ABSTRACT

Objectives. Our aim was to study the prevalence of oral pain and its association with perceived oral health and with proximal (individual health-related) and distal (sociocultural and environmental) risk factors among adolescents.

Study Design. Cross-sectional questionnaire survey.

Methods. The data were collected in 2001–2002 by questionnaires as part of the 1986 Northern Finland Birth Cohort Study. The number of eligible replies was 7,344 (response rate 80%) among 15/16-year-old adolescents and 6,985 (response rate 76%) among parents. Of the risk factors, sociocultural factors (distal) and unhealthy habits (proximal) were included. Logistic regression analyses were conducted with oral pain as the dependent variable. The independent variables were unhealthy diet, smoking, alcohol use, mother’s/father’s education, financial status, parents’ attentiveness and perceived cavities.

Results. The best predictor of oral pain was perceived cavities. Girls and frequent users of alcohol were more likely to report oral pain than were boys and less frequent users of alcohol.

Conclusions. Even though caries contributed to oral pain among adolescents, there were also other factors involved. Poor health habits such as smoking and alcohol consumption were more common among adolescents who experienced oral pain. Thus, an adolescent’s perceived pain should be treated seriously and be properly attended to by oral health personnel.

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Keywords: adolescent, family, oral health, pain, self-reported
INTRODUCTION

The prevalence of oral pain, one of the severe consequences of oral diseases, has been found to range from 5% to 49% among representative child and adolescent populations in different countries (1–10). Dental caries, a prevalent cause of oral pain, is the most common oral disease, affecting 60% to 90% of school-aged children and adolescents in industrialized countries (11,12). Among Finnish adolescents, caries has shown to be more prevalent in northern parts than in southern parts of the country, as measured by the number of decayed, filled and missing teeth (DMFT index) (13), although the current caries prevalence levels are lower than those among previous generations (14). Provision of oral health services has also been affected by the long distances and lack of dentists in the northern areas. The number of oral health care visits per treated adolescent has noted to be lower in Lapland than in Finland in general (13). Among the other causes of pain and headaches in adolescents are the temporomandibular disorders (TMD) (15,16). Although the signs and symptoms of TMD have been shown to be mild, they are relatively common in childhood, becoming more prevalent in young adulthood (16). Further, oral pain among adolescents may be a result of dental treatment, especially orthodontics (17,18). Symptoms of dental erosion also include tooth sensitivity and pain (19).

Oral diseases are suggested to have their roots in a complex chain of environmental and behavioural events that are shaped by broader socio-economic determinants (20). Dental caries is most often used as a measure to describe adolescents’ oral health. However, according to a commonly accepted conceptual framework, subjective evaluations, such as perceived pain, in addition to clinical indices should be included when oral health outcomes are measured (21–23). Besides clinically determined oral health, certain distal and proximal risk factors affect oral health-related quality of life (11,20). The distal factors include health system and oral health services, sociocultural and environmental risk factors, of which low socio-economic status as well as unhealthy lifestyles are associated with increased levels of oral diseases (12,20,24,25). The proximal factors include the individual’s behaviour, such as use of oral health services and unhealthy habits, of which poor oral hygiene practices, smoking and frequent sugar and alcohol consumption, in particular, are associated with elevated levels of oral diseases (26–30).

Earlier studies have paid little attention to the amount of support children receive from their social network, primarily their parents, support which has been suggested as contributing to child’s oral health (31,32). Families’ goals and values are pursued through daily routines that affect the family’s health (33). Thus, family culture – which comprises health-related habits (diet and hygiene), parents’ rearing style, support for and control of the children as well as the parents’ own behaviour – has an important effect on the oral health and oral hygiene performance of children and adolescents (34–36). Similarities between the health-related habits of parents and their children has also been reported in other studies (37–40). Åström (34) suggests that, based on the strong effects of role-modelling, the family should play a central role in prevention campaigns directed towards adolescents.

Thus, our aim was to study the prevalence of oral pain among adolescents participating in the 1986 Northern Finland Birth Cohort
Study, who have from birth been entitled to free comprehensive oral care services, including preventive care. Additionally, our objective was to study the association between oral pain and other factors such as oral health and proximal and distal risk factors. Our specific aim was to look at the role family circumstances played in oral pain.

MATERIAL AND METHODS

The data for this study were collected as part of the 1986 Northern Finland Birth Cohort Study (NFBC 1986). Originally, the project was set out to explore the genetic and environmental evolution of long-term morbidity, intermediate disease markers, symptom variation and social well-being throughout the life-course. The NFBC study began in 1985 and was known as “the mother–child cohort study of morbidity and mortality during childhood with the special purpose of preventing mental and physical handicap.”

The original sample was collected from a geographically defined area of the two northernmost provinces of Finland. Geographically, the area covers 49% of the country and is inhabited by 12% of the Finnish population. The sample consisted of an unselected, general population-based birth cohort of 9,432 live births, whose expected date of delivery fell in the period between 1 July 1985 and 30 June 1986, representing 99% of all the births in the area. Details of the study’s population and the earlier data collection have been presented elsewhere (41).

In 2001–2002, postal questionnaires were sent to those 15/16-year-old adolescents (n=9,215) and their parents whose home addresses were known. The number of eligible replies was 7,344 (response rate 80%) among adolescents and 6,985 (response rate 76%) among parents. When necessary, two reminders were sent to the selected participants.

The NFBC’s 15/16-year-old follow-up study was a multidisciplinary one that covered several fields, thus only limited space was available for oral health matters. Subjective evaluation of oral health was measured with the question: “Do you currently have any of the following problems: (a) Pain or other symptoms in your mouth? (b) Cavities in your teeth?” The reply choices were “yes” or “no” (1=yes, 0=no). The proximal risk factors included questions about the frequency of alcohol consumption and smoking habits (1=weekly or more often, 0=occasionally to not at all) as well as dietary habits. For dietary habits, four subscales (sweet delicacies, fatty delicacies, lot of sucrose in coffee or tea, irregular eater) indicating different aspects of healthy eating behaviour were formed (Table I). Then, the sum of all subscales was calculated, and those who had 1 or more points were classified as having an unhealthy diet. The distal risk factors included questions on the parents’ education (1=comprehensive school or less, 0=high school) and the adolescent’s perceptions of the family’s financial status (“How do you see your family’s financial status?” 1=some or many economical problems, 0=quite or very good) and parents’ attentiveness (“Are your parents interested in your schooling, hobbies or other things that are important to you?” 1=never-seldom, 0=almost always). All the questions used in the analyses, except for those pertaining to the parents’ education, were derived from the questionnaire for the adolescents.

In the first stage, we examined the bivariate associations of oral pain with perceived cavities and with proximal and distal risk factors.
The statistical differences between groups were evaluated by chi-square tests. As a number of factors were associated with oral pain, we used exploratory multivariable modelling for further data analysis. The dependent variable was oral pain. As there was collinearity between different dietary variables, we made several models in order to use each of the dietary variables separately. Because the effect of an unhealthy diet variable in the models was most clear and accurate when compared with the other four dietary variables, it was chosen for the final models. The other independent variables included were perceived cavities, smoking, alcohol use, mother’s/father’s education, financial status and parents’ attentiveness.

The initial model was defined as a complete model that included all previously mentioned covariates and their first-order interactions. To obtain the most parsimonious and best-fitting model, we then proceeded with the manual backward elimination method excluding all interaction coefficients that did not reach statistical significance (p<0.05). After elimination of non-significant interaction terms, the main effects that did not reach statistical significance (p<0.05) or were not part of a significant interaction term were eliminated manually. We used odds ratios (OR) and their 95% confidence intervals (CI) to estimate the effect of different independent variables on oral pain. The data were analysed using SPSS version 12.0.

**Table I.** Formation of four dietary habit subscales and the final unhealthy diet summary scale and proportions of unhealthy eaters among weekly and non-weekly smokers and alcohol consumers.

| Subscale                  | Points received | Proportion of unhealthy eaters |
|---------------------------|-----------------|--------------------------------|
|                           | Foods included  |                                | Alcohol consumption once a week or more often | Smoking weekly or more often |
|                           | Daily or almost daily eaters | Eating 5 days/week or less often | Recoded as unhealthy eater if the sum of points on the subscale was | Yes n=1530 | No n=645 | Yes n=501 | No n=1101 |
| Sweet delicacies          | Soft drink with sucrose | 1 0 >2 | 8.1 | 7.0 | 10.3 | 6.8 |
|                           | Sweet rolls | 1 0 | (n.s.) | |
|                           | Chocolate | 1 0 | (***
|                           | Sweets | 1 0 | (***
| Fatty delicacies          | Hamburgers or pizza | 1 0 >1 | 2.9 | 1.5 | 3.7 | 1.8 |
|                           | Potato chips | 1 0 | (***
| Lot of sucrose in coffee or tea | Cups of coffee or tea with sucrose | > 3 cups | 13.4 | 9.9 | 19.4 | 9.7 |
|                           | (***
| Irregular eater           | Sum of the number of meals by day during weekdays (breakfast + lunch + dinner + evening snack) | 2 or less | 14.3 | 5.2 | 18.5 | 7.4 |
|                           | (***

P-values for chi-square test between regular and irregular smokers or alcohol consumers

***p<0.001, ns=not significant
The study was approved by the Ethical Committee of the Northern Ostrobothnia Hospital District.

RESULTS

Of the adolescents included in the analyses, 3,508 (52%) were girls and 3,239 (48%) were boys. In total, 260 of the girls (7.4%) and 175 of the boys (5.4%) had experienced oral pain, and the difference was statistically significant at the p=0.001 level. One-fifth of the girls (n=748, 21.3%) and boys (n=691, 21.2%) had perceived cavities in their teeth. The numbers of frequent smokers, alcohol consumers and those with unhealthy diets were 1,403 (19.8%), 169 (2.4%) and 1,602 (22.6%), respectively. Of the children 1,033 (14.6%) reported poor attentiveness by their parents.

Those reporting oral pain more often reported having perceived cavities than those not reporting pain (Table II). Adolescents who had poor dietary habits, used alcohol frequently, came from a poor family and who had little parental attentiveness reported more often that

| Table II. Percentage of adolescents from 1986 Northern Finland Birth Cohort study with and without oral pain by perceived cavities, health habits and socio-economic background. |
|-----------------------------------------------|
| Variable                                      | Oral pain (yes) | Oral pain (no) |
|                                               | n=435 Girls    | n=6312 Girls   |
|                                               | Boys           | Total Girls    | Boys           | Total |
| Perceived cavities                            | 11.0           | 12.0           | 89.0           | 87.8  | 88.0  |
| No perceived cavities                         | 6.0***         | 3.6***         | 4.9***         | 94.0*** | 96.4*** | 95.1*** |
| Smoking weekly or more often                  | 9.4            | 5.8            | 7.9            | 90.6  | 94.2  | 92.1  |
| Smoking not at all—occasionally               | 6.9*           | 5.3 ns         | 6.1*           | 93.1* | 94.7 ns | 93.9* |
| Alcohol once a week or more often             | 8.3            | 6.8            | 7.6            | 91.7  | 93.4  | 92.4  |
| Alcohol not at all—occasionally               | 6.4*           | 4.5*           | 5.4***         | 93.6* | 92.5* | 94.6*** |
| Mother’s educational level comprehensive school of less | 7.5          | 5.4            | 6.5            | 92.5  | 94.6  | 93.5  |
| Mother’s education high school                | 7.4 ns         | 4.6 ns         | 6.1 ns         | 92.6 ns | 95.4 ns  | 93.9 ns |
| Father’s educational level comprehensive school or less | 7.3          | 5.6            | 6.5            | 92.7  | 94.4  | 93.5  |
| Father’s education high school                | 7.8 ns         | 4.1 ns         | 6.0 ns         | 92.2 ns | 95.9 ns  | 94.0 ns |
| Financial status —some or many economical problems | 7.9            | 7.3            | 7.6            | 92.1  | 92.7  | 92.4  |
| Financial status – quite or very good         | 7.3 ns         | 4.9*           | 6.1**          | 92.7 ns | 95.1* | 93.9** |
| Parents’ caring never/seldom                  | 10.5           | 8.4            | 9.5            | 89.5  | 91.6  | 90.5  |
| Parents’ caring almost always                 | 6.9*           | 4.9**          | 5.9***         | 93.1** | 95.1** | 94.1*** |
| Two or less meals per day on weekdays         | 9.9            | 8.1            | 9.5            | 90.1  | 91.9  | 90.5  |
| Three or more meals per day on weekdays       | 6.9*           | 5.2 ns         | 6.0**          | 93.1* | 94.8 ns | 94.0** |
| Two or less meals per day on weekends         | 9.2            | 9.1            | 9.2            | 90.8  | 90.9  | 90.8  |
| Three or more meals per day on weekends       | 6.7*           | 4.7**          | 5.7***         | 93.3* | 95.3** | 94.3*** |
| Sugared tea two times or more per day         | 7.0            | 4.3            | 5.8            | 93.0  | 95.7  | 94.2  |
| Sugared tea once a day or less often          | 7.5 ns         | 5.6 ns         | 6.6 ns         | 92.5 ns | 94.4 ns  | 93.4 ns |
| Sugared coffee two times or more per day      | 10.1           | 5.4            | 6.9            | 89.9  | 94.6  | 93.1  |
| Sugared coffee once a day or less often       | 7.1*           | 5.3 ns         | 6.3 ns         | 92.9* | 94.7 ns | 93.7 ns |
| Sweet delicacies two times or more per day    | 8.2            | 5.7            | 6.8            | 91.8  | 94.3  | 93.2  |
| Sweet delicacies once a day or less often     | 6.9 ns         | 5.2 ns         | 6.2 ns         | 93.1 ns | 94.8 ns  | 93.8 ns |
| Unhealthy diet                                | 9.1            | 6.3            | 7.7            | 90.9  | 93.7  | 92.3  |
| Healthy diet                                  | 6.7*           | 5.1 ns         | 6.0*           | 93.3* | 94.9 ns | 94.0*  |

P-values for chi-square test between adolescents with poor or good habits/background

*p<0.05, **p<0.01, ***p<0.001, ns=not significant.
they had experienced oral pain than adolescents with good dietary habits and a good socio-economic family background. Frequent users of alcohol reported eating more fatty delicacies, drinking more sugared coffee or tea and eating more irregularly when compared with infrequent users of alcohol. A similar pattern of consuming sweet delicacies was observed among frequent smokers (Table I).

Perceived cavities were the best predictor for oral pain, but this association was not very strong (Table III). Girls and frequent users of alcohol were more likely to report oral pain than boys and those who did not consume alcohol frequently. Parents’ attentiveness modified the effect of smoking on oral pain. Of the frequent smokers, those who reported poor parental attentiveness were less likely to report oral pain (OR 0.44, 95% CI 0.25-0.78); among those who reported good parental attentiveness, the effect of smoking on oral pain was opposite but not statistically significant.

**DISCUSSION**

The prevalence of oral pain found in the present study was similar to oral pain reported by adolescents in other countries (7,9,42), but it was lower than in an earlier Finnish study (6) which, however, did not result to regional differences. This could be a result of the differences between the studies in terms of the reference periods and questions, but it could also be a result of improved oral health. In our study, questions were asked about current pain and symptoms, and thus a lower percentage can be expected compared with studies with longer reference periods (6,7,42). Because the large cross-sectional study included questions concerning several fields of medicine, the number of dental questions was restricted as was the clinical data, and thus these became the limitations of the study. However, sufficient data on proximal and distal factors were available to evaluate their association with pain. Even though the presence of cavities was evaluated only by the participants, the results support the previous finding on the importance of caries as a main cause of toothaches (5) implicating the validity of the question. Additionally, perceived cavities reflected the earlier reported prevalence of dental caries as being only slightly lower than that reported in Finland and in Sweden (43,44). This finding suggests that self-reported estimates can be considered rather reliable, especially as the coverage of oral health care in Finland is very high, especially in the northern regions where it was highest in Finland in 2000 (13).

Taking into account the representativeness and the high response rate of this study,

| Variables and their dichotomization | Crude OR | OR  | 95% CI  |
|-------------------------------------|----------|-----|---------|
| Perceived cavities (1=yes)          | 2.66     | 2.57| 2.09–3.17|
| Gender (1=girl)                     | 1.40     | 1.35| 1.10–1.65|
| Alcohol (1=weekly or more often)    | 1.45     | 1.29| 1.04–1.61|
| Smoking (1=weekly or more often)    | 1.31     |     |         |
|                                      |          |     |         |
| among those who reported their parents’ cared never or seldom | 0.44 | 0.25–0.78 |
| among those who reported their parents’ cared almost always | 1.20 | 0.91–1.59 |
our findings lead to the concern that the oral health services do not take care of all children experiencing oral pain (6). Those who reported having cavities in their teeth were almost three times more likely to report oral pain as compared with those who did not report cavities. However, it should be taken into account that other oral diseases such as TMD, occlusal problems (15,16) or orthodontic treatment (17,18) might also be associated with the reported oral pain. Even though cavities are well taken care of by the oral health system, TMD problems are often neglected (45). In the present study, girls were more likely to report oral pain, but no gender differences in who was reporting the cavities were observed. Our result agrees with several studies in which gender-related differences in pain perception and behaviour have been reported, in such a way that girls and women report more pain than do boys and men (46,47). Research suggests that the influence of gender on the processing and experience of pain is a result of several mechanisms (48). One mediating variable is emotion, and it has been suggested that gender differences in the experience of pain may arise from differences in the experience and processing of emotion that, in turn, differentially alter pain processing (48). Further, the findings by Myers et al. (49) suggest that gender socialization influences young people’s pain responses and highlight the importance of a multifactorial developmental approach to studying the impact of gender socialization on the emergence of sex differences in pain responses after puberty.

Supportive parenting styles, social supports and controls, good parental examples and other positive family characteristics have been associated with better perceived oral health (31,32,34–36, 40), while living with single parents or other people than parents is a higher likelihood for oral pain (51). Among adolescents who smoke, those who reported a lack of attentiveness by their parents showed a decreased risk of reporting oral pain. This may indicate that smoking itself can be used for controlling poor health such as oral pain, especially in a situation where little support is received from the parents; but it can also be due to the fact that if the child feels rejected or treated indifferently, it is difficult for him/her to recognize or report his/her own sensations (52). On the other hand, the findings that smoking and alcohol consumption were associated with subjective oral health support the common risk-factor approach (53), suggesting that the same risk factors that contribute to poor perceived health in general also contribute to poor oral health (54).

The association between perceived cavities and oral pain might reflect inappropriate oral health care. However, providing oral health care for children is a complex interaction between the child and his/her parents where the factors related to parental norms, knowledge, attitudes, behaviour and education are associated with the parents’ abilities to conduct or promote adequate dental health behaviour in their children (33,34,54,55). It seems that a low educational level, low social class and inconsistent and unsupportive rearing styles often go hand in hand (35,36,50,56). Therefore, it is important to invest in supporting factors associated with parenthood. According to Sanders and Spencer (35), the quality of parenting was significantly associated with the child’s psychosocial attributes later in life; and those who described their upbringing as negative and unsupportive reported statistically significantly poorer oral health.
Oral pain among adolescents in northern Finland

Conclusions

Our findings suggest that even though poor oral health in the form of perceived cavities contributed to oral pain among adolescents in northern Finland, other factors were also important. Thus, adolescents’ oral pain should be taken seriously and be properly attended to by oral health personnel. Poor health habits such as smoking and alcohol consumption were more common among adolescents with oral pain than among those who reported having no pain. Oral health personnel should understand and implement a common risk-factor approach in their prevention activities among adolescents, since habits related to oral health also affect an adolescent’s overall health.

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Satu Lahti, Department of Community Dentistry
Institute of Dentistry
P.O. Box 5281
FIN-90014 University of Oulu
FINLAND
Email: satu.lahti@oulu.fi

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