of oral health in U.S. employed adults and seniors: 1985–86. National Institutes of Health publication. No. 87-2868; 1987.
- WHO/FDI. Goals for oral health in the year 2000. *Br Dent J* 1982; 152: 21–2.
- ANDREASEN JO, PINDBORG JJ, HJÖRTING-HANSEN E, AXÉLL T. Oral health care: more than caries and periodontal disease. A survey of epidemiological studies on oral disease. *Int Dent J* 1986; 36: 207–14.
- AXÉLL T. A prevalence study of oral mucosal lesions in an adult Swedish population. Thesis, Odontol Revy 1976; 27: Suppl 36.
- PINDBORG JJ. *Atlas of diseases of the oral mucosa*. 4.ed. Copenhagen: Munksgaard, 1985.
- HELLDÉN L, SALONEN L, GUSTAFSSON I. Oral health status in an adult Swedish population. Prevalence of teeth, removable dentures and occlusal supporting zones. *Swed Dent J* 1989; 13: 45–60.
- WHO. *Application of the international classification of diseases to dentistry and stomatology. ICD-DA*. 2nd ed. Geneva 1978.
- AXÉLL T. Occurrence of leukoplakia and some other oral white lesions among 20333 adult Swedish people. *Community Dent Oral Epidemiol* 1987; 15: 46–51.
- AXÉLL T, HOLMSTRÖM P, KRAMER IRH, PINDBORG JJ, SHEAR M. International seminar on oral leukoplakia and associated lesions related to tobacco habits. *Community Dent Oral Epidemiol* 1984; 12: 145–54.
- ROED-PETERSEN B, RENSTRUP G. A topographical classification of the oral mucosa suitable for electronic data processing. Its application to 560 leukoplakias. *Acta Odontol Scand* 1969; 27: 681–95.
- JOHANSEN JR, GJERMO P, BELLINI HT. A system to classify the need for periodontal treatment. *Acta Odontol Scand* 1973; 31: 297–305.
- AJANMO J, BARNES D, BEAGRIE G, CUTRESS T, MARTIN J, SARDO-INFIRRI J. Development of the World Health Organization (WHO) Community Periodontal Index of Treatment Needs (CPITN). *Int Dent J* 1982; 32: 281–91.
- HEDEGÅRD B, LIEGREN P, SCHENNINGSS L. *Hälsoundersökning av 66-åringar. Socialstyrelsens och Stockholms läns landstings hälsoundersökning av 66-åringar i Stockholms Kommun* 1971. Project A71. Socialstyrelsen, Stockholm 1973.
- LAVSTEDT S, BOHLIN A, HENRIKSSON C-O, JONSSON B. *Tandtillstånd och behov av tandvård hos en normalpopulation. En longitudinell epidemiologisk studie. Delegationen för social forskning. Rapport* 1982; 7. Stockholm 1982.
- FRÉDEN H, RINGQVIST M. *Vårdbehovsundersökning som planeringsunderlag. Tandläkartidningen* 1982; 74: 968–77.
- PALMQVIST S. Oral health patterns in a Swedish county population aged 65 and above. Thesis. *Swed Dent J Suppl*. 32, 1986.
- AXÉLL T, ÖWALL B. Prevalence of removable dentures and edentulousness in an adult Swedish population. *Swed Dent J* 1979; 3: 129–37.
- PINDBORG JJ, REIBEL J, ROED-PETERSEN B, MEHTA FS. Tobacco-induced changes in oral leukoplakia epithelium. *Cancer* 1980; 45: 2330–6.
- WHEELER CE. Pathogenesis of recurrent herpes simplex affections. *J Invest Dermatol* 1975; 65: 341–6.
- AXÉLL T, KOCH G. Traumatic ulcerative gingival lesion. *J Clin Periodontol* 1982; 9: 178–83.
- HUME WJ. Geographic stomatitis: A critical review. *J Dent* 1975; 3: 25–43.