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Sense of coherence and oral health status in an adult Swedish population

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Abstract

Objective. To investigate sense of coherence in relation to oral health status in an adult Swedish population in order to better understand the determinants of positive oral health-promoting behavior and differences in oral health. ***Material and methods.*** A stratified random sample of 910 individuals from Jönköping, Sweden aged 20, 30, 40, 50, 60, 70 and 80 years was obtained. The investigation used the Swedish short version of the Sense of Coherence (SOC) questionnaire comprising 13 items and a self-report questionnaire to elicit demographic information. In addition, a clinical and radiographic oral examination was performed. ***Results.*** A total of 525 individuals, 261 men and 264 women, consented to participate in the study. Bivariate analysis revealed that higher mean SOC scores were statistically significantly associated with more decayed and filled surfaces (DFS) and filled surfaces (FS), fewer decayed surfaces (DS), fewer teeth with calculus and periodontal health. Multivariate analysis showed that higher SOC scores represented a predictor of fewer occurrences of a periodontal probing pocket depth of ≥4 mm and a lower risk of plaque in different regression models. ***Conclusions.*** Higher SOC scores may be a protective determinant of plaque and periodontal disease, indicating an association between SOC and oral health.

Key Words: *Cross-sectional, epidemiology, oral health promotion, salutogenic, Sense of Coherence questionnaire*

Introduction

Traditionally, dental care has adopted a biomedical approach, focusing on disease treatment and prevention [1]. Despite improvements in the prevention of oral diseases (and extensive efforts to do so), oral health inequalities can still be found within the population, in countries with or without well-developed dental healthcare systems [2–5]. However, oral health involves more than simply focusing on the absence of disease, as in the biomedical model [6], which does not reflect the multidimensional perspectives of oral health [6,7] or an oral health-promotion perspective [6,8]. This indicates a need to adopt a theoretical framework with a more holistic approach, i.e. being seen as a complete entity and concerning aspects of the individual [9,10]. An holistic approach also brings out the salutogenic influence on oral health, focusing on people's resources and capacity to promote health which, together with more traditional biomedical models, may be useful in the promotion of general [11,12] and oral health [8]. In order to explore the underlying psychosocial determinants of oral health and to understand the factors that may explain differences in oral status, as well as contribute to the maintenance of oral health [6,13,14], epidemiological studies need to adopt a theoretical framework based on the complex and causal context between oral health and psychosocial factors [14,15]. A broader research approach is needed to understand and explain people's behavior and actions in their living context, which can both promote and have an unfavorable effect on oral health [15,16]. This is in line with Antonovsky's salutogenic theory of Sense of Coherence (SOC), which seeks to explain the relationship between coping with life stresses and maintaining health. SOC is based on life experiences, also known as general resistance resources (GRRs), and describes the physical, biochemical, material, cognitive, emotional and sociocultural characteristics of an individual or group that are effective in avoiding stressors. A person with a strong SOC has many

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different GRRs and, more importantly, the ability to use these resources in a healthy direction, i.e. adaptive health behavior. SOC includes three abilities: comprehensibility, manageability and meaningfulness. Comprehensibility is the ability to understand life events as structured and clear in a cognitive manner (I know); manageability is the feeling of managing the situation and knowing that you have access to internal and/or external resources, i.e. having the instruments (I can); and meaningfulness is the emotional dimension and the motivational feeling of being worthy of investment and engagement (I want) [17]. Between these three components there is, however, a dynamic relationship and Antonovsky stated that SOC should be seen as a global orientation rather than a personality trait [17]. SOC appears to be a health resource which promotes resilience and the development of a positive subjective state of health [8,17,18]. SOC can be measured using both a 29-item self-reported questionnaire and a short version containing 13 items [17].

There is a need to investigate the relationship between the determinants of positive oral health-promoting behavior and differences in oral health. These determinants may be captured by SOC. It has also been suggested that the salutogenic approach, which is included in the SOC concept, is a useful model within oral health promotion, as it focuses on resources for health rather than the risk of diseases.

An individual's SOC may have an impact on oral health, as SOC reflects a person's way of acting and living within her/his life context which, in the next step, can have an influence on oral health [8].

There are only a few studies of the associations between SOC and oral health. In these studies, adolescents with high SOC scores have been shown to have less caries experience than those with low SOC scores [19]. Moreover, high SOC scores have been shown to be associated with low reports of self-reported gingivitis [20] and dental plaque [21]. SOC has also been studied in relation to oral health-related quality of life, where individuals with a strong or moderate SOC had significantly fewer oral health-related problems and thereby better oral health-related quality of life [22].

Oral diseases such as caries and periodontitis are not only caused by biological factors but are also usually consequences of non-biological factors, i.e. behaviors, which are in turn expressions of several underlying factors, such as psychosocial, cultural, material and environmental factors [6,23–26]. Oral health-related preventive behavior, such as tooth-brushing frequency and dental attendance [19,21,27], and dietary habits [28] have also been positively correlated with higher SOC scores. SOC as a psychosocial measurement in relation to gingivitis and plaque has recently been analyzed in two published papers [20,21]. However, to the authors' knowledge, no study has explored SOC in relation to several objectively assessed oral health outcomes, including caries, periodontitis and plaque, in an adult population.

The aim of this study was to investigate the association between SOC and oral health status in an adult Swedish population. One hypothesis was that high SOC scores were related to a healthier oral status.

Material and methods

Study population

The study was based on a stratified random sample of individuals from Jönköping, Sweden, a medium-sized city with ≈125,000 inhabitants. The sample consisted of 130 randomly selected subjects from the County Government Board who turned 20, 30, 40, 50, 60, 70 or 80 years of age between March and May 2003, a total of 910 individuals. Everyone selected for the study received a personal invitation by letter. They were informed of the purpose of the investigation and that they were going to be examined clinically and radiographically. They were also informed that the examination would be free of charge and that all the radiographs would be sent to their regular dentist. There were 589 individuals, 283 men and 306 women, who consented to participate in the examination. Depending on age group, 29–36% of the 20- to 70-year-olds who were invited to participate in the study declined to take part for various reasons. In the 80-year age group, 53% were non-respondents. The reasons for non-participation were mainly indicated to be lack of interest or lack of time, while others could not be reached or had handicaps or illnesses which prevented their participation. In some cases, a recent visit to the dentist was also given as the reason for not participating. The examinations started in September 2003 and were completed in November 2004. The sampling procedure and non-participation analysis have been reported and discussed in previous publications [29,30].

The ethical rules for research described in the Declaration of Helsinki were followed [31]. The study was approved by the Ethics Committee at the University of Linköping, Linköping, Sweden (ref. no: 02-376).

Measurements

Questionnaires. The investigation included the Swedish version of Antonovsky's short version of the orientation to life questionnaire comprising 13 items [17,32]. The questionnaire has been shown to produce acceptable results in terms of high validity, reliability and cross-cultural comparisons [33]. The SOC questionnaire consists of three dimensions: comprehensibility (five

items); manageability (four items); and meaningfulness (four items). Every item was scored on a Likert scale ranging from one to seven. The sum of the scores for SOC was 13–91. A high score indicates a strong SOC. The individuals' total SOC scores were divided into tertiles (t) as follows: $t_1 < 66$ ($n = 173$), $t_2 = 67$–75 ($n = 167$) and $t_3 > 76$ ($n = 185$). Approximately one-third of the respondents with the lowest total scores were included in the lowest SOC, while one-third of the respondents with the highest scores were included in the high SOC group, in accordance with some previous studies [29,33,34]. Cronbach's alpha of internal consistency for total SOC was 0.86, while it was 0.85, 0.80 and 0.84 for comprehensibility, manageability and meaningfulness, respectively. Only participants who answered all 13 items on the SOC questionnaire were included. As a result, 64 participants had to be excluded from the analysis.

Finally, the response rate in this study was 89% and, of the total sample examined (589 individuals), a total of 525 individuals, 261 men and 264 women aged 20–80 years, answered all the items in the questionnaire (Table I). However, since six individuals were edentulous, 519 individuals could be included in the analyses that required teeth to be present.

The demographic variables considered to be possible confounders of the association between SOC and the oral status outcomes were age, gender, marital status (married or cohabiting versus unmarried, divorced or widower), income (≥240,000 versus <240,000 SEK), low (less than high school), intermediate (completed high school or vocational training) and higher education (university degree or more) and occupational level (employed versus unemployed, which also included housewives, pensioners and students).

Oral status variables. Participants were examined clinically at dental offices by one of five dentists who were calibrated in terms of the diagnostic criteria below. Each clinical and radiographic examination took 60–90 min. The radiographic examination in 20-, 30- and 40-year-olds consisted of an orthopantomogram and six bite-wing radiographs. For the ≥50 years age group, an orthopantomogram and a full-mouth, intra-oral radiographic examination, including 16 peri-apical and four bite-wing radiographs, were performed in dentate individuals. Dental examinations of a few disabled or elderly people were performed in their homes or institutions.

Table I. Description of the sample according to age and gender.

Age group (years)	Total; *n* (%)	Men; *n* (%)	Women; *n* (%)
20	78 (14.9)	43 (8.2)	35 (6.7)
30	87 (16.6)	40 (7.6)	47 (9.0)
40	74 (14.1)	44 (8.4)	30 (5.7)
50	86 (16.4)	40 (7.6)	46 (8.8)
60	76 (14.5)	38 (7.2)	38 (7.2)
70	73 (13.9)	36 (6.9)	37 (7.0)
80	51 (9.7)	20 (3.8)	31 (5.9)
Total	525 (100)	261 (49.7)	264 (50.3)

Diagnostic criteria. Number of teeth included all permanent teeth, excluding third molars, and was recorded. Clinical caries was recorded according to the criteria described earlier, as follows [35]: initial caries was recorded as the loss of mineral in the enamel causing a chalky appearance but not clinically classified as a cavity. Manifest caries was recorded on previously unrestored surfaces that could be verified as cavities by probing and in which the probe stuck when probing in fissures using light pressure. Radiographic caries was recorded as lesions seen on the proximal tooth surfaces as clearly defined reductions in mineral content. Lesions (i) less than one-third of the enamel and (ii) less than two-thirds of the enamel but not involving the dentine were recorded as initial caries. Manifest caries was recorded as lesions extending into the dentine. Caries was calculated as the sum of initial and manifest lesions on each decayed tooth surface (DS). For each tooth surface, the presence of restorations was recorded (FS). The presence of plaque (PLI) and gingivitis (GI) was recorded if code 2 and 3 criteria were fulfilled according to the Löe criteria [36]. Plaque was recorded for four tooth surfaces per tooth and the presence of GI for four sites per tooth. The probing pocket depth (PPD) was recorded in millimeters and was only registered if it was ≥4 mm. The presence of supragingival calculus was recorded for each tooth after drying with air. The radiographic alveolar bone level was recorded mesially and distally for each molar and pre-molar tooth in the lower jaw and was calculated as a percentage of the total tooth length [37,38]. For each individual, teeth with calculus, decayed and filled tooth surfaces (DFS), DS, FS, plaque, GI and PPD ≥4 mm were calculated as percentages of both the total number of teeth and tooth surfaces and were used as outcome variables in the analysis. The frequency of DFS and the number of FS were divided into low, intermediate and high levels, where low included one-third of the lowest values and high included one-third of the highest values. In Scandinavia, 10–15% of the population with the highest caries scores are usually regarded as a risk group [39]. This corresponded to DS ≥6 in this study and represented 10.5% of the population, which explains why the cut-off points were set at this level.

Subjects were classified according to the severity of their periodontal disease experience as follows [38]:

Group 1. Healthy or almost healthy gingival units and normal alveolar bone height; ≤12 bleeding gingival units in the molar-pre-molar regions.

Group 2. Gingivitis; >12 bleeding gingival units in the molar–pre-molar regions, with normal alveolar bone height.

Group 3. Alveolar bone loss around most teeth not exceeding one-third of the length of the roots.

Group 4. Alveolar bone loss around most teeth ranging between one-third and two-thirds of the length of the roots.

Group 5. Alveolar bone loss around most teeth exceeding two-thirds of the length of the roots, including the presence of angular bone defects and/or furcation defects.

Individuals classified as belonging to periodontal disease experience Groups 3, 4 or 5 were treated as a single variable. This variable was then dichotomized into one healthy group (periodontally treated; $n = 85$) and one diseased group (with gingivitis and a PPD < 4 mm; $n = 138$). The criteria for the healthy group were <20% bleeding sites and <10% sites with PPDs of >4 mm, while the criteria for the diseased group were >20% bleeding sites and >10% sites with a PPD of >4 mm [38].

Statistics

Data analysis was conducted using the Statistical Package for Social Sciences version 16.0 (SPSS Inc, Chicago, IL). The total SOC scores and the three dimensions, comprehensibility, manageability and meaningfulness, were analyzed as continuous variables, but the total SOC score was also analyzed as a categorical variable, i.e. tertiles, as mentioned above and suggested in previous studies [29,33,34]. Differences in mean SOC scores in relation to oral health variables were tested with a *t*-test and one-way ANOVA including the Tukey test. Linear regression analyses were performed to evaluate total SOC scores for associations with different clinical variables and demographic factors. As the distribution of some variables was considered non-normal, we performed transformations of variables. However, the models did not differ and the untransformed results are therefore presented. Multiple logistic regression was performed to estimate the risk of having a poor oral status with regard to SOC scores (i.e. high >76 points, intermediate 67–75 points and low <66 points). In other words, the likelihood that respondents who had high SOC scores had a better oral health status, compared with individuals with low SOC scores, in terms of caries, periodontitis, gingivitis, plaque and supragingival calculus, after adjustment for potential confounders.

Results

Differences in total mean SOC scores and in the three components according to different levels of oral health status are shown in Table II. Individuals with high total SOC scores had a higher frequency of DFS ($P = 0.001$), lower DS ($P = 0.019$), a higher FS ($P < 0.000$) and a lower frequency of teeth with supragingival calculus ($P = 0.004$) compared with individuals with lower SOC scores. Independently of using the outcome variables measured in absolute or relative numbers in the analysis, the results and interpretations were similar. For individuals belonging to any of the Groups 3, 4 or 5 with periodontal disease experience, there was a statistically significant difference between individuals with higher and lower total SOC scores, where individuals with higher mean SOC scores had a more healthy periodontal status compared to those with lower SOC scores ($P = 0.041$).

When analyzing the three subcomponents, the mean scores for comprehensibility were statistically significantly higher for individuals with higher DFS and FS. Moreover, high scores were associated with fewer teeth with calculus and with a healthy periodontal status. Almost the same results were found for manageability and meaningfulness (Table II).

Table III describes how much of the variance in the oral status variables can be explained by SOC (Model I, unadjusted) and by the other explanatory variables (Model II). Model I shows that SOC scores can explain some of the variance in relation to the frequency of DFS ($r^2 = 0.026$, $P < 0.000$), DS ($r^2 = 0.020$, $P = 0.008$), FS ($r^2 = 0.010$, $P = 0.053$) and teeth with calculus ($r^2 = 0.008$, $P = 0.02$). After adjusting for all demographic variables (Model II), the SOC score was a statistically significant predictor of a PPD of ≥4 mm ($P = 0.039$). The model explained 10.1% of the variance (Table III) and age and high and low educational levels were also associated with PPD ($P < 0.05$).

The results of the multiple logistic regression (Table IV) show that, after adjusting for all socio-demographic variables (gender, age, marital status, income level, education and occupational level), a significant association with plaque was found, where individuals with high SOC scores were more likely to have less plaque compared with those with a low SOC score ($P = 0.040$). In the model, age was also a predictor of plaque ($P < 0.000$). Moreover, a high SOC score indicated an association with less risk of having gingivitis ($P = 0.059$), even if this was not a statistically significant result. No other oral clinical variables were significantly associated with SOC.

Discussion

In order to better understand the determinants of positive oral health-promoting behavior and

Table II. Total mean SOC scores and mean scores for the three sub-components of comprehensibility, manageability and meaningfulness ($n = 525$), in relation to different oral health measures (outcome variables). Only variables with a statistically significant association between the SOC score and the oral health measure are shown.

Clinical variable	*n*	Total SOC; mean (SD)	*P*	Comprehensibility; mean (SD)	*P*	Manageability; mean (SD)	*P*	Meaningfulness; mean (SD)	*P*
DFS (%)									
Low (1/3 lowest)	174	68.0 (12.3)		24.8 (5.4)		20.7 (4.4)		22.4 (4.2)	
Intermediate	174	69.8 (11.0)		25.8 (5.1)		21.2 (3.7)		22.8 (3.9)	
High (1/3 highest)	171	72.6 (10.5)	0.001[a]	26.9 (5.1)	0.002[a]	22.2 (3.4)	0.001[a]	23.5 (3.6)	0.029[a]
DS (%)									
<6 caries lesions	466	70.5 (11.2)		26.0 (5.2)		21.5 (3.8)		23.0 (3.8)	
≥6 caries lesions	53	66.6 (13.0)	0.019	24.6 (5.7)	NS	20.0 (4.7)	0.018	22.1 (4.6)	NS
FS (%)									
Low (1/3 lowest)	173	67.6 (12.4)		24.7 (5.5)		20.7 (4.3)		22.2 (4.3)	
Intermediate	173	70.0 (11.1)		26.0 (5.1)		21.1 (3.8)		22.8 (3.9)	
High (1/3 highest)	173	72.8 (10.2)	<0.000[a,b]	26.9 (5.1)	<0.000[a]	22.3 (3.3)	<0.000[a,b]	23.6 (3.5)	0.007[a]
Teeth with calculus (%)									
<20%	400	70.9 (11.0)		26.1 (5.1)		21.6 (3.7)		23.1 (3.8)	
≥20	119	67.4 (12.4)	0.004	24.8 (5.6)	0.012	20.5 (4.5)	0.005	22.1 (4.3)	0.014
Periodontal status[c]									
Healthy	85	72.8 (10.2)		27.3 (4.8)		22.0 (3.4)		23.4 (3.6)	
Diseased	138	69.6 (11.5)	0.041	25.5 (5.5)	0.015	21.4 (4.0)	NS	22.8 (3.9)	NS

[a]Statistically significant between low and high.
[b]Statistically significant between intermediate and high.
[c]Only individuals from periodontal disease Groups 3,4 and 5.

Table III. Results from linear regression between total SOC scores (explanatory variable) and clinical variables (outcome variables) for unadjusted (model I) and adjusted (model II) models for different sociodemographic variables ($n = 525$).

		SOC Model I			SOC Model II		
Clinical variable	*n*	R^2	β	*P*	R^2	β	*P*
Number of teeth	525	0.001	–0.027	NS	0.420	–0.015	NS
DFS (%)	519	0.026	0.167	0.000	0.584	0.013	NS
DS (%)	519	0.020	–0.140	0.008	0.135	–0.051	NS
FS (%)	519	0.010	0.177	0.053	0.608	–0.038	NS
PLI (%)	519	0.002	–0.063	NS	0.070	–0.090	NS
GI (%)	519	0.005	–0.080	NS	0.007	–0.060	NS
PPD ≥4 mm (%)	519	0.001	–0.054	NS	0.101	–0.099	0.039
Teeth with calculus (%)	519	0.008	–0.102	0.020	0.012	–0.089	NS

differences in oral health, the aim of this study was to investigate the relationship between SOC and oral health status. Bivariate analysis revealed that higher mean SOC scores were statistically significantly associated with more decayed and filled tooth surfaces and filled tooth surfaces, fewer decayed tooth surfaces, fewer teeth with calculus and periodontal health. However, the main results of the multivariate analysis indicated a significant association between higher SOC scores and less plaque and periodontitis, as measured by fewer teeth with a PPD of >4 mm. This indicates that individuals with higher SOC scores run less risk of disease. As SOC is designed to estimate an individual's capacity for healthy behavior supported by internal and external resources, i.e. psychosocial aspects, these results may contribute to a new approach within epidemiological studies explaining differences in oral health status. However, the differences in mean SOC levels between the different variables were not large and the ability of

Table IV. Results from multiple logistic regression analysis of the association between SOC scores (explanatory variable), quantified as high (≥76 points), intermediate (67–75 points) or low (≤66 points) SOC, and various clinical oral status measures (outcome variables). Adjusted for different sociodemographic variables (gender, age, marital status, income level, educational level and occupational level).

Clinical variables and SOC level	*n*	Nagelkerke R^2	β	OR (95% CI)	*P*
Number of teeth (>20/≤20)					NS
SOC low (reference)	153	0.490		1	
SOC intermediate	151		0.022	1.02 (0.42–2.50)	NS
SOC high	166		–0.401	0.67 (0.27–1.66)	NS
Frequency DFS (%) (low/high)					NS
SOC low (reference)	101	0.868		1	
SOC intermediate	94		–0.631	0.53 (0.13–2.22)	NS
SOC high	114		–0.168	0.85 (0.24–2.97)	NS
Frequency of DS (%) (<6 sites/≥6 sites)					NS
SOC low (reference)	153	0.259		1	
SOC intermediate	150		0.475	1.61 (0.71–3.61)	NS
SOC high	166		0.469	1.60 (0.65–3.92)	NS
Frequency of FS (%) (low/high)					NS
SOC low (reference)	98	0.912		1	
SOC intermediate	98		–0.647	0.52 (0.09–2.98)	NS
SOC high	113		–0.269	0.77 (0.16–3.82)	NS
PLI (%) (≤20%/>20%)					NS
SOC low (reference)	153	0.103		1	
SOC intermediate	151		–0.407	0.67 (0.40–1.12)	NS
SOC high	166		–0.547	0.58 (0.34–.98)	0.040
GI (%) (≤20%/>20%)					NS
SOC low (reference)	153	0.037		1	
SOC intermediate	150		–0.109	0.90 (0.53–1.52)	NS
SOC high	166		–0.544	0.58 (0.33–1.02)	.059
PPD ≥4 mm (%) (≤10%/>10%)					NS
SOC low (reference)	153	0.175		1	
SOC intermediate	150		–0.378	0.68 (0.38–1.22)	NS
SOC high	166		–0.266	0.77 (0.44–1.35)	NS
Teeth with calculus (%) (≤20%/>20%)					NS
SOC low (reference)	153	0.052		1	
SOC intermediate	151		–0.233	0.79 (0.45–1.39)	NS
SOC high	166		–0.334	0.72 (0.40–1.27)	NS
Periodontal status (healthy/diseased)					NS
SOC low (reference)	65	0.070		1	
SOC intermediate	63		–0.004	1.0 (0.46–2.16)	NS
SOC high	76		–0.197	0.82 (0.39–1.71)	NS

SOC to discriminate effectively may therefore be questioned.

Analysis revealed that high mean SOC scores were associated with high DFS and with the separate variable FS. This result may be somewhat surprising, as the theoretical hypothesis was that individuals with a high SOC would have a more healthy dental status than those with a low SOC. This is in line with another study in which older people with higher self-efficacy had more dental care in the past, i.e. more fillings, but at the same time less periodontal disease [40]. DFS and FS can be seen as an historical description of a restorative dental treatment and an effect of a lack of knowledge of caries etiology, prevention and treatment, but also as a way of describing an individual's dental attendance during his/her

lifespan. A Danish study [41] found that individuals with regular dental attendance had more fillings compared with those with low dental attendance, and an earlier Swedish study by Björn [42] found significant associations between regular dental care and more restored and lost teeth compared with individuals with sporadic dental care. Moreover, a Brazilian study found relationships between high DMFT and dental attendance [43]. Possible explanations of this relationship may be regular attention patterns related to healthy behavior and the criteria for treatment decisions. A high SOC score was also associated with fewer DS, fewer teeth with calculus and a more healthy periodontal status, which confirms previous findings that a strong SOC is associated not only with general health [12,17,18] but also with objectively assessed oral health [19–21]. The analysis of the three subcomponents thus indicated that the degree of comprehensibility, manageability or meaningfulness may be useful when explaining differences in oral status. When considering these results, some caution must be shown, as only SOC was the explanatory variable in these bivariate analyses.

The results after controlling for all sociodemographic factors (Model II in Tables III and IV) indicated that high SOC scores were associated with fewer teeth with a PPD of ≥4 mm and better oral hygiene, i.e. ≤20% of tooth sites with plaque. Age was also significantly associated with plaque, with an odds ratio of 1.03 (95% confidence interval 1.02–1.04; data not shown). Gingivitis showed a similar tendency, but was not statistically significant. However, SOC was the only factor explaining the variability in gingivitis, even if it was fairly weak (3.7%). These results have been confirmed in other studies analyzing SOC and clinical oral status, such as caries experience [19], plaque [21] and gingivitis [20]. Studies using other psychosocial measurements also confirm the associations between oral status, such as plaque, and gingivitis [44]. Individuals with a high internal locus of control who placed a high value on having their own teeth had less visible plaque and fewer decayed surfaces and root caries surfaces [45]. Moreover, in a recently published Swedish study, relationships were found between dental health locus of control and oral status in terms of plaque and gingivitis [46]. Contrary to these findings, Freire et al. [19] found no relationship between SOC and plaque and bleeding on probing. In another study, Syrjälä et al. [47] analyzed the relationship between different measures of psychological characteristics and oral health and failed to find any (or only very weak) associations between psychological characteristics and the clinical variables of dental caries and PPD. Even if the present study points towards some statistically significant associations, it is important to be cautious about the findings, since some of the bivariate associations did not remain statistically significant after adjustment for other explanatory variables. Moreover, the association between SOC in relation to plaque and a PPD of ≥4 mm in the multivariate analysis was fairly weak.

Previous studies have demonstrated a strong relationship between SOC and dimensions of general health, e.g. mental health [18,34], well-being and quality of life [18], and a weaker relationship between SOC and physical health [18]. According to Antonovsky, the SOC questionnaire aims to measure a global view of life, whereas physical health only reflects one dimension [17,18]. In this study, oral status represents physical health, where no consideration of any other dimension of health was involved. The weak associations between SOC and oral status could therefore depend on factors associated with SOC but also on biological factors that are involved. It is also important to remember that most people in society do not experience oral diseases such as caries and periodontitis as traumatic or stressful situations.

There are still only a few studies analyzing the relationship between SOC and oral health. This study should be seen as one in a series of epidemiological studies examining possible psychosocial measurements at population level as a means of understanding an individual's ability to adopt healthy behavior with a favorable effect on oral health. In modern dental care, in order to better understand changes in oral health and the influence of adaptive, health-promoting behavior, it is important to consider both the professional's objective data together with the patient's total life context. Although this study was cross-sectional and no causal relationships could be analyzed, the findings show that strong SOC can be seen as a determinant of improved oral health status, i.e. lower PPD and less plaque, which relates to positive oral health behavior. With more knowledge in this area, information about an individual's SOC could be used to complement oral clinical data, with the aim of adopting an holistic, salutogenic approach to oral health prevention and promotion.

If SOC can be viewed as a global internal resource within individuals, a plethora of social, psychological measures, together with the SOC scale, could prove useful as a means of estimating the interrelationship between health status and health behaviors. However, modeling of this kind calls for complex statistical analysis.

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