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The relationship between Sense of Coherence and toothbrushing behaviours in Iranian adolescents in Mashhad

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Abstract

Aim: The aim of this study was to assess the association between Sense of Coherence (SOC) and toothbrushing behaviours in Iranian adolescents in Mashhad. **Materials and Methods:** A representative stratified random sample of 1054 grade 6 Iranian students, living in Mashhad, answered a 37-item questionnaire with questions on socio-demographic characteristics, frequency of toothbrushing behaviours and Antonovsky's 13-item SOC scale. Binary logistic regression was used to test the association between SOC and toothbrushing behaviours.

Results: Higher SOC scores were significantly associated with more frequent toothbrushing behaviours (p = 0.01). This positive association remained significant after adjusting for sex and father's education level (p = 0.01). When testing this association for the boys and girls separately, the association was significant only for girls (p = 0.02). However, the interaction between sex and SOC was not significant (p = 0.56). The association between toothbrushing and sex remained significant after adjusting for SOC (p < 0.001). Boys had a significantly stronger SOC than girls (p = 0.04).

Conclusions: SOC was associated with toothbrushing frequency in Iranian adolescents in Mashhad. SOC did not fully explain the sex difference in toothbrushing behaviours.

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Effective personal oral hygiene is the main approach to controlling periodontal diseases (Löe 2000, Albandar & Tinoco 2002). Despite this fact, there is relatively little information on the socio-psychological factors influencing toothbrushing behaviours (Sheiham & Nicolau 2005). There are associations

Conflict of interest and source of funding statement

The authors declare that they have no conflict of interests. This study was sponsored by Shahid Beheshti Dental School, Iran. between oral hygiene behaviours and socio-demographic factors such as age, sex, race/ethnicity and socio-economic status (Papapanou 1999, Jenkins & Papapanou 2001, Albandar 2002a, b, Baelum & Scheutz 2002, Corbet et al. 2002, Gjermo et al. 2002, Sheiham & Netuveli 2002, Maes et al. 2006). For example, it is a universal finding that girls have better oral hygiene than boys (Hodge et al. 1982, Bergler 1989, Albandar 2002a, b, Maes et al. 2006). However, this sex difference has not yet been fully explained.

Psychological factors such as health locus of control, self-esteem, self-efficacy and self-image also influence oral hygiene behaviours (Macgregor et al. 1997, Albandar & Rams 2002, Koerber et al. 2006). Such psychological factors increase an individual's propensity to carry out health-promoting behaviours such as toothbrushing. Interestingly, the aforementioned psychological factors also influence people's views about control over their life and what steps can be taken to improve their health. These factors are encompassed by a concept; Sense of Coherence (SOC) (Antonovsky 1987). Antonovsky (1987) postulated that a SOC is a personality disposition to view life in a coherent, meaningful

and manageable manner. Those with a strong SOC feel capable of understanding the situations they are placed in throughout life. Moreover, they view these situations as manageable and worth investing in. Similarly, those with an internal health locus of control, compared with those with an external health locus of control, are more likely to feel that they can manage their health and, in general, their life (Antonovsky 1987). They see life events, including diseases and their symptoms, as manageable and worth doing something about. This link between psychological factors influencing oral hygiene beha-

factors influencing oral hygiene behaviours and SOC suggests that SOC may influence health behaviours including toothbrushing behaviours. This assumption is in accord with the findings of a systematic review on SOC and its relation to health, which proposed that SOC was a health-promoting resource (Eriksson & Lindström 2006).

A few studies have tested whether there is an association between SOC and oral health behaviours. Freire et al. (2001) showed that oral health behaviours such as daily frequency of sugar intake, between-meal frequency of sugar intake and daily toothbrushing frequency were not significantly associated with SOC, whereas visiting dentists mainly for check-ups rather than when there is a problem was associated with a higher SOC. On the other hand, Ayo-Yusuf et al. (2009), in a longitudinal study of South African eighth-grade adolescents, found that an increase in SOC over an 18-month period was significantly associated with an improvement to twice-daily toothbrushing. The change in SOC reported by Ayo-Yusuf et al. (2009) is consistent with the results of other studies indicating that SOC can change during childhood and adolescence and up to the end of the third decade of life, when it is fully established (Antonovsky 1987). A study in Finnish adults aged 30-64 years reported that those with a stronger SOC were significantly more likely to brush their teeth two or more times a day than those with a less strong SOC (Savolainen et al. 2005). They concluded that a weak SOC was associated with poor oral hygiene and less frequent (less than once a day) toothbrushing behaviour. These findings suggest that SOC is associated with the frequency of toothbrushing. There is little research on the relationship between SOC and oral hygiene behaviours, particularly in adolescents in developing countries. On this basis, the first objective of this study was to examine the association between SOC and toothbrushing frequency in Iranian adolescents living in Mashhad.

As mentioned earlier, studies have failed to explain the universal sex difference in oral hygiene behaviours. SOC is assumed to be a comprehensive indicator of oral hygiene behaviours of adolescents, which encompasses established psychological indicators of oral hygiene behaviours. This suggests that SOC may explain the sex difference in oral hygiene practice in adolescents. If SOC can explain the sex difference in oral hygiene, it is rational to expect that there should be a sex difference in SOC in adolescents. Furthermore, despite the fluctuation of SOC in early life, the sex difference in SOC should be stable throughout life as sex differences in oral hygiene occur throughout the life course. The few studies that have reported on sex differences in SOC among adolescents have yielded inconsistent findings. Avo-Yusuf et al. (2009) reported no sex difference in the SOC scores among South African eighthgrade adolescents. On the other hand, 16- and 19-year-old Swedish boys had stronger SOC than their female counterparts (Simonsson et al. 2008). Similarly, Honkinen et al. (2008) found higher SOC scores for 15- and 18- year-old Finnish boys than in girls. They also showed that this disparity in SOC among girls and boys did not change between the ages of 15 and 18. The inconsistency in the findings on sex differences in SOC among different populations may be partly explained by cultural differences. This highlights the importance of examining this hypothesis in different adolescent populations. In the Iranian community, where Islam is the dominant religion, girls are encouraged to conform to religious practices at an earlier age than boys. Around the age of 8 years, girls are expected to adopt certain social roles and commitments. For boys, the pressure to conform occurs around the age of 11–12 years. This may result in a better developed SOC for Iranian girls compared with boys. On this basis, the second objective of the present study was to investigate the sex difference in SOC among Iranian adolescents in Mashhad, and whether SOC can provide an explanation for the difference in oral hygiene between female and male Iranian adolescents in Mashhad.

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The original SOC-13 scale, used in this study, was developed in English (Antonovsky 1987). Every time a scale is used in a new context or with a different group of people, it is necessary to re-establish its psychometric properties (Streiner & Norman 2000). For this purpose, the third objective of the present study was to develop and to assess the Persian version of the SOC-13 scale among Iranian adolescents in Mashhad.

Sixth-grade adolescents were chosen as they are at an important stage of life. At this age, girls and majority of boys have typically entered puberty. They desire independence and adopt adult health-related behaviours. In the Iranian education system, sixth-grade is the first year in the middle school. Adolescents enter a study environment different from primary school, where they are more independent and have to make choices about the modules they take, and form more mature peer groups. Health-related behaviours developed at this age are likely to continue into adulthood (Jessor 1982). This may also apply to the SOC. There is little available evidence on changes of SOC from this age through to adulthood. However, based on findings from Honkinen et al. (2008) and the fact that some gender-specific behaviours become more evident at this age, it is rational to assume that the genderrelated pattern of SOC at this age would remain unchanged later in life.

Materials and Methods Sample

Subjects were sixth-grade Iranian students in Mashhad, Iran. A two-stage stratified random sampling method was used. Strata were from different distinct socio-economic regions identified by the local education authority. Primary sampling units were middle schools within each region. Middle schools and then sixth-grade male or female classes (secondary units) within selected schools were randomly selected using random number tables. Sample size was calculated, using data from a pilot study, to have a 90% power of demonstrating a statistically significant difference in the SOC scores between two groups of toothbrushing frequency (two or more times per day, once a day or less) at a 5% level. Assuming a 10% drop-out, a minimum sample size of 956 was required for the study. However, the present study was part of a project that

required a larger sample size. For this reason, a sample size of 1132 was invited to participate in the study.

Ethical approval was obtained from the Iranian National Ethical Committee. Parents' consent was obtained by a selfadministered questionnaire. Students were free to withdraw at any stage of the study. Subjects with disabilities, with chronic systemic diseases in the past 6 months, those wearing orthodontic appliances and those who had worn one in the last 2 years were excluded.

Instruments and measures

Subjects completed a 37-item pre-tested questionnaire. The questionnaire contained questions on socio-demographic variables (age, sex, parent's level of education), frequency of toothbrushing (more than three times per day, twice a day, once a day, less frequently than once a day, not at all) and the SOC scale. To measure SOC, Antonovsky's SOC scale was used (Antonovsky 1987). This instrument has been used in 33 languages in 32 countries (Eriksson & Lindström 2005). One version of SOC, SOC-13, has 13 items with a seven-point Likert-type scale. The scores for these 13 items were combined to calculate the total SOC score. Higher scores indicated a stronger SOC (Antonovsky 1987). The internal consistency of this scale measured by Cronbach's α ranged from 0.70 to 0.92 in 127 studies presenting a high internal consistency (Eriksson & Lindström 2005). Longitudinal studies reporting test-retest reliability showed considerable stability (Eriksson & Lindström 2005).

As the SOC questionnaire was originally developed in English and Hebrew, it was translated and validated for use in the target Persian-speaking population. The linguistic validation method of Acquadro et al. (2004) was used, with some modifications. It consisted of forward and backward translation and validation in a pilot study. Students participating in the pilot study were asked to report any difficulties they experienced with the questions. These feedbacks were discussed among the researchers and advice was sought from one female and one male senior middle-school teacher. Minor amendments were made and the final version was accepted for use in the main study. As in the pilot study, the majority of students reported difficulty in understanding the Persian SOC-13 scale; a set of examples were developed for each question of the SOC-13 scale. These examples were read out by the questionnaire administrator after each question. Examples were the same for all students so as to avoid operator effects. Students were given enough time to answer the questions and were free to ask questions from the administrator. In the present study, Cronbach's α of internal consistency for the Persian SOC-13 was 0.87. (The Persian SOC-13 scale is available from the first author).

To test the reliability of students' responses to the questionnaire, forty randomly selected male and female students were asked to answer the questionnaire again after a 1-week interval. In the present study, the test–retest correlation with a 1-week interval was 0.77.

Statistical analysis

Data were entered into a Dell computer and processed for analysis using the Statistical Package for Social Sciences (SPSS for Windows, version 14.0/PC; SPSS, Chicago, IL, USA). Data analysis was carried out using STATA (STATA Corp., College Station, TX, USA). Toothbrushing frequency, the main study outcome variable, had five categories. This was to investigate the frequency distribution of toothbrushing among Iranian adolescents in Mashhad. However, to improve the interpretation of the results of bivariate and multivariable analyses, this variable was later dichotomized into once a day or less versus twice or more a day, based on the recommended frequency of twice a day (Löe 2000). SOC was treated as a continuous variable. The SOC score was calculated only for those who answered all 13 items in the SOC-13 scale. To assess the relationship between sex and other study variables, including age, parents' education level, toothbrushing frequency, and SOC, χ^2 and Mann-Whitney tests were used as appropriate. The association between toothbrushing frequency and sex was also examined using binary logistic regression. SOC was added to the model to test whether SOC explained the sex difference in toothbrushing behaviour. The associations between toothbrushing frequency and age, parents' education level and SOC were examined using binary logistic regression. The association between toothbrushing frequency and SOC was also adjusted for sex and father's education level, the only socio-demographic variables that were significantly associated with toothbrushing. Tests for interaction between sex and SOC were carried out in order to test whether the association between SOC and toothbrushing frequency was the same in boys and girls.

Results

One thousand and one hundred and thirty-two grade 6 students in Mashhad were recruited. Twenty-nine students did not meet the inclusion criteria and were excluded: 21 had worn orthodontic appliances in the last 2 years, mainly space maintainers, and eight were suffering from chronic systemic diseases. Forty nine students were excluded either because of lack of parental consent or absence on the day of the study. Although 93.1% of those invited answered the questionnaire, data were missing for some of the variables in the questionnaire (the extent of missing data ranged from 0.1% to 13.6%). Therefore, the number of participants for different variables varied from 911 to 1054.

Descriptive data

The majority of students were males (59.2%). Their ages ranged from 11 to 16 years. The mean age for the whole sample was 12.4 (SD = 0.7). The mean age for girls was 12.3 (SD = 0.7) and that for boys was 12.5 (SD = 0.8). 89.2% of the subjects were 12-13 years old. Students' mothers were more likely than their fathers to be illiterate or just have primary school education: 47.4% and 39.9%, respectively. 21.4% of the fathers and 16.2% of the mothers had a university degree (Table 1). 27 (3%) participants failed to report their toothbrushing frequency. The difference in the distribution of toothbrushing frequency between the two sexes was significant (p<0.001). Girls (52.9%) were more likely to brush their teeth at least twice a day than boys (38.6%) (Table 1).

The total SOC score varied between 20.0 and 82.0 (Table 1). The mean SOC score was 48.6 (SD = 10.7). Boys had a stronger SOC than girls (p = 0.04). When calculating the scores for SOC, subjects who did not answer even one corresponding question were excluded. This resulted in a non-response rate of 13.6% for SOC.

Table 1. Characteristics of the study participants, by sex

	Male	Female	Total
Age (years)			
Mean (SD)	12.49 (0.83)	12.31 (0.71)	12.42 (0.79)
Minimum-maximum	11-16	11-16	11-16
Number of participants	623	426	1049
Father's education level (%)			
Illiterate/primary school	40.4	39.3	39.9
Completed middle school	10.9	22.8	15.8
Completed secondary school	23.9	17.7	21.4
Had a university degree	22.8	19.3	21.4
Do not know	2.1	0.9	1.6
Total	100.0 (624)	100.0 (430)	100.0 (1054)
Mother's education level (%)			
Illiterate/primary school	48.1	46.5	47.4
Completed middle school	8.7	20.7	13.6
Completed secondary school	23.1	18.4	21.2
Had a university degree	18.1	13.5	16.2
Do not know	2.1	0.9	1.6
Total	100.0 (624)	100.0 (430)	100.0 (1054)
Toothbrushing frequency (%)			
Twice a day or more	38.6	52.9	44
Once a day or less	61.4	47.1	56
Total	100(611)	100 (416)	100 (1027)
Sense of Coherence (SOC score)			
Mean (SD)	49.1 (10.6)	47.9 (10.7)	48.6 (10.7)
Minimum-maximum	20.0-82.0	22.0-79.0	20.0-82.0
Number of participants	530	381	911

Bivariate and multivariable analyses

Girls were significantly more likely than boys to brush their teeth more frequently (OR 1.722; 95% CI: 1.342, 2.213) (p < 0.001) (Table 2). This association remained significant after adjusting for SOC (OR 1.681; 95% CI: 1.302, 2.123) (p < 0.001). There was no significant association between toothbrushing frequency and age (OR 1.102; 95% CI: 0.941, 1.283) (p = 0.24) (Table 2). However, the association among boys was significant (OR 1.274; 95% CI: 1.043, 1.542) (p = 0.02) (Table 2). The test for interaction between sex and age was not significant (p = 0.43).

There was a significant association between father's education level and toothbrushing frequency (p = 0.01) (Table 2). When testing this association by sex separately, the results were significant only for boys (p = 0.01). The interaction between sex and father's education level was not significant (p = 0.39). The association between mother's education level and toothbrushing frequency was not significant for the whole sample (p = 0.38) or among the two sexes separately, girls (p = 0.35) and boys (p = 0.28) (Table 2).

A stronger SOC was significantly associated with higher frequencies of toothbrushing (OR 1.022; 95% CI: 1.001, 1.031) (p = 0.01) (Table 2). This association remained significant after adjusting for sex and father's education level [odds ratio (OR) 1.021; 95% CI: 1.001, 1.032] (p = 0.01). When the two sexes were examined separately, the OR for girls (OR 1.021; 95% CI: 1.001, 1.041) and boys (OR 1.013; 95% CI: 0.991, 1.021) were very similar but the significance of this association was different for the two sexes. It was significant among girls (p = 0.02) but not for boys (p = 0.23). However, the result of the interaction test between sex and the SOC score was not significant (OR 0.992; 95% CI: 0.973, 1.011) (p = 0.56).

Discussion

SOC was significantly associated with toothbrushing frequency in Iranian adolescents in the city of Mashhad. The association remained unaltered after adjusting for sex and father's level of education. Similar results were found in South African adolescents who completed an abbreviated version of SOC-13 scale (Ayo-Yusuf et al. 2009). Moreover, in a study among adult Finns, SOC was associated with frequency of toothbrushing (Savolainen et al. 2005). Our

findings are in contrast to a study on Brazilian adolescents for whom this association was not significant (Freire et al. 2001). Freire et al. (2001) concluded that oral health behaviours at this age are more influenced by parents. The Brazilian adolescents (mean age of 15 years) were older than the Iranian adolescents (mean age of 12.4). The cut-off point for dichotomizing toothbrushing frequency in the Brazilian study was three times a day. This may explain the difference in the findings from this Iranian study. The observed disparity in the association between SOC and toothbrushing behaviours among different populations suggests that this association may be influenced by cultural differences. It is important to note that although there was a significant association between toothbrushing and SOC in the present study, the OR for this association was very close to 1. This indicates that oral hygiene-promoting programmes for Iranian adolescents in Mashhad should incorporate stronger indicators of oral hygiene alongside SOC

Iranian girls were significantly more likely to brush their teeth more often than boys. This is in line with the universal finding that girls have cleaner bodies and mouths than boys (Hodge et al. 1982, Honkala et al. 1988, 1990, Macgregor & Balding 1988, Bergler 1989, Biswas et al. 1990, Nzioka et al. 1993. Kuusela et al. 1997. Albandar 2002b, Taani et al. 2003). We hypothesized that SOC may explain this sex difference in toothbrushing frequency. As a prerequisite for this hypothesis, it was assumed that there should be a sex difference in SOC. The results of the present study showed a significant difference in SOC between Iranian girls and boys in Mashhad. Similar results were found among 15- to 18-year-old Finns and 16- and 19-year-old Swedes (Honkinen et al. 2008, Simonsson et al. 2008). However, there was no significant difference in SOC between male and female South African eighth-grade adolescents (Ayo-Yusuf et al. 2009). Similar differences in SOC by sex among adolescents from different communities were reported among adults in some populations. Some studies reported no sex differences in SOC of adults (Due & Holstein 1998, Abel et al. 1999), while others found that men have a stronger SOC than women (Kark et al. 1996, Schumacher et al. 2000, Suominen et al. 2001, Nilsson et al. 2002,

Toothbrushing frequency	Male		Female		Overall		Overall (adjusted mod sex, father's education	el includes and SOC)
	OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	<i>p</i> value
Sex Female					1.722 (1.342, 2.213)	< 0.001	1.681 (1.302, 2.123)	<0.001
Age (per year)	1.274 (1.043, 1.542)	0.02	0.943 (0.722, 1.231)	0.66	1.102 (0.941, 1.283)	0.24		
rather s education level	-	10.0	Ŧ		-	0.01	-	
Illiterate or did primary school	1	0.01	1	0.00	Ι	0.01	l	0.02
Completed middle school	1.549 (0.891, 2.714)	0.12	$1.552\ (0.941,\ 2.561)$	0.09	1.762 (1.224, 2.533)	< 0.001	1.592 (1.073, 2.362)	0.02
Completed secondary school	2.146 (1.413, 3.274)	< 0.001	1.112 (0.652, 1.911)	0.70	1.614 (1.612, 2.241)	< 0.001	1.574 (1.102, 2.244)	0.01
Had a university degree	1.634 (1.062, 2.501)	0.03	1.202 (0.713, 2.023)	0.51	1.497 (1.011, 1.942)	0.05	1.568 (1.092, 2.243)	0.02
Do not know	1.482 (0.471, 4.662)	0.51	1.113 (0.153, 8.083)	0.92	1.203 (0.451, 3.222)	0.72	1.389(0.473, 4.163)	0.56
Mother's education level								
Illiterate or did primary school	1	0.28	1	0.35	1	0.38		
Completed middle school	1.012 (0.549, 1.850)	0.98	1.082 (0.653, 1.772)	0.78	1.212 (0.831, 1.761)	0.31		
Completed secondary school	1.293 (0.861, 1.937)	0.22	0.723 (0.432, 1.232)	0.23	1.013 (0.743, 1.392)	0.94		
Had a university degree	1.466 (0.951, 2.287)	0.08	1.361 (0.751, 2.462)	0.31	1.372 (0.964, 1.944)	0.08		
Do not know	0.563(0.154, 2.072)	0.38	2.881 (0.293, 28.184)	0.36	0.773 (0.281, 2.122)	0.62		
SOC (per unit score)	1.013 (0.991, 1.021)	0.23	1.021 (1.001, 1.041)	0.02	1.022 (1.001, 1.031)	0.01	1.021 (1.001, 1.032)	0.01

Thome & Hallberg 2004). This sex difference in SOC may be explained by different social roles and values assigned to men and women in different cultures and communities. The results of the present study did not support the hypothesis that SOC may explain the sex difference in hygiene behaviours. The association between toothbrushing and sex did not change after adjusting for SOC. This was because girls were more likely to brush their teeth frequently, but boys had a stronger SOC. Similarly, in other studies that reported a sex difference in SOC, boys had a stronger SOC than girls. SOC does not appear to explain the sex difference in toothbrushing behaviours of sixth-grade Iranian adolescents in Mashhad. However, as evident from the diverse results relating to sex differences in SOC in the studies described above, it should be borne in mind that this conclusion may not apply in other societies. SOC is influenced by genetics, culture and social support (Antonovsky 1987) and may manifest differently in other communities.

The results of the initial analysis showed that the association between SOC and toothbrushing frequency was significant among girls and not boys. This may suggest that sex influences this association. However, the interaction between sex and SOC was not significant, and the estimate was not very different between the two sexes. This may be because the study did not have enough statistical power to detect the difference, as it was not designed to be powered to test for interactions.

The association between toothbrushing frequency and age was only significant among boys. However, because the result of interaction between sex and age was not significant, it cannot be concluded that this association is different in boys and girls. This may again be due to lack of statistical power. Previous studies did not provide consistent results. In a multinational study in 32 countries in Europe and North America, а significant positive association between toothbrushing frequency and age was found only in 15 countries such as Italy, France and Russia (Maes et al. 2006). On the contrary, a negative association between toothbrushing and age was reported in countries including Macedonia, Greece, Spain, Israel, Malta, Germany and the Netherlands.

Apart from sex, father's education level was the only socio-demographic

factor associated with toothbrushing frequency. This confirms the findings of Lopez et al. (2006, p. 193), who reported parents' level of education alongside father's income as "the most influential social indicators" of periodontal diseases in adolescents. They demonstrated a social gradient in periodontal diseases as well as oral health behaviours including toothbrushing frequency, and concluded that parents' level of education may "reduce the risk of exposure to damaging factors and reinforce protective health behaviours and psychosocial resources" (Lopez et al. 2006, p. 193). Parental education is also an indicator of occupational status and family income. Mother's education level was not associated with toothbrushing frequency, as in Iran, mothers contribute small amounts to family income, compared with fathers.

Cronbach's α coefficient (0.87) for the Persian SOC-13 was comparable with that of other versions of the SOC-13 (0.70-0.92) (Eriksson & Lindström 2005). This value was higher than the recommended value of 0.70 (Kline 1993), confirming a high internal consistency. Test-retest reliability (0.77) was higher than the range of 0.69-0.72 reported by other studies (Eriksson & Lindström 2005). This was expected, as a shorter interval between measurements (1 week) was used for this study compared with previous studies. These results provide evidence for the reliability of the Persian SOC-13 scale in adolescents.

In conclusion, the present study highlights the importance of SOC as a factor influencing toothbrushing behaviours in adolescents. SOC did not explain the sex difference in toothbrushing behaviours in Iranian adolescents in Mashhad. Further studies are required to investigate factors that may explain the sex difference in hygiene behaviours of adolescents.

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References

- Abel, T., Walter, E., Niemann, S. & Weitkunat, R. (1999) The Berne-Munich lifestyle panel. Background and baseline results from a longitudinal health lifestyle survey. *Sozial- und Präventivmedizin* 44, 91–106.
- Acquadro, C., Conway, K., Giroudet, C. & Mear, I. (2004) Linguistic Validation Manual for Patient-Reported Outcomes (PRO) Instruments. Lyon: Mapi Research Institute.
- Albandar, J. M. (2002a) Periodontal diseases in North America. *Periodontology 2000* 29, 31–69.
- Albandar, J. M. (2002b) Global risk factors and risk indicators for periodontal diseases. *Periodontology 2000* 29, 177–206.
- Albandar, J. M. & Rams, T. E. (2002) Global epidemiology of periodontal diseases: an overview. *Periodontology 2000* 29, 7–10.
- Albandar, J. M. & Tinoco, E. M. B. (2002) Global epidemiology of periodontal diseases in children and young persons. *Periodontology 2000* 29, 153–176.
- Antonovsky, A. (1987) Unraveling the Mystery of Health. How People Manage Stress and Stay Well. San Francisco: Jossey Bass.
- Ayo-Yusuf, O. A., Reddy, P. S. & van den Borne, B. W. (2009) Longitudinal association of adolescents' sense of coherence with tooth-brushing using an integrated behaviour change model. *Community Dentistry and Oral Epidemiology* 37, 68–77.
- Baelum, V. & Scheutz, F. (2002) Periodontal diseases in Africa. *Periodontology 2000* 29, 79–103.
- Bergler, R. (1989) Personal hygiene and cleanliness in an international comparison. Zentralblatt für Bakteriologie, Mikrobiologie und Hygiene. Serie B, Umwelthygiene, Krankenhaushygiene, Arbeitshygiene, präventive Medizin 187, 422–507.
- Biswas, A. B., Roy, A. K., Das, K. K., Sen, A. K. & Biswas, R. (1990) A study of the impact of health education imparted to school children on their knowledge, attitude and practice in regard to personal hygiene. *Indian Journal* of Public Health **34**, 87–92.
- Corbet, E. F., Zee, K. Y. & Lo, E. C. M. (2002) Periodontal diseases in Asia and Oceania. *Periodontology 2000* 29, 122–152.
- Due, E. P. & Holstein, B. E. (1998) Sense of coherence, social class and health in a Danish population study. Ugeskrift for Laeger 160, 7424–7429.
- Eriksson, M. & Lindström, B. (2005) Validity of Antonovsky's sense of coherence scale: a systematic review. *Journal of Epidemiology and Community Health* 59, 460–466.
- Eriksson, M. & Lindström, B. (2006) Antonovsky's sense of coherence scale and the relation with health: a systematic review. *Journal of Epidemiology and Community Health* 60, 376–381.
- Freire, M. C., Sheiham, A. & Hardy, R. (2001) Adolescents' sense of coherence, oral health status, and oral health-related behaviours. *Community Dentistry and Oral Epidemiology* 29, 204–212.

- Gjermo, P., Rosing, C. K., Susin, C. & Oppermann, R. (2002) Periodontal diseases in Central and South America. *Periodontology* 2000 29, 70–78.
- Hodge, H. C., Holloway, P. J. & Bell, C. R. (1982) Factors associated with toothbrushing behaviour in adolescents. *British Dental Journal* 152, 49–51.
- Honkala, E., Kannas, L., Rimpela, M., Wold, B., Aaro, L. E. & Gilles, P. (1988) Dental health habits in Austria, England, Finland and Norway. *International Dental Journal* 38, 131–138.
- Honkala, E., Kannas, L. & Rise, J. (1990) Oral health habits of schoolchildren in 11 European countries. *International Dental Journal* 40, 211–217.
- Honkinen, P. L., Suominen, S., Helenius, H., Aromaa, M., Rautava, P., Sourander, A. & Sillanpää, M. (2008) Stability of the sense of coherence in adolescence. *Int J Adolesc Med Health.* 20, 85–91.
- Jenkins, W. M. & Papapanou, P. N. (2001) Epidemiology of periodontal disease in children and adolescents. *Periodontology 2000* 26, 16–32.
- Jessor, R. (1982) Problem behavior and developmental transition in adolescence. *The Journal of School Health* **52**, 295–300.
- Kark, J. D., Carmel, S., Sinnreich, R., Goldberger, N. & Friedlander, Y. (1996) Psychosocial factors among members of religious and secular kibbutzim. *Israel Journal of Medical Sciences* 32, 185–194.
- Kline, P. (1993) *The Handbook of Psychological Testing*. London: Routledge.
- Koerber, A., Graumlich, S., Punwani, I. C., Berbaum, M. L., Burns, J. L., Levy, S. R., Cowell, J. M. & Flay, B. R. (2006) Covariates of tooth-brushing frequency in low-income African Americans from grades 5 to 8. *Pediatric Dentistry* 28, 524–530.
- Kuusela, S., Honkala, E., Kannas, L., Tynjala, J. & Wold, B. (1997) Oral hygiene habits of 11year-old schoolchildren in 22 European countries and Canada in 1993/1994 65. *Journal of Dental Research* 76, 1602–1609.
- Löe, H. (2000) Oral hygiene in the prevention of caries and periodontal disease. *International Dental Journal* 50, 129–139.
- Lopez, R., Fernandez, O. & Baelum, V. (2006) Social gradients in periodontal diseases among adolescents. *Community Dentistry* and Oral Epidemiology 34, 184–196.
- Macgregor, I. D. & Balding, J. W. (1988) Toothbrushing frequency and personal hygiene in 14-year-old schoolchildren. *Dental Health* 27, 12–15.
- Macgregor, I. D., Regis, D. & Balding, J. (1997) Self-concept and dental health behaviours in adolescents. *Journal of Clinical Periodontology* 24, 335–339.
- Maes, L., Vereecken, C., Vanobbergen, J. & Honkala, S. (2006) Tooth brushing and social characteristics of families in 32 countries. *International Dental Journal* 56, 159–167.
- Nilsson, B., Stegmayer, B., Holmgren, L. & Westman, G. (2002) Sense of Coherence in Two Cross-Sectional Studies in Northern

Sweden 1994 and 1999. Patterns Among Men and Women. Ume ä: Umeä University.

- Nzioka, B. M., Nyaga, J. K. & Wagaiyu, E. G. (1993) The relationship between tooth brushing frequency and personal hygiene habits in teenagers. *East African Medical Journal* 70, 445–448.
- Papapanou, P. N. (1999) Epidemiology of periodontal diseases: an update. *Journal of the International Academy of Periodontology* 1, 110–116.
- Savolainen, J. J., Suominen-Taipale, A. L., Uutela, A. K., Martelin, T. P., Niskanen, M. C. & Knuuttila, M. L. (2005) Sense of coherence as a determinant of toothbrushing frequency and level of oral hygiene. *Journal* of *Periodontology* **76**, 1006–1012.
- Schumacher, J., Wilz, G., Gunzelmann, T. & Brahler, E. (2000) The Antonovsky Sense of Coherence Scale. Test statistical evaluation of a representative population sample and construction of a brief scale. *Psychotherapie*, *Psychosomatik, medizinische Psychologie* 50, 472–482.

Clinical Relevance

Scientific rationale for the study: Although studies have shown the importance of SOC for general health behaviours, little is known about the influence of SOC on oral

- Sheiham, A. & Netuveli, G. S. (2002) Periodontal diseases in Europe. *Periodontology* 2000 29, 104–121.
- Sheiham, A. & Nicolau, B. (2005) Evaluation of social and psychological factors in periodontal disease. *Periodontology* 2000 **39**, 118–131.
- Simonsson, B., Nilsson, K. W., Leppert, J. & Diwan, V. K. (2008) Psychosomatic complaints and sense of coherence among adolescents in a county in Sweden: a crosssectional school survey. *BioPsychoSocial Medicine* 2, 4.
- Streiner, D. L. & Norman, G. R. (2000) Health Measurement Scales. A Practical Guide to Their Development and Use, 2nd edition. New York: Oxford University Press.
- Suominen, S., Helenius, H., Blomberg, H., Uutela, A. & Koskenvuo, M. (2001) Sense of coherence as a predictor of subjective state of health: results of 4 years of follow-up of adults. *Journal of Psychosomatic Research* 50, 77–86.

health behaviours such as toothbrushing.

Principal findings: SOC is significantly associated with toothbrushing behaviours in Iranian adolescents in Mashhad. Taani, D. S., al-Wahadni, A. M. & al-Omari, M. (2003) The effect of frequency of toothbrushing on oral health of 14–16 year olds. *Journal* of the Irish Dental Association 49, 15–20.

Thome, B. & Hallberg, I. R. (2004) Quality of life in older people with cancer – a gender perspective. *European Journal of Cancer Care* 13, 454–463.

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Practical implications: Clinicians should take into account the influence of SOC when implementing programmes promoting oral hygiene.

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