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Cynical hostility as a determinant of toothbrushing frequency and oral hygiene

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Abstract

Aim: Our aim was to investigate whether cynical hostility, self-reported toothbrushing frequency and objectively assessed levels of oral hygiene were associated.

Material and Methods: The present study sample consisted of 4156 30–64-year-old dentate Finns. The questionnaire and the home interview included information about socioeconomic and sociodemographic factors and behavioural variables, such as toothbrushing frequency, dental attendance, smoking and cynical hostility. The level of oral hygiene was assessed during a clinical oral examination. The χ^2 test and ordinal logistic regression analyses were used.

Results: After controlling for sociodemographic and socioeconomic factors, smoking habits and reported dental attendance, the subjects belonging to the lowest cynical hostility level were found to brush their teeth significantly more often and to have better oral hygiene compared with those belonging the highest cynical hostility level. Toothbrushing frequency was adjusted when oral hygiene was used as the outcome variable. The association of cynical hostility with toothbrushing frequency and the oral hygiene seems to be partly dependent on the level of education.

Conclusions: Cynical hostility is a psychosocial risk marker for the frequency and quality of toothbrushing and it could be a connecting trait between general health behaviour and oral health behaviour.

Key words: level of cynical hostility; toothbrushing frequency and oral hygiene

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The maintenance of good oral hygiene is considered a salient issue in dental health promotion. This has been well documented in both periodontal disease and caries research, as reviewed (Chu & Craig 1996, Löe 2000). According to previous studies, a high toothbrushing frequency is associated with various psychological traits, including good self-efficacy (Syrjälä et al. 2001), locus of control (Kneckt et al. 1999), optimism (Ylöstalo et al. 2003) and sense of coherence (Savolainen et al. 2005).

Cynical hostility is a psychosocial factor that has been proposed as a mediating factor between poor health and socioeconomic status (Williams et al. 1985, Williams 1998, Wilkinson 1999, Haukkala 2002). Another tradition comes from cardiovascular research, where psychosocial factors, such as type A behaviour, hostility, lack of social support or depression, have been used as risk factors for cardiovascular diseases (Keltikangas-Järvinen & Räikkönen 1989, Adler et al. 1994, Julkunen 1996, Kivimäki et al. 1996, Rajava 1996). There are no previous studies directly assessing the relationship between cynical hostility and oral health behaviour.

Cynical hostility is a psychosocial factor that is manifested as a consistent lack of confidence in or bitterness with other people. Cynical hostility can be expressed as either a lack of confidence in other people or as a strong motivation and eagerness for change, but a lack of confidence. Also, people with cynical hostility have insufficient capability for anger expression (Haukkala 2002).

Cynical hostility and cynical distrust have been regarded as independent personality traits (Zuckerman & Cloninger 1996) but also as representative of more general personality traits (Eysenck & Eysenck 1995, Costa & McCrae 1997, Bouchard & Loehlin 2001).

Cynical hostility is a feature that interacts with education and social support (Haukkala 2002). Both education and social support are important factors in oral health behaviour (Österberg et al. 1998, Källestål et al. 2000, McGrath &

Bedi 2002, Östberg 2002). Therefore, it can be assumed that cynical hostility also interacts with oral health behaviour.

In line with another viewpoint on cynical hostility and oral health behaviour, previous studies have shown hostility to be associated with a poor general lifestyle (Leiker & Hailey 1988, Haukkala 2002). It has been shown that oral health behaviour is part of general health behaviour (Sakki 1999, Ylöstalo et al. 2003).

The maintenance of good oral hygiene can also be considered a structured, predictable and explicable task posing specific demands to the person. The person must use his or her available psychological resources, including cynical hostility, on meet these demands. The most common manner to achieve the objective of good oral hygiene is tooth brushing, including two distinct dimensions: the frequency and the quality of brushing.

We hypothesize that cynical hostility could predict both the frequency and the quality of toothbrushing. In this study, we analysed the relationship between cynical hostility, self-reported toothbrushing frequency and objectively assessed level of oral hygiene by taking into account the effect of different mediating factors.

Material and Methods

A nationally representative Health 2000 survey, including 8028 persons aged 30 or older, was carried out by the National Public Health Institute in Finland in 2000–2001. A large network of researchers, coordinated by the abovementioned institute, were responsible for the planning and execution of the study. The study consisted of an interview, a thorough health examination including a clinical oral examination and several questionnaires.

This study covered the dentate subjects aged up to 64 years out of the total sample. Subjects were considered dentate if they reported having at least one natural tooth. The data for this study were obtained from subjects who had participated in an interview, had been clinically examined and had returned a self-administered postal questionnaire ($n = 4539$). Those living permanently in institutional care ($n = 4$), those whose level of oral hygiene was not assessed ($n = 41$) and those who had missing data on the level of education, toothbrushing frequency, marital status, smoking habits, number of teeth or cynical hostility were excluded. The final series comprised 4156 30–64-year-old individuals (1975 females and 2181 males).

Toothbrushing frequency was measured with the question: ''How often do you brush your teeth''? The response alternatives were (1) more than twice a day, (2) twice a day, (3) once a day, (4) less than once a day and (5) never. For the analyses, categories (1) and (2) and categories (4) and (5) were combined, respectively, to yield a three-class variable.

During the clinical oral examinations, the level of oral hygiene was visually evaluated from three teeth at different sites as follows: the buccal surface of the most posterior teeth on the right upper jaw quarter (dd. 17–14), the lingual surface of the most posterior teeth on the left lower jaw quarter (dd. 37–34) and the buccal surface of d. 33. Each site was given a score from zero to two, with zero indicating that the site was plaque free, one indicating dental plaque at the gingival margin of the site and two indicating dental plaque also elsewhere at the site (Silness & Löe 1964). The scores were categorized into three groups using the following criteria: in group one, the scores ranged from zero to one, indicating that there was no dental plaque, or that there was dental plaque at the gingival margin in only one of the assessed teeth. In group two, the scores ranged from two to three, indicating that there was dental plaque at the gingival margin in at least two of the assessed teeth, or that there was dental plaque also elsewhere at the site in one of the assessed teeth. In group three, the scores ranged from four to six, indicating that there was dental plaque also elsewhere except at the gingival margin of the site in at least two of the assessed teeth. In each category, the sum score was calculated and then it was divided by the number of evaluated teeth. The consequent cut-off points of the categories were 0.34, 1 and >1.

The cognitive component of hostility was measured with the cynical distrust scale by using questionnaires. The cynical distrust scale is assumed to measure distrust and selfishness (Greenglass & Julkunen 1989). Greenglass and Julkunen (1989) derived the scale from a factor analysis of the Cook & Medley (1954) hostility scale. As the psychometric properties of the Cook–Medley hostility scale were inadequate, Greenglass & Julkunen (1989) developed a shorter version of the cynical distrust scale. They applied exploratory factor analysis to the 50 original items and found that the three-factor model (which included the cognitive, affective and behavioural components of hostility) fitted the data well. The nine items of the first factor measure the cognitive component of hostility and include statements such as ''It is safer to trust nobody'' and ''No one cares much about what happens to you''. Later, one of the nine items was dropped (Julkunen et al. 1994) out of the scale called the cynical distrust scale, which was also used in this study. In this study, all of the eight items were evaluated by the subjects using a set of four alternatives ranging from one (agree exactly/fully agree) to four (do not agree). In this study, the cynical hostility sum was then categorized into quintiles of equal (almost/approximately) size as follows: 8–18, 19–21, 22–23, 24–25 and 26–32. The lowest scores thus indicate the highest level of cynical hostility, and the highest scores indicate the lowest level. The quintiles were named I–V, respectively.

The background variables used in this study were gender, age, level of education, marital status, reported dental attendance, smoking habits and removable dentures. Age was divided into four categories: 30–39 years old, 40–49 years old, 50–59 years old and 60–64 years old. Education was classified into three categories. The lowest category consisted of subjects having less than high school education and no formal vocational education. The middle category consisted of those who had graduated from a high school or vocational school, and the highest category comprised subjects who had graduated from a polytechnic or had a university degree. Marital status was classified into two categories. The first category consisted of subjects who were married or cohabiting, and the second category consisted of divorced, widowed or single subjects who were not cohabiting. Smoking habits were categorized into three groups: current, ex- and never-smokers. Reported dental attendance pattern was measured with the question: ''Do you make a habit of seeing a dentist''? The response alternative were (1) regularly for check-ups, (2) only when you have a toothache or some other complaint and (3) never. For the analyses, categories (1) and (2) were combined to yield a dichotomous variable.

The possession of removable dentures was found in the clinical study and was used as an independent variable to observe its significance to the relationship between cynical hostility and outcome variables.

Statistical methods

A stratified, two-stage cluster sampling design was used in this study. Thus, the corresponding weights were used to correct the effect of non-response. Weighting of the sample was based on post-stratification with gender, age and region.

The first stage in our analysis was to describe the bivariate relations between the outcome variables (toothbrushing frequency and level of oral hygiene) and the explanatory variables (cynical hostility, sociodemographic and socioeconomic factors, smoking habits and reported dental attendance) by using χ^2 tests. The inter-relations of independent variables were tested by using χ^2 tests.

At the second stage, separate ordinal logistic regression models were created for the two outcome variables categorized into three classes. In the basic model, the association between cynical hostility and outcome variables was adjusted for gender and age (continuous variable). Thereafter, several models were constructed, which included other independent variables separately or in combination, as shown in Tables 2 and 3. Finally, separate ordinary logistic regression models including all variables were formulated. Data analysis was performed with the SAS (version 8.0) software using the SUDAAN (2001) program.

Results

The distribution of toothbrushing frequency and the level of oral hygiene by gender, age, level of education, marital status, reported dental attendance, smoking habits and cynical hostility are shown in Table 1. The level of cynical hostility was not dependent on age or gender.

The relationship between toothbrushing frequency and cynical hostility is represented in Table 2. The influence of education, smoking and reported dental attendance on the association between toothbrushing frequency and cynical hostility is shown in models 1–4. Model 1 shows that the subjects with the lowest

Table 1. Toothbrushing frequency and level of oral hygiene in relation to gender, age, level of education, marital status, smoking habits, cynical hostility and removable denture

	n	Frequency of tooth brushing (%)				Level of oral hygiene (%)			
		twice or more a day	once a day	less frequently	*p*-value	good	moderate	poor	*p*-value
All	4156	63	31	7		60	31	9	
Gender									
Female	1975	79	20	1	<0.001	69	27	4	<0.001
Male	2181	47	40	12		51	36	13	
Age (years)									
30–39	1321	64	30	6	0.115	62	31	7	<0.001
40–49	1351	65	29	6		63	29	7	
50–59	1104	60	32	7		56	34	10	
60–64	380	60	33	7		53	32	15	
Level of education									
High	1086	77	21	2	<0.001	66	29	5	<0.001
Middle	1562	59	34	7		61	30	9	
Low	1508	51	38	12		50	36	13	
Marital status									
Married or cohabiting	3135	63	31	6	0.004	62	30	8	<0.001
Single, divorced or widowed	1021	63	28	9		55	35	11	
Smoking habits									
Current smoker	1296	58	32	10	<0.001	51	36	14	<0.001
Ex-smoker	1081	61	33	6		65	28	6	
Never-smoker	1779	68	28	4		63	30	7	
Reported dental attendance									
Regularly	2546	70	27	4	<0.001	66	28	6	<0.001
Irregularly	1610	53	36	11		50	37	13	
Cynical hostility									
V (lowest level)	924	77	21	2	<0.001	68	28	5	<0.001
IV	713	64	30	6		65	28	7	
III	766	66	28	6		60	33	7	
II	920	58	34	8		58	32	10	
I (highest level)	833	51	38	11		48	35	16	
Removable denture									
Yes	354	66	30	4	0.007	50	36	14	<0.001
No	3802	63	30	7		61	32	7	
Frequency of toothbrushing									
Twice or more a day	2509					65	29	6	<0.001
Once a day	1288					54	35	11	
Less frequently	359					34	37	29	
Level of oral hygiene									
Good	2653	69	28	4	<0.001				
Moderate	1245	58	34	8					
Poor	258	41	38	21					

Table 2. Association of cynical hostility and the other independent factors with tooth brushing frequency

	COR (95% CI)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender						
Female	4.2 (3.7–4.8)	4.2 (3.6–4.8)	4.0 (3.5–4.6)	4.2 (3.6–4.8)	4.2 (3.7–4.8)	4.1 (3.5–4.7)
Male	1.0	1.0	1.0	1.0	1.0	1.0
	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$
Age group (years)						
30–39	1.0	1.0	1.0	1.0	1.2 (1.0–1.5)	1.0 (0.8–1.3)
40–49	1.1 (0.9–1.3)	1.3 (1.1–1.5)	1.1 (0.9–1.3)	1.1 (0.9–1.3)	1.3 (1.0–1.7)	1.2 (0.9–1.5)
50–59	0.9 (0.8–1.1)	1.1 (0.9–1.3)	0.9 (0.7–1.1)	0.9 (0.7–1.0)	1.1 (0.8–1.3)	1.0 (0.8–1.2)
60–64	0.9 (0.7–1.1)	1.2 (1.0–1.6)	0.9 (0.7–1.1)	0.8 (0.7–1.1)	1.0	1.0
	$p=0.121$	$p=0.041$	$p=0.081$	$p=0.053$	$p=0.035$	$p=0.123$
Level of education						
High		3.2 (2.6–4.0)				3.1 (2.5–3.9)
Middle		1.6 (1.4–1.9)				1.6 (1.4–1.9)
Low		1.0				1.0
		$p<0.001$				$p<0.001$
Marital status						
Single, divorced or widowed						1.0 (0.8–1.1)
Married or cohabiting						1.0
						$p=0.551$
Reported dental attendance						
Regularly			1.8 (1.6–2.1)			1.7 (1.5–2.0)
Irregularly			1.0			1.0
			$p<0.001$			$p<0.001$
Smoking habits						
Never-smoker				1.2 (1.0–1.5)		1.0 (0.8–1.2)
Ex-smoker				1.3 (1.1–1.5)		1.2 (1.0–1.4)
Current smoker				1.0		1.0
				$p=0.014$		$p=0.106$
Cynical hostility						
V (lowest level)	2.6 (2.1–3.2)	2.0 (1.6–2.4)	2.3 (1.9–2.9)	2.5 (2.0–3.1)	2.6 (2.1–3.2)	1.8 (1.5–2.3)
IV	1.6 (1.2–1.9)	1.2 (0.9–1.5)	1.4 (1.2–1.8)	1.5 (1.2–1.8)	1.5 (1.2–1.9)	1.1 (0.9–1.4)
III	1.8 (1.4–2.2)	1.5 (1.2–1.8)	1.7 (1.3–2.1)	1.7 (1.4–2.1)	1.8 (1.4–2.2)	1.4 (1.2–1.8)
II	1.3 (1.1–1.5)	1.1 (0.9–1.3)	1.2 (1.0–1.4)	1.2 (1.0–1.5)	1.2 (1.1–1.5)	1.0 (0.9–1.2)
I (highest level)	1.0	1.0	1.0	1.0	1.0	1.0
	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$
Removable denture						
Yes					1.4 (1.1–1.8)	1.7 (1.4–2.2)
No					1.0	1.0
					$p=0.005$	$p<0.001$
Intercept 1						0.3 (0.2–0.4)
Intercept 2						3.2 (2.3–4.4)

Cumulative odds ratios (CORs) and 95% confidence intervals (95% CIs) based on cumulative logistic regression models, where toothbrushing frequency was grouped on an ordinal scale (twice or more a day, once a day, less frequently.

Model 1, adjusted for age and gender; model 2, adjusted for age, gender and level of education; model 3, adjusted for age, gender and reported dental attendance; model 4, adjusted for age, gender and smoking; model 5, adjusted for all independent variables.

cynical hostility level have a higher toothbrushing frequency than those with the highest level of cynical hostility. When gender, age and education were controlled, the association between toothbrushing frequency and cynical hostility tended to level off. The level of education and cynical hostility were closely associated ($p<0.001$).

When both education and reported dental attendance were controlled, dental attendance had only a slight independent effect on the association between cynical hostility and the toothbrushing frequency (data not shown). Subjects with a high level of education showed significantly more regular dental attendance compared with subjects with a low level of education ($p<0.001$). Adjustment for smoking (model 4) did not change the association between toothbrushing frequency and cynical hostility compared with the first model.

When all variables were included in the model (model 5), the association between cynical hostility and toothbrushing frequency was significant at the lowest cynical hostility level.

In Table 3, model 1 represents the relationship between the level of oral hygiene and cynical hostility after adjustment for gender and age. The subjects with the lowest level of cynical hostility had a better level of oral hygiene compared with those belonging to the other quintiles.

When the gender- and age-adjusted association between cynical hostility and the level of oral hygiene was also controlled for education or the frequency of toothbrushing, the association weakened slightly (models 2 and 4). Adjustment for reported dental attendance or smoking did not change the association between the level of oral hygiene and cynical hostility (data not shown). However, never- and ex-smokers had significantly better oral hygiene

Table 3. Association of cynical hostility and the other independent factors with the level of oral hygiene

	COR (95% CI)						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Gender							
Female	2.2 (1.9–2.5)	2.2 (1.9–2.5)	2.1 (1.8–2.4)	1.9 (1.6–2.1)	2.2 (1.9–2.5)	2.2 (2.0–2.5)	1.9 (1.7–2.2)
Male	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$
Age group (years)							
30–39	1.5 (1.2–1.8)	1.3 (1.0–1.6)	1.5 (1.2–1.9)	1.5 (1.2–1.8)	1.7 (1.4–2.1)	1.1 (0.9–1.4)	1.2 (0.9–1.5)
40–49	1.6 (1.3–2.0)	1.5 (1.2–1.8)	1.6 (1.3–2.0)	1.6 (1.3–2.0)	1.8 (1.4–2.2)	1.3 (1.0–1.6)	1.3 (1.0–1.6)
50–59	1.2 (1.0–1.5)	1.2 (1.0–1.5)	1.2 (1.0–1.6)	1.2 (1.0–1.6)	1.3 (1.0–1.6)	1.0 (0.8–1.3)	1.0 (0.8–1.3)
60–64	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p=0.147$	$p=0.179$
Level of education							
High		1.6 (1.4–1.9)					1.2 (1.0–1.5)
Middle		1.4 (1.2–1.7)					1.3 (1.1–1.4)
Low		1.0					1.0
		$p<0.001$					$p=0.008$
Marital status							
Single, divorced or widowed							1.2 (1.0–1.4)
Married or cohabiting							1.0
							$p=0.036$
Reported dental attendance							
Regularly			1.7 (1.5–1.9)				1.5 (1.3–1.7)
Irregularly			1.0				1.0
			$p<0.001$				$p<0.001$
Frequency of tooth brushing							
Twice or more a day				2.9 (2.2–3.8)			2.4 (1.8–3.2)
Once a day				2.3 (1.8–2.9)			1.9 (1.5–2.5)
Less frequently				1.0			1.0
				$p<0.001$			$p<0.001$
Smoking habits							
Never-smoker					1.6 (1.4–1.8)		1.4 (1.2–1.6)
Ex-smoker					2.0 (1.8–2.4)		1.8 (1.6–2.2)
Current smoker					1.0		1.0
					$p<0.001$		$p<0.001$
Cynical hostility							
V (lowest level)	2.0 (1.6–2.5)	1.8 (1.5–2.3)	1.9 (1.5–2.3)	1.9 (1.5–2.3)	1.9 (1.5–2.4)	2.0 (1.6–2.4)	1.5 (1.2–1.9)
IV	1.9 (1.5–2.4)	1.8 (1.4–2.2)	1.8 (1.5–2.3)	1.8 (1.5–2.3)	1.8 (1.4–2.3)	1.9 (1.5–2.3)	1.6 (1.3–2.0)
III	1.7 (1.3–2.1)	1.5 (1.2–1.9)	1.6 (1.3–2.0)	1.6 (1.3–2.0)	1.6 (1.3–2.0)	1.6 (1.3–2.0)	1.4 (1.1–1.6)
II	1.5 (1.2–1.8)	1.4 (1.2–1.7)	1.5 (1.2–1.8)	1.5 (1.2–1.8)	1.4 (1.2–1.8)	1.5 (1.2–1.8)	1.3 (1.0–1.6)
I (highest level)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$	$p<0.001$
Removable denture							
Yes						1.0	1.0
No						1.6 (1.2–2.0)	1.5 (1.2–1.9)
						$p<0.001$	$p=0.001$
Intercept 1							0.1 (0.1–0.2)
Intercept 2							1.0 (0.6–1.6)

Cumulative odd ratios (CORs) and 95% confidence intervals (CIs) based on cumulative logistic regression models, where the level of oral hygiene was grouped on an ordinal scale (group 1 = good, 2 and 3 = poor).

Model 1, adjusted for age and gender; model 2, adjusted for age, gender and level of education; model 3, adjusted for age, gender and reported dental attendance; model 4, adjusted for age, gender and smoking; model 5, Adjusted for all independent variables.

compared with current smokers when age, gender and cynical hostility were controlled (model 5). On the other hand, smoking was most prevalent in the group with the highest level of cynical hostility compared with the group showing the lowest level of cynical hostility (34% *versus* 27%, χ^2 test $p = 0.008$).

The intensity of cynical hostility related positively to the level of oral hygiene when all confounding factors were adjusted (model 6).

Discussion

Our study showed that the intensity of cynical hostility had a consistent association with both self-reported toothbrushing frequency and objectively assessed level of oral hygiene. The results emphasize the significance of cynical hostility as a determinant of oral hygiene behaviour.

The relationship between the level of oral hygiene, periodontal diseases and some psychosocial factors has been reported previously (Kurer et al. 1995, Croucher et al. 1997, Deinzer et al. 1998, 2001, Monteiro da Silva et al. 1998). In the light of these findings, it is not surprising that cynical hostility is related to the level of oral hygiene.

According to previous studies, toothbrushing frequency can be considered a habit that is formed in childhood and adolescence (Östberg 2002, Östberg et al. 2002). Positive oral health atti-

tudes and social support in childhood are of great importance for oral health behaviour in adulthood (Källestål et al. 2000, Östberg 2002, Östberg et al. 2002). Williams (1998) stated that, in order to reduce health inequalities, it is important to reduce hostility by improving childhood conditions, especially the maternal parenting style, in the different socioeconomic groups. Consequently, hostility is seen as a permanent trait that develops during childhood. It has also been shown that adverse childhood experiences increase hostility scores in later life (Matthews et al. 1996, Räikkönen et al. 2000). Our study showed that age was of no significance in the relationship between toothbrushing frequency and cynical hostility among dentate subjects, which supports the idea that cynical hostility develops before the age of 30, possibly in childhood. In order to improve oral health behaviour, it is important to take into account the formation of cynical hostility in childhood and to try to prevent its development. Thus, parents need both social support and knowledge of dental care, as well as support to minimize cynical hostility affecting oral health behaviour.

The quality of toothbrushing cannot be explained directly by the childhood conditions or the environment. Our results suggest that cynical hostility affects the quality of toothbrushing, which is an assumption supported by the association between cynical hostility and oral hygiene after adjustment for toothbrushing frequency and the other most important confounding variables. One explanation may be that people who brush poorly usually have a strong motivation and eagerness to improve the quality of tooth brushing, but lack confidence in their success.

After adjustment for confounding factors, such as education and smoking, cynical hostility still had a significant independent effect, which suggests that completely different pathways may explain the observed association. These pathways can be considered in relation to the models used in cardiovascular diseases (Smith 1994).

The first model is called the *physiological reactivity model*. Negative affects, such as anger, contribute to cardiovascular disease via increased physiological responses to stressors (Williams et al. 1985). Frequent episodes of anger create adverse neuroendocrine and cardiovascular responses. According to the *psychosocial vulnerability model*, people with hostility have lower levels of social support, experience more stressful life events and more depression (Smith & Frohm 1985). The *transactional model* extends the reactivity and psychosocial models in such a way that hostile individuals have increased reactivity to self-imposed stressors, which means that their own negative behaviour leads them to heightened cardiovascular reactivity (Smith & Pope 1990). This model weights the social consequences of behaviour, while the psychosocial models treats them as correlates (Smith 1994). Krantz & Durel (1983) speculated that biological factors may cause both manifestations of anger and vulnerability to heart diseases. This model is labelled the *constitutional vulnerability model*. According to the *health behaviour model,* hostility produces poor physical health through lifestyle factors (Leiker & Hailey 1988). Using these models, however, we could also try to understand why hostile individuals behave poorly.

Cynical hostility has been found to increase the prevalence of smoking (Haukkala 2002), and smoking, in turn, results in a poor level of oral hygiene (Sakki 1999), a finding that is also supported by the health behaviour model (Leiker & Hailey 1988). Both results were also obvious in this study. However, adjustment for smoking does not change the magnitude of the association between cynical hostility and the level of oral hygiene. The result, which did not support a role of smoking as a mediating factor, could be a consequence of the generalized structure of the smoking variable. In further studies, other ways to construct the variable could enlighten/clarify the issue.

In addition, our results showed that part of the association was mediated by the level of education. Previous studies (Haukkala 2002) as well as our study established an association between cynical hostility and education. The other psychosocial factors that correlated with education were also in line with this. For example, a sense of coherence has been shown to associate with the level of education (Savolainen et al. 2005). It may also be possible that cynical hostility may have affected the level of education. The effect of dental attendance on the association between cynical hostility and oral hygiene level was distinctly weaker than the effect of education.

The above results are externally highly valid because the sample is representative of Finnish adults. The manifestation of cynical hostility is also consistent with this, which enhances the reliability of the result. The large sample generated a significant variation in the cynical hostility scores and also enabled us to stratify the data into several subcategories. For example, cynical hostility was divided into quintiles, which were considered adequately divergent in relation to the cynical hostility scores. Because cynical hostility is a psychological dimension and there is no agreement on ''low'' or ''high'' cynical hostility, we refer to ''the highest level of cynical hostility'' and ''the lowest level of cynical hostility'' according to the distribution into quintiles. Also, both dependent variables were divided into tertiles, which increases the credibility of the association between cynical hostility and these variables.

This study is a part of national health survey and because of the short time available for the dental examination, oral hygiene was evaluated only for three teeth. Unfortunately, we have not correlation to the index where oral hygiene has been evaluated from all teeth at all sites.

The cynical hostility scale (Julkunen et al. 1994) used in the present study has been found to be valid and has also been used in the most recent studies on cynical hostility (Haukkala 2002). Despite being accepted as important, the tradition of examining psychosocial factors in the field of dentistry has been neglected for a long time. We find it important and topical to examine the possible underlying psychosocial factors related to dental health behaviour. We also found it especially interesting to explore the issue as there are no previous studies on the associations between cynical hostility and dental health behaviour.

The association between cynical hostility and oral health behaviour was significant. The risk estimates of cynical hostility, although statistically significant, were not extremely high (odds ratios (ORs) 1.6–1.8). This is partly because of the fact that the effect of cynical hostility is partly mediated by education, marital status, smoking and dental attendance. When cynical hostility was adjusted for the above variables, salient pathways between cynical hostility and oral health behaviour were eliminated. When it was only adjusted for gender and age, the ORs

of these estimates were higher compared with the ORs of estimates also adjusted for other variables. However, this result should not be understood too narrowly, because cynical hostility is also related to cardiovascular diseases, depression and obesity, for instance (Haukkala 2002). The association between general health behaviour and oral health behaviour has also been established as remarkable (Dolan et al. 1991, Fukai et al. 1999, Kawamura et al. 2001), as has that between general health behaviour and oral diseases (Payne & Locker 1996, Sakki 1999, Saito et al. 2001).

Attributable risk is defined as the proportion of cases in the total population that are attributable to the risk factor (Armitage & Berry 1994). If the risk factor is the highest level of cynical hostility then the proportion of cases that are due to this factor is 16% in case of a low frequency of tooth brushing and 27% in case of low level of a oral hygiene. These figures support the idea that the highest level of cynical hostility can be regarded as a significant determinant for a low toothbrushing frequency and a low level of oral hygiene.

Because there are no previous studies on the relationship between cynical hostility and dentistry, we found it important in the first place to focus on the association between cynical hostility and oral health behaviour. The association between cynical hostility and oral hygiene does not necessarily mean that cynical hostility is associated with oral health. However, as we know now that cynical hostility seems to be mediated by oral health behaviour, there is an obvious need to clarify through further studies as to whether cynical hostility may have a direct association with oral health.

Conclusion

In conclusion, cynical hostility seems to be a psychosocial risk marker of the frequency and quality of toothbrushing, and it could be a connecting trait between general health behaviour and oral health behaviour.

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Clinical Relevance

Scientific rationale for study: Cynical hostility is a psychosocial factor that has been proposed as a mediating factor between poor health and socioeconomic status.

Principal findings: The subjects with the lowest cynical hostility level were found to brush their teeth significantly more often and to have better oral hygiene compared with those with the highest cynical hostility level. The association of cynical hostility with the toothbrushing frequency and oral hygiene seems to be partly dependent on the level of education.

Practical implications: Cynical hostility can be regarded as a risk marker for the frequency and quality of toothbrushing.