

# Determinants of oral health in a group of Danish alcoholics

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The purposes of this survey were to describe dental health in a group of alcoholics and to analyze the influence of social background, dental health behavior and alcohol-related variables on dental health among alcoholics. The dental health in a group of consecutively admitted alcoholics ( $n=195$ ) was described with respect to number of teeth present, DMFS, DS and the prevalence of dental erosion, removable dentures, edentulousness, and untreated dental decay. No major differences were found with respect to number of teeth and dental caries (DMFS), when compared to reference figures of the general population. As to untreated decay, however, 3–5  $\times$  more actual decayed surfaces were found among the alcoholics. In the multivariate analyses, neither DMFS, nor untreated decay were found to be associated with alcohol-related indicators. These variables were, however, related to variables of social background and dental health behavior. As to number of teeth present, an association was found with duration of alcoholism, but this relationship was eliminated, when the analysis was controlled with respect to social situation. In contrast, dental erosion was related to duration of alcoholism irrespective of confounding control of dental health behavior and social situation. Hence, the study indicates that oral health in alcoholics can be explained mainly by social situation and dental health behavior and not by variables associated directly with alcohol consumption. An exception was the presence of dental erosion, which was associated with the exposure to alcohol.

**Key words:** alcohol; oral health; caries; dental health behavior; dental erosion

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Dependency on alcohol is a frequent condition among dental patients (1). Studies of dental health in alcoholics (2–5) are scarce, however, as the dental literature reveals only 1 study (6) concerning the influence of alcohol-related indicators on dental health. In contrast to oral epidemiological data available on drug-addicts (7), information on the dental health situation of alcoholics is almost absent in Scandinavia.

In an American survey (3), more frequent tooth loss and higher DMFT scores were found among hospitalized alcoholic patients compared to the national figures for corresponding age groups, and a UK study (8) showed significantly more tooth wear in alcoholics compared to age- and sex-matched controls. The tooth wear seemed to be erosive in nature, and the palatal surfaces of the upper anterior teeth were affected in 40% of the participants. Sim-

ilar findings were demonstrated in a case-report (9) of dental erosion in patients with chronic alcoholism. Finally, a study (6) of dental health in an outpatient clinic sample indicated inter-relationships between measures of dental health (tooth loss, number of untreated carious teeth and severity of periodontal disease) and indicators of alcohol consumption.

Alcoholism may imply social consequences such as unemployment or early retirement, as well as toxic effects on general health such as liver cirrhosis. Hypothetically, an extensive alcohol consumption may affect oral health in several ways: in the first place, a direct effect, for example, in case of caries due to alcohol-related xerostomia (10); secondly, an indirect effect ascribed to changes in dental health behavior (10). This association can be caused by specific changes in behavior owing to the

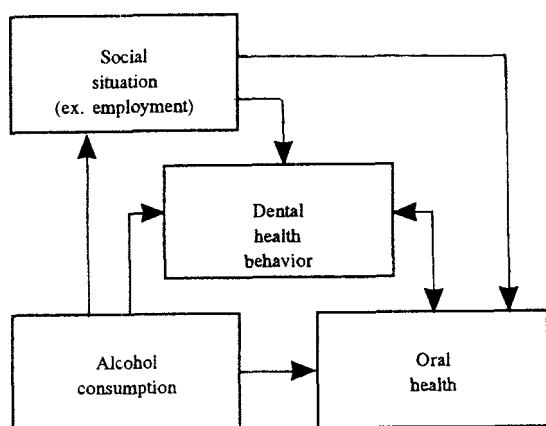


Fig. 1. Hypothetical model of the interactions between oral health, extensive alcohol consumption, dental health behavior and social situation.

frequent state of intoxication, irrespective of changes in social situation, or may be explained by altered dental health behavior due to social situation, which in many cases of alcoholism is the outcome of a social come-down. Finally the social situation itself may have a more direct course of action, for instance by affecting the ability of paying for expensive dental treatment. Fig. 1 illustrates the hypothetical interactions between alcohol consumption, social situation, oral health behavior and oral health among alcoholics.

No studies so far have described whether dental health is influenced directly by the exposure to alcohol, or may be ascribed to an indirect effect due to the social situation of alcoholics. Hence, the purposes of the present study were: (1) to describe the dental health in a group of chronic alcoholics; (2) to analyse the possible associations between variables of dental health and indicators of social situation, dental health behavior and exposure to alcohol.

### Study population and methods

#### Subjects

The study population comprised consecutive patients ( $n=195$ ) at a psychiatric emergency unit, hospitalized for 2 days or more due to abstinences from alcohol. The study population was restricted to the age group 30–65 years, and persons suffering from a major psychiatric illness (psychosis or affective disorder) were excluded from the study. The final study population represented 77.4% of the persons invited to participate in the study. The most frequent reasons for non-participation were discharge from the hospital prior to contact with the examiner, lack of interest or persistent indisposition owing to abstinences.

#### Dental examination

The survey was approved by the Ethical Committee of Copenhagen County, and a written consent was obtained from the participants prior to examination. All examinations were performed by the author, and took place in the hospital dental clinic situated in connection with the psychiatric emergency unit. A probe (Maillefer no. 20), the WHO periodontal probe, and plane mirrors were used in the dental examination, and the number of teeth present (including 3rd molars), dental caries (DMFS) (including roots) were recorded as recommended by WHO (11). Furthermore, the presence of dental erosion was recorded. Dental erosion among alcoholics (8, 9) has mainly been described in the form of perimylolysis, which means erosion due to regurgitation, vomiting or pyrosis (12). The most frequent location of dental erosion and especially perimylolysis has been reported to be the upper anterior teeth (12, 13). Furthermore erosion can be most difficult to detect on occlusal surfaces (13). Hence, erosion was defined as lesions of class I to class III in the upper anterior teeth according to the index presented by ECCLES (14). Whenever fillings, decay, artificial crowns or bridgework made the registration of erosion questionable, the variable was recorded as missing ( $n=42$ ).

#### Interview

In succession to the dental examination, the author interviewed the participants by means of a standardized questionnaire. The structured questionnaire included the following items: age, sex, employment, schooling, education, symptoms and diseases of the gastro-intestinal tract, duration of abuse, daily alcohol consumption during periods of abuse, dental visiting habits and toothbrushing habits. No additional questions about dietary habits (acidic intake etc.) were asked, since the association of main interest was the relationship between dental health and alcohol consumption. The daily alcohol consumption was measured in terms of number of drinks per day (15), and the questions of dental visiting habits and toothbrushing habits were standard questions also used in studies of the general population and psychiatric patients (16–19). None of the questions were answered by all participants owing to lack of memory or non-compliance to part of the interview. Especially lack of memory concerning daily alcohol consumption was found ( $n=40$ ). The study population distributed according to age, gender, social background, alcohol consumption and dental health behavior is presented in Table 1.

Table 1

Participants distributed according to age, gender, schooling, employment, duration of alcohol abuse, drinks per day and variables of dental health behavior

Variable	Category	n	(%)
gender	male	127	65
	female	68	35
age (years)	30–39	59	30
	40–49	87	45
	50–64	49	25
schooling	primary school	140	72
	secondary school	36	19
	high school	18	9
employment	early retirement	58	30
	temporary unemployed	97	50
	employed	39	20
duration of alcohol abuse	0–4 years	47	25
	5–19 years	99	53
	>19 years	40	22
no. drinks per day	0–9	13	8
	10–29	101	65
	>29	41	26
constant regular dental visits	yes	83	43
	no	110	57
neglect of toothbrushing	yes	55	30
	no	129	70

### Statistical analysis

The statistical analyses were carried out by Statistical Analysis System (SAS). The  $\chi^2$ -test was used in the bivariate analyses. Multivariate analyses were applied in order to control confounding and included multiple linear regression analysis of number of teeth present and DMFS. Furthermore, logistic linear regression analyses of the prevalence rates of erosion and untreated decay were performed. The statistical evaluations of the estimated regression coefficients were carried out by the *t*-test in the multiple linear regression analyses, and by the Wald statistics ( $\chi^2$ ) in the logistic regression analyses.

In order to analyze the possible influence of alcohol consumption on dental health (Fig. 1), 3 different models were evaluated by multivariate statistics. At first, a model (model A) including age and sex as the only confounders was analysed. This model re-

vealed whether any relationships between alcohol consumption and the oral health variable were present. In the next place, indicators of social background (schooling and employment status) were entered into the analysis (model B), thereby controlling the direct and indirect effect of these variables (caused partly by interaction with oral health behavior). In the final analysis (model C), the confounding effects of age, gender and social situation as well as oral health behavior were controlled. Hence, the pure direct effect of alcohol consumption was evaluated in the final analysis. Several different analyses including education as independent variable (in model B and C) and schooling in model C, were carried out without any significant changes in the results.

### Results

Number of teeth present, DMFS and DS distributed according to age are shown in Table 2, while the prevalence of actual decay, removable dentures, edentulousness and dental erosion are distributed with respect to age in Table 3.

Bivariate analyses of the presence of dental erosion revealed that 24% of the participants without dental erosions suffered from symptoms or diseases of the gastrointestinal tract, whereas the corresponding figure for participants with dental erosion present was 43% ( $p < 0.05$ ). As to episodes of vomiting, 23% of the participants without erosion re-

Table 2

Mean number of teeth present, DMFS, and DS (standard deviation given in brackets)

Age (years)	No. teeth present (n=195)	DMFS (n=195)	DS (n=188)
30–39	26.2 (5.5)	55.7 (26.3)	5.3 (14.3)
40–49	23.5 (6.6)	79.3 (30.3)	5.2 (9.3)
50–64	16.5 (10.3)	103.0 (33.1)	7.1 (12.9)
total	22.6 (8.3)	78.1 (34.6)	5.7 (11.9)

Table 3

*Prevalence (%) of untreated dental caries, removable dentures, edentulousness, and dental erosion*

Age (years)	Untreated caries (n=188)	Removable dentures (n=195)	Edentulousness (n=195)	Dental erosion (n=153)
30–39	52.5	5.1	0.0	24.1
40–49	58.8	19.5	2.3	22.5
50–64	54.5	44.9	10.2	21.4
Total	55.9	21.5	3.6	22.9

Table 4

*Multiple linear regression analyses of three different models concerning number of teeth present and DMFS among chronic alcoholics*

Dummy variable	Category	No. teeth present (n=141)			DMFS (n=141)		
		$\beta^a)$	$\beta^b)$	$\beta^c)$	$\beta^a)$	$\beta^b)$	$\beta^c)$
sex	female	0.7	–0.09	1.6	–9.5	–6.3	–11.1*
	male						
age (years)	30–39	6.8***	6.4***	6.6***	–41.5***	–42.2***	–42.1***
	40–49	4.4***	4.2***	4.3***	–16.8**	–17.1**	–17.1**
	50–64						
schooling	high school		2.9			–10.3	
	secondary school		0.6			–0.9	
	primary school						
occupational status	early retirement		–5.9***	–4.8**		22.5**	20.0**
	temporary unemployed		–2.1	–1.3		13.6*	11.2
	employed						
duration of alcoholism	0–4 years	4.0*	2.2	2.2	–12.8	–6.7	–6.3
	5–19 years	1.7	1.0	1.4	–5.3	–3.2	–4.9
	>19 years						
number of drinks per day	0–9	–3.8	–2.6	–3.3	20.0	16.1	18.4
	10–29	0.16	–0.16	–0.08	3.8	3.6	4.3
	>29						
regular dental visits	yes=1			3.5***			–7.4
	no=0						
neglect of toothbrushing	yes=1			–2.8**			11.9*
	no=0						
adjusted $R^2$		0.17	0.26	0.35	0.27	0.31	0.32
intercept		17.5	21.1	19.0	103.1	87.4	75.4
F		5.2***	5.4***	8.0***	8.4***	6.7***	7.7***

\*  $p<0.05$ , \*\* $p<0.01$ , \*\*\* $p<0.001$ .<sup>a)</sup> Model A.<sup>b)</sup> Model B.<sup>c)</sup> Model C.

ported such symptoms versus 59% in the group with dental erosion ( $p<0.0001$ ).

The results of the multivariate analyses are presented in Tables 4, 5. As to number of teeth present, the 5% confidence interval for the regression coefficient in model A was 0.7–7.3 when alcoholics with a short history of alcoholism were compared with participants with a long experience of alcoholism. With respect to number of teeth present and DMFS, the confidence interval for the regression coefficients were 2.9–6.7 and 8.9–31.1, respectively, when employed and early retired participants were compared (Model C). The regression coefficients concerning dental erosion (in models B and C) for

duration of alcoholic abuse in a period of 0–4 years correspond to an odds ratio of 0.42 (5% confidence interval 0.18–0.95) when compared with participants with a duration of alcohol abuse for more than 15 years. Finally, the odds ratio for untreated decay was 0.62 when participants with regular dental visits were compared to irregular dental visitors (5% confidence interval 0.89–0.43).

## Discussion

It is not possible to identify a representative sample of alcoholics, due to the social stigma associated with alcoholism and owing to the indistinct delimita-

Table 5

Multiple logistic regression of three different models concerning perimylolysis and untreated dental decay present. The regression coefficients (b) represent the log Odds Ratio

Dummy variable	Category	Erosion present (n=117)			Untreated decay present (n=141)		
		b <sup>a)</sup>	b <sup>b)</sup>	b <sup>c)</sup>	b <sup>a)</sup>	b <sup>b)</sup>	b <sup>c)</sup>
sex	female	-0.35	-0.41	-0.32	0.20	0.23	0.04
	male						
age (years)	30-39 years	0.38	0.44	0.56	-0.29	-0.26	-0.30
	40-49 years	0.36	0.43	0.48	-0.05	-0.03	-0.06
	50-64 years						
education	high school		-0.69			-0.28	
	secondary school		-0.30			0.02	
	primary school						
occupational status	early retirement		-0.12	-0.01		0.15	-0.03
	temporary unemployed		-0.54	-0.51		-0.03	-0.14
	employed						
duration of alcoholism	0-4 years	-0.93*	-0.87*	-0.87*	0.12	0.17	0.17
	5-19 years	-0.44	-0.39	-0.50	-0.03	-0.007	-0.04
	>19 years						
no. drinks per day	0-9	-0.07	-0.20	-0.04	0.10	0.04	0.13
	10-29	0.17	0.18	0.14	-0.04	-0.05	-0.009
	>29						
regular dental visits	yes=1			0.36			-0.48*
	no=0						
neglect of toothbrushing	yes=1			0.41			0.28
	no=0						

\*  $p < 0.05$ .

<sup>a)</sup> Model A.

<sup>b)</sup> Model B.

<sup>c)</sup> Model C.

tion of the group of alcoholics. Hence, selection bias may be introduced in such studies by the choice of study group. Compared to the present study group, however, a sample of persons from weaning-homes or weaning clinics was estimated to be more heavily influenced by selection bias by the demand of cure and by the type of weaning clinic chosen. Although consecutively sampled, this study included persons with acute alcohol-related problems, irrespective of demand of cure or choice of weaning clinic. However, the sample was selected and not random, why the results may not be generalizeable for all alcoholics, but rather reflect the oral health among persons with a severe alcohol problem.

The dental health data were collected by well-defined validated measures (11). As to the interview data, however, memory bias has to be considered. Previous studies have shown that underreporting or non-reporting of drinking habits may be more prevalent among persons with an extensive consumption of alcohol (20). This corresponds with the frequent non-response to the question on the level of daily alcohol consumption in the present study. However, interview was considered far the most relevant method to obtain the rather sensitive and personal data concerning drinking habits.

A comparison of the present data of dental health with similar data on the general population of the study area (19) revealed no major differences with respect to the mean number of teeth present, DMFS, or prevalence of edentulousness and removable dentures. As to the mean number of surfaces with untreated dental decay and the presence of untreated decay, however, the figures in the group of alcoholic were 3-5  $\times$  greater than for the comparison group as far as number of untreated surfaces was concerned, and more than 2  $\times$  the figure of prevalence of untreated decay. No data of the prevalence of dental erosion among randomly selected Danes is available, but compared to a UK study of pathological toothwear in a group of alcoholics (8), the lesions were only half as frequent in the present study. The UK study, however, included erosion as well as abrasion and attrition in the definition of pathological toothwear using a different toothwear index (21). Furthermore, toothwear on all teeth present was recorded. This might explain the difference between the two studies.

In the multivariate analyses, only number of teeth present and dental erosion showed any association to variables of alcohol consumption. The relationship between number of teeth present and duration

of alcohol abuse (in model A), was, however, eliminated, when a variable of social situation was introduced in model B. The association between social status and oral health has been documented in several studies (22), and has mainly been explained by differences in dental health behavior. In the present study, however, number of teeth present as well as DMFS were associated with social situation (model B and C), even when controlled with respect to dental health behavior (model C). This indicates that other factors related to social situation (e.g., economic barriers) affect oral health among alcoholics. Such an explanation relates to a theory of material deprivation (23). However, the findings can alternatively be explained as the result of a selection process. Early retirement could be an indicator of individuals with a low level of self-care and inferior coping-ability in general, or be an indicator of the individuals with the most serious mental and physical impairment due to alcohol. Hence, the differences may reflect the selection of alcoholics with high and low level of coping ability, or the alcoholics with the most healthy and the poorest mental and physical condition. However, no matter the explanation, employment status seems to be a significant predictor of dental health among alcoholics.

A direct effect of alcohol-induced xerostomia on DMFS has been suggested by some authors (10, 24), but has never been verified. If such an association was present, a statistically significant association between measures of alcohol consumption and DMFS was to be expected in all 3 regression models. A similar kind of dose-response association has been shown between DMFS and duration of psychiatric disease/treatment in a study of psychiatric patients (16). In contrast, dental erosion was found to be dependent of alcohol consumption in all three models, which may be ascribed to a greater number of episodes of vomiting in persons with a long history of alcoholism.

To conclude, the study indicated that dental health among alcoholics mainly may be explained by the social situation and by dental health behavior. However, with respect to dental erosion, associations were found with duration of alcoholic abuse, and with symptoms and diseases of the gastro-intestinal tract.

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