



Turun yliopisto  
University of Turku

# CHILD DENTAL FEAR

Individual and Family-Level Changes and  
Oral Health-Related Quality of Life

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Anni Luoto

## University of Turku

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Faculty of Medicine

Department of Community Dentistry

Finnish Doctoral Program in Oral Sciences (FINDOS-Turku)

## Supervised by

---

Professor Satu Lahti

Department of Community Dentistry

Institute of Dentistry

University of Turku, Finland

Docent Mimmi Tolvanen

Department of Community Dentistry

Institute of Dentistry

University of Turku, Finland

## Reviewed by

---

Professor Gunilla Klingberg

Department of Pediatric Dentistry

Institute of Dentistry

University of Malmö, Sweden

Professor Magnus Hakeberg

Department of Behavioral

and Community Dentistry

Institute of Odontology

Sahlgrenska Academy

University of Gothenburg, Sweden

## Opponent

---

Professor Heikki Murtomaa

Department of Oral Public Health

Institute of Dentistry

University of Helsinki, Finland

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**DON'T PANIC**

*- Douglas Adams, Hitchhiker's Guide to the Galaxy*



## ABSTRACT

Anni Luoto

### **Child Dental Fear – Individual and Family-Level Changes and Oral Health-Related Quality of Life**

University of Turku, Faculty of Medicine, Department of Community Dentistry

Finnish Doctoral Program in Oral Sciences (FINDOS-Turku)

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The objective of this thesis was to study if dental fear of children and their parents and changes in it are associated, if children and parents can evaluate each other's fear, and if children's oral health-related quality of life is associated with their fear.

Two different data from questionnaire surveys were used: (1) Child and parental dental fear was evaluated at three time points and studied as parent/child dyads and at individual level when the children were 11–12, 13–14, and 15–16 years old. The number of participants included in the analyses varied according to the study design from 817 to 2,124. (2) 11–14-year-old children's oral health-related quality of life and dental fear were evaluated (n=133).

Children of fearful parents were more often fearful in early adolescence, but only girls displayed dental fear also in their mid-adolescence. Neither the parents nor the children were able to correctly evaluate each other's fear. Dental fear of the children and parents was no longer statistically significantly associated when adjusted to the children's evaluation of their parents' dental fear. Dental fear did not change similarly between the parents and their children. Dental fear seems to be more stable among adults than among children. The females were more likely to be fearful than the males. Fearful children had poorer oral health-related quality of life, especially in terms of their social and emotional wellbeing, than non-fearful children.

In addition to oral health, dental fear can affect a child's life in general. Fear should be enquired from the children themselves when studying the fear of 11–16-year-olds. Furthermore, it would be worthwhile to address fear already during the childhood and to acknowledge girls' higher risk of developing fear.

**Keywords:** dental fear, parent/child dyad, self-reported, longitudinal, oral health, quality of life



## TIIVISTELMÄ

Anni Luoto

### **Lasten hammashoitopelko – yksilölliset ja perhetason muutokset sekä suunterveyteen liittyvä elämänlaatu**

Turun yliopisto, Lääketieteellinen tiedekunta, Sosiaalihammaslääketieteen oppiaine

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Tämän väitöskirjatyön tavoitteena oli selvittää lasten ja vanhempien hammashoitopelkojen välistä yhteyttä, hammashoitopelkojen muuttumista ja muutosten välistä yhteyttä sekä lasten ja vanhempien tietoa toistensa hammashoitopeloista. Lisäksi selvitettiin lasten hammashoitopelon ja lasten suunterveyteen liittyvän elämänlaadun välistä yhteyttä.

Väitöskirjatyössä käytettiin kahta eri kyselytutkimusaineistoa: (1) Lasten ja vanhempien hammashoitopelkoa tutkittiin yksilötasolla sekä lapsi/vanhempi-pareilla lasten ollessa 11–12-, 13–14- ja 15–16-vuotiaita pitkittäis- ja poikkitaasisetelmillä. Tutkittavien määrä vaihteli asetelmittain (n=817–2 124). (2) Lasten suunterveyteen liittyvää elämänlaatua ja hammashoitopelkoa puolestaan arvioitiin 11–14-vuotiailla (n=133) poikkitaasisaineiston perusteella.

Pelkäävien vanhempien lapsilla oli hammashoitopelkoa 11–12-vuotiaina useammin kuin muilla ikätovereillaan, mutta 15–16-vuotiaina vain pelkäävien vanhempien tyttäret olivat useammin pelkääviä. Vanhemmat ja lapset eivät tunnistanee toistensa hammashoitopelkoa. Kun otettiin huomioon lasten arvio vanhemman pelosta, vanhempien ja lasten pelon välinen yhteys ei enää ollut tilastollisesti merkitsevä. Vanhempien ja lasten hammashoitopelot eivät muuttuneet samanaikaisesti eikä samalla tavalla. Hammashoitopelko oli stabiilimpaa aikuisilla kuin 11–16-vuotiailla lapsilla. Naiset pelkäsivät hammashoittoa todennäköisemmin kuin miehet. Pelkäävien lasten suunterveyteen liittyvä elämänlaatu – etenkin sosiaalinen ja emotionaalinen hyvinvointi – oli huonompi kuin ei-pelkäävillä.

Hammashoitopelko vaikuttaa lapsen elämän muihinkin osa-alueisiin kuin vain suunterveyteen. Koska vanhemmat eivät tunnista lastensa todellista hammashoitopelkoa, heitä ei tulisi käyttää tiedonlähteinä ainakaan 11–16-vuotiaiden lasten hammashoitopelkoa tutkittaessa, vaan hammashoitopelosta tulisi kysyä lapselta itseltään. Hammashoitopelkoon kannattaisi puuttua jo lapsuudessa/nuoruudessa. Lisäksi pitäisi huomioida, että tytöille kehittyvä voimakas hammashoitopelko teini-iässä poikia useammin.

**Avainsanat:** hammashoitopelko, lapsi/vanhempi-pari, itsearvio, pitkittäinen, suunterveys, elämänlaatu



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## ABBREVIATIONS

|           |  |
|-----------|--|
| AD        | Attending the Dentist factor   |
| CFSS-DS   | Children's Fear Survey Schedule – Dental Subscale                                |
| CLP       | Cleft Lip and/or Palate  |
| CPQ11–14  | Child Perceptions Questionnaire for 11–14-year-old children                      |
| DMFT      | Number of Decayed, Missing and/or Filled permanent Teeth                         |
| dmft      | Number of decayed, missing and/or filled primary teeth                           |
| dmft/DMFT | Sum of dmft and DMFT   |
| DMFS      | Number of Decayed, Missing and/or Filled Surfaces of permanent teeth             |
| DSM-IV    | Diagnostic and Statistical Manual of mental disorders                            |
| FDI       | World Dental Federation  |
| GF        | General Fear   |
| ICD-10    | International statistical Classification of Diseases and related health problems |
| MCFSS-DS  | Modified Children's Fear Survey Schedule – Dental Subscale                       |
| MDAS      | Modified Dental Anxiety Scale  |
| OHP       | Oral Health Promotion program  |
| OR        | Odds Ratio   |
| OHRQoL    | Oral Health-Related Quality of Life  |
| r         | Spearman correlation coefficient   |
| RCT       | Randomized Clinical Trial  |
| TDD       | Treatment of Dental Decay factor   |



## LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following articles, which are referred to in the text by roman numerals I–IV. The original publications have been reproduced with the permission of the copyright holders.

- I. Luoto A, Tolvanen M, Pohjola V, Rantavuori K, Karlsson L, Lahti S. A longitudinal study of changes and associations in dental fear in parent/adolescent dyads. *Int J Paediatr Dent* 2017 Jan 28. doi: 10.1111/ipd.12289. [Epub ahead of print].
- II. Luoto A, Tolvanen M, Rantavuori K, Pohjola V, Lahti S. Can parents and children evaluate each other's dental fear? *Eur J Oral Sci* 2010; 118: 254–258.
- III. Luoto A, Tolvanen M, Rantavuori K, Pohjola V, Karlsson L, Lahti S. Individual changes in dental fear among children and parents: A longitudinal study. *Acta Odontol Scand* 2014; 72: 942–947.
- IV. Luoto A, Lahti S, Nevanperä T, Tolvanen M, Locker D. Oral health-related quality of life among children with and without dental fear. *Int J Paediatr Dent* 2009; 19: 115–120.



# 1 INTRODUCTION

*Fear, stuck in my chest and pressing my lungs. Fear, unbearable, clouding my judgement and I'm starting to lose my grip on reality. Fear, excruciating, shattering my self-esteem. Fear seizes me, I shudder and am scared to death.*

One of the basic human emotions is fear. Fear is not pathologic basically; it is just a reaction to avoid danger. Every one of us has been at least a little afraid of going to the dentist as a child. Some because they know by experience what will happen and others because they do not know what will happen to them. Whether one learns to bear the emotion depends on various factors. Fear is not only a biological and psychological but also a social and cultural phenomenon. The differentiation between normal fear and pathological fear, especially in children, can sometimes be difficult because many fears are part of children's normal development. Nevertheless, if one tries to avoid fear-induced situations whenever possible, the fear degenerates into pathological fear and begins to affect the quality of life.

One of the fears which can degenerate into the pathological state is dental fear. Dental fear is restricted to a precisely defined situation or target, and the etiology of dental fear is multidimensional. The dominating factor behind dental fear is often previous traumatic and unpleasant dental experience. Many Finnish adult dental fear patients relate their dental fear to one or more negative dental experiences, such as bad experiences from elementary school dental care. Transmission of negative information may also cause dental fear. Stories about the treatment being painful can make the upcoming procedure threatening. In addition, personality and its wide spectrum of vulnerabilities can also affect dental fear.

Dental fear can cause considerable challenges to children suffering from it: dental fear hinders rather than promotes the development of the child. Child dental fear can also cause challenges to the parents by challenging their parenting skills, as well as to the oral health care personnel by causing stress to them when carrying out treatments and interacting with the child. My personal interest in the subject of dental fear in general and the multidimensionality of child dental fear and its potential lifelong effects on the quality of life were the main inspirations behind this study.

## 2 REVIEW OF LITERATURE

### 2.1 Definitions

Fear, anxiety and phobia are emotions of apprehension. Fear is one of our basic emotions and part of the child's normal development; it is a reaction to avoid danger (Beesdo-Baum & Knappe 2012). While fear is an emotional response to a real or unreal threat, phobia is an intense, specific fear which interferes with one's ability to function. Compared to fear, anxiety is more diffuse, non-specific, and can be experienced without any stimulus (Table 1). According to the Classification of Mental and Behavioral Disorders (ICD-10/F40.2) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5/300.29), dental fear is a specific phobia which is restricted to a precisely defined situation or target and being in contact with the trigger can cause panic attacks. In this study, the term *dental fear* covers both fear and anxiety.

**Table 1. Definitions of fear, anxiety and phobia**

|                              | Fear   | Anxiety  | Phobia  |
|------------------------------|--|--|---|
| Definition                   | Apprehension with specific cause   | Apprehension without apparent cause  | Severe specific irrational fear, interferes with normal life                |
| Manifestation in dental care | Normal unpleasant and uncomfortable emotional reaction during dental treatment | Unpleasant and uncomfortable emotional reaction due to the thought of future dental appointment with a sense of losing control | Persistent emotional reaction towards dental care, avoidance of dental care |

## 2.2 Etiology

The etiology of dental fear is multidimensional. According to Weiner & Sheehan (1990), and supported in many other studies (e.g. Berggren 1992, Roy-Byrne 1994, Locker *et al.* 2001, Thomson *et al.* 2009, Pohjola *et al.* 2011), dental fear consists of both exogenous and endogenous factors. *Exogenous dental fear* originates from external and specific situations. According to Rachman's (1977) theory of fear, there are three major exogenous pathways that can also be applied to dental fear: classical conditioning, vicarious learning, and transmission of information (Table 2).

**Table 2. Rachman's three pathways to fear**

| Classical conditioning                            |   | Vicarious acquisition/learning                        | Fear acquisition by transmission of information/instruction |
|---|---|---|---|
| Direct  | Indirect  |   |   |
| Displaying fear of situations one has experienced | Displaying fear of situations one has not experienced | Learning from the behavior of the parents or of peers | Getting information and instructions from the environment   |

Behind *endogenous dental fear* are internal factors, such as personality and temperament (easy, difficult and slow-to-warm-up) (Thomas & Chess 1977), behavioral management problems (Murray *et al.* 1989, Arnrup *et al.* 2002a, Klingberg *et al.* 2007), and cognitive vulnerability (Armfield *et al.* 2008, Crego *et al.* 2013), not forgetting psychological disorders along with other fears, anxieties, and depression (Pohjola *et al.* 2011). Endogenous dental fear can also manifest as minor medical conditions, such as tachycardia, nausea, or dizziness (Milgrom *et al.* 2009).

## 2.3 Treatment experiences

Knowledge of the causes of child dental fear provides dentists with better possibilities to prevent and treat the dental fear. The dominating factor behind dental fear is suggested to be direct classical conditioning by people displaying fear of situations they have experienced, such as

previous traumatic and unpleasant dental experiences (Davey 1989, Weiner & Sheehan 1990, ter Horst & de Wit 1993, Klingberg 1995, Milgrom *et al.* 1995, Locker *et al.* 1996, Kruger *et al.* 1998, Locker *et al.* 1999, Poulton *et al.* 2001, Rantavuori *et al.* 2002, ten Berge *et al.* 2002, Karjalainen *et al.* 2003, Milsom *et al.* 2003, Rantavuori *et al.* 2004, Klingberg *et al.* 2007, Lahti *et al.* 2007, Thomson *et al.* 2009). The association between negative experiences and dental fear can even follow from a single dental treatment situation. Children's dental fear has been reported to be in association with previous dental treatment situations, such as extractions, pain, drilling, or local anesthesia (ten Berge *et al.* 2002, Milsom *et al.* 2003, Karjalainen *et al.* 2003, Rantavuori *et al.* 2004). Caries experience has been reported to be associated with dental fear, and children with caries (dmft/DMFT>0) have been reported to have dental fear more likely than children without caries (Lahti *et al.* 1989, ten Berge *et al.* 2002, Karjalainen *et al.* 2003, Milsom *et al.* 2003, Rantavuori *et al.* 2004). Thomson *et al.* (2009) have reported that high dmft scores at the age of five prognosticate stable dental fear later in life, whereas the lowest DMFS scores throughout their study were found in the stable non-fearful group. Dental fear due to classical conditioning can lead to avoidance of regular visits to the dentist, high level of caries, and failure to adopt preventive dental health care practices, which are also related to dental fear (Poulton *et al.* 2001).

People may also have dental fear even though they have not had any negative or painful experiences. When applying Rachman's theory of fear (1977) to dental fear in such a case, the pathway to fear could be due to indirect conditioning or transmission of information, where people display fear of dental situations they have not experienced. For example, one assumes to know that the treatment must be painful, in which case the situation becomes threatening. A child with a belief that the upcoming procedure is potentially threatening, compared to a child with neutral beliefs about the outcome of the procedure, may be more likely to evolve fear after a traumatic situation (Askew *et al.* 2016).

## **2.4 Dental fear in relation to child development**

There are many different developmental theories on the progress of psychological development. (Table 3) Psychological development should be taken into account when studying child dental fear and changes in dental fear, because children's ability to understand different situations

and experiences is associated with their psychological development, especially logical thinking and cognitive development. From a psychological point of view, adolescence is a period when a child meets new challenges while growing up from childhood to adulthood by developing personality with individual attitudes, preferences, and opinions. Because this study focuses on children aged from 11 to 16 years old (who were in their early adolescence at the baseline and in their mid-adolescence at the end of the study) and partly on their parents, the review of psychological development and development of dental fear focuses on this development phase.

**Table 3. Theories of psychological development and development phases concerning 11–16-year-olds**

|            | Psychosexual development by Freud (1905)   | Cognitive development by Piaget (1958,1966)   | Psychosocial development by Erikson (1950)  | Moral development by Kohlberg (1958)  |
|------------|--|---|---|---|
| Definition | The development of sexuality and its meaning to later phases of life. Describes the development of the personality through child's psychosexual energy.  | Focuses on thinking, reasoning, and logical deduction. Children of the same age tend to make similar conclusions.   | Child confronts different crises in different phases of life which have to be solved for balanced development.  | Expanded Piaget's work. Child's idea of moral changes throughout different phases of development.   |
| Phase      | Latency stage: Play and friends. Efficient learning. Gender is subsidiary, sexual interests are repressed.<br><br>Genital stage: Puberty begins, awakening of sexual identity and sexual feelings. | Formal operational stage: Advanced thinking, development of hypothetical reasoning, understanding of abstract and theoretical concepts, use of logic, creative problem solving solutions. | Early school age: Importance of learning, getting feedback, and experiences of success.<br><br>Youth: Search of the identity and experiments of behavior. Successful experiments lead to intact identity. | Conventional moral: Child begins to picture the right and wrong from a community perspective.<br><br>Traditional moral: Moral standard of the adolescent is defined for both the benefit of one's own and the benefit of the community. |

### 2.4.1 Cognitive development

Of the psychological development theories, Piaget's theory of cognitive development (Piaget & Inhelder 1958, 1966) is one of the important ones. According to Piaget & Inhelder (1958, 1966), children go through four phases of cognitive development (Table 4). When the formal operational phase begins, the child's thinking starts to change to the hypothetical level, and the emotional life is greatly associated with social life and the community. Children's growth towards independence is promoted, and detaching from one's parents is assisted by the peers, who become more important in the child's (social) life – the company of the peers strengthens the child's ego and identity.

**Table 4. Phases and characteristics of cognitive development by Piaget**

| Phase                | Age     | Characteristics  |
|----------------------|---------|--|
| Sensorimotor         | Birth–2 | Fast cognitive growth, gaining knowledge through senses and motor movements, interaction with the environment  |
| Preoperational       | 2–7     | Understanding of symbolic play and development of dealing with symbols   |
| Concrete operational | 7–11    | Development of logical thought of concrete and specific matters  |
| Formal operational   | 11→     | Advanced thinking, development of hypothetical reasoning, understanding of abstract and theoretical concepts, use of logic, creative problem solving solutions |

### 2.4.2 Learning theory

Maturation of intelligence is an important part of psychological development, and experience is needed for the intelligence to develop (Piaget 1952). Experience and practice form the basis for learning, and learning theory is based on the behaviorist interpretation, which can also be applied to dental fear (Table 5). Watson (1928) is regarded as the driving force behind learning theory. He emphasized studying the external behavior instead of the internal, mental process. Others who have influenced the formation of learning theory are Pavlov through his concept of learning through classical conditioning (1927), Skinner through his operant conditioning (1965), and Bandura through his social learning theory (1977). Pavlov stated that when a conditional stimulus precedes

frequently enough an unconditional stimulus which induces a specific reaction, the conditional stimulus begins to induce the same reaction as the unconditional stimulus. Skinner stated that behavior is a result from a combination of a stimulus and reaction, and Bandura that observation, imitation, and modeling are the learning pathways to behavior.

**Table 5. Learning pathways by Watson, Pavlov, Skinner, and Bandura applied to dental fear**

|                        | Definition  | How to put into practice  |
|------------------------|---|---|
| Habituation            | Adaptation to a repetitive stimulus   | Annual check-ups, conditioning, and gradual exposure to dental treatments   |
| Classical conditioning | Reactions to a new stimulus become common, an unconditional reaction becomes a conditional reaction   | Unwanted and harmful emotional attachments can be treated by associating positive emotions to dental fear-inducing situations and supporting the child's self-control during dental treatment   |
| Operant conditioning   | Learning through consequences, as behavior causes consequences and consequences influence the recurrence of the behavior. Conditioning is often subconscious and the child learns the consequences of the behavior unconsciously  | Positive consequences support the wanted behavior: applauding when the child cooperates. Negative consequences weaken the unwanted behavior: clarify and explain why the treatment did not go well. Negative consequences support the wanted behavior: if treatment is always stopped because the child is screaming, the child continues the behavior to escape the situation. Behavior without any consequences weakens the unwanted behavior: e.g. ignoring false crying |
| Imitation              | Learning from the behavior of the parents or of peers. Often subconscious, and the effect increases if the role model is important to the child and if the behavior is reinforced. Especially social interactions, role behavior, and emotional relations are learned through imitation | Positive attitude towards the upcoming treatment. A child with neutral beliefs about the outcome of the dental procedure unlikely evolves fear after a traumatic situation compared to a child with negative beliefs  |
| Cognitive learning     | Learning through verbal constructions. Central learning pathway for school-age children. Essential factor is how the experiences are interpreted and remembered and the significance of the experience.   | The aim is to change the cognition and emotions by changing the behavior. Behavior can also be changed by changing the cognition. "Tell-Show-Do" and supporting child's sense of control during the treatment   |

Learning theory has many links to Rachman's (1977) theory of fear acquisition. During maturation and psychological development from childhood to adulthood, the psychosocial environment affects the developing individual both positively and negatively. Children can get negative information and instructions about dental treatments from their parents, family members or peers by the transmission of information, according to Rachman's (1977) theory of fear acquisition. In pursuance of developing cognitive skills, the child forms new associations conditioned by latent inhibition. Latent inhibition is a behavioral phenomenon, which has been studied both in animals and humans (Lubow 1973, Rodríguez & Hall 2016). By latent inhibition, children learn to ignore or reduce attention to irrelevant stimuli. Pre-learning neutral situations with a stimulus by latent inhibition may inhibit the later vicarious fear acquisition. For example, the conditioning and gradual exposure of children to dental treatments may prevent dental fear (Poulton *et al.* 2001, Klaassen *et al.* 2008, Nicolas *et al.* 2010); although Rantavuori *et al.* (2014) have reported that this may not apply to orthodontic treatments.

### ***2.4.3 Personality and temperament***

Acquisition of dental fear is also affected by personality. In other words, not all negative experiences cause fear to everyone. Because every child has individual personality and temperament – which forms the basis of the personality – their experiences of similar situations vary individually. Thomas & Chess (1977) have categorized *temperament* into three groups: Children with easy/flexible temperament are positive and adjust easily to new situations, whereas children with difficult/feisty temperament are more often negative and adjust slowly to new situations and tend to respond negatively to changes. Children who have slow-to-warm-up/fearful temperament express their feelings poorly and are typically wary and fearful in new situations. Slow-to-warm-up/fearful temperament is suggested to be associated with the risk of developing a social anxiety disorder in childhood (Buss *et al.* 2013, Buss & McDoniel 2016). Slow-to-warm-up/fearful children adjust somewhat slowly to changes and tend to avoid new situations. At rest or during a task, slow-to-warm-up/fearful children have also increased physical reactivity.

Because of the different phases of the child development, researchers have been intrigued by the question when the child is in the most vulnerable phase to develop dental fear. Dental fear has been suggested to be either early-onset (prior to the age of 18 years) or late-onset (after the age of 18 years) (Poulton *et al.* 2001, Thomson *et al.* 2009). Although recollection of traumatic dental experiences can be biased by fallacy, in two population-based studies from two-thirds up to a half of the subjects reported their dental fear to originate in their childhood (Milgrom *et al.* 1988, Locker *et al.* 1999). Children with endogenous risk factors – nervous, sensitive, and prone to worry – are likely to develop early-onset dental fear (Poulton *et al.* 2001, Thomson *et al.* 2009). Dental fear related to the treatment of dental caries has been reported to be more usual among older than younger children, whereas dental fear related to attending the dentist has been reported to be more usual among younger than older children (Rantavuori *et al.* 2004). This may be due to the likelihood that older children have more experiences of dental treatments compared to younger children. In addition, logical thinking develops as the child matures (Piaget & Inhelder 1958, 1966) and the child learns to connect dental fear with a certain situation better than when the child was younger. However, experience of caries lesions/dental treatments of caries lesion at the age of five has been reported to predict stable dental fear later in adulthood (Thomson *et al.* 2009).

#### **2.4.4 Prevalence of dental fear**

Due to maturation and psychological development, the age of the child has to be acknowledged when measuring the child's dental fear because the prevalence and dimension of dental fear differs with age (Rantavuori *et al.* 2004). Depending on the population, dental fear measures used, and the age of the respondents, the prevalence of child-reported child dental fear between 5 and 18 years of age has been reported to vary from 7.1 to 19.5% (Milgrom *et al.* 1995, Raadal *et al.* 1995, Bergius *et al.* 1997, Taani *et al.* 2005, Rantavuori *et al.* 2009). Younger children have been found to report more often dental fear compared to older children (Milgrom *et al.* 1995, Raadal *et al.* 1995, Wogelius *et al.* 2003); however, one study (Rantavuori *et al.* 2004) has found opposite results: in a population of 3–15-year-old Finnish children, dental fear was more common among 12–15-year-olds than among 3–9-year-olds (Rantavuori *et al.* 2004). Change in child dental fear is barely studied, and only a few longitudinal studies of child dental fear are child-reported (Thomson *et al.* 1997, Thomson *et al.*

2009), especially by children under 16 years of age (Murray *et al.* 1989). In longitudinal studies, the prevalence of child-reported dental fear has been reported to increase between the ages of 9 and 12 years, but the increase was statistically significant only among girls (Murray *et al.* 1989). Among adolescents, the prevalence of dental fear has been reported to decrease between the ages of 15 and 18 years (Thomson *et al.* 1997). In longitudinal studies of child dental fear evaluated by parents, the prevalence of dental fear has been found to increase between the ages of 5 and 9 years (Tickle *et al.* 2009) but also to decrease between the ages of 5 and 8 years and 10 and 13 years (Klaassen *et al.* 2008).

Among adults, the prevalence of dental fear has been reported to vary between 2.2–45% (Hägglin *et al.* 1999, Thomson *et al.* 2000, Lahti *et al.* 2007, Nicolas *et al.* 2007, Armfield *et al.* 2009, Humphris *et al.* 2013, Liinavuori *et al.* 2016). In longitudinal studies, dental fear has been reported to increase more among younger adults than among older adults (Locker & Liddell 1995, Hägglin *et al.* 1999, Thomson *et al.* 2000, Maggiriias & Locker 2002, Thomson *et al.* 2009, Liinavuori *et al.* 2016). In Finnish studies, 2.2–19% of Finnish adults aged 30 years or older reported having dental fear, and dental fear was found to be more common among younger than older adults, especially among 30–34-year-olds. (Lahti *et al.* 2007, Liinavuori *et al.* 2016)

## 2.5 Sex

In certain phases of development, children learn if evincing their emotions is socially approved according to their age and sex. The sex differences may result from girls' and boys' different social experiences. Children learn different behavioral models from the environment through imitation or from the behavior of their parents or peers. (Bussey & Bandura 1999)

In most studies, sex is associated with dental fear. Longitudinal and cross-sectional studies (Murray *et al.* 1989, Chellappah *et al.* 1990, Alvesalo *et al.* 1993, Klingberg *et al.* 1994a, Klingberg *et al.* 1994b, Bergius *et al.* 1997, Thomson *et al.* 1997, Thomson *et al.* 2000, ten Berge *et al.* 2002, Wogelius *et al.* 2003, Baier *et al.* 2004, Rantavuori *et al.* 2004, Taani *et al.* 2005, Klaassen *et al.* 2008, Rantavuori *et al.* 2009, Thomson *et al.* 2009, Tickle *et al.* 2009, Ray *et al.* 2010, Rantavuori *et al.* 2014) have found girls to report dental fear more likely compared to boys. Signs of sex differences in child-reported dental fear have been reported to show at the youngest

among 9-year-old children (Murray *et al.* 1989). On the other hand, Rantavuori *et al.* (2009) found no sex differences when reporting dental fear among children younger than 15 years of age (Rantavuori *et al.* 2009). Between the ages from 5 to 8 years and 10 to 13 years, dental fear of the boys has been reported to decrease. For girls, the decrease in dental fear between 5 and 8 years and 10 and 13 years has been reported to be statistically non-significant (Klaassen *et al.* 2008). On the other hand, Murray *et al.* (1989) have reported girls' dental fear to increase between 9 and 12 years of age, whereas the increase of boys' dental fear was reported to be statistically non-significant. Among adults, females are more likely to report dental fear than males (Skaret *et al.* 1998, Ragnarsson *et al.* 2003, Schuller *et al.* 2003, Lahti *et al.* 2007, Vika *et al.* 2008, Thomson *et al.* 2009, Pohjola *et al.* 2011, Humphris *et al.* 2013, Liinavuori *et al.* 2016). Eight-year incidence rates of dental fear according to sex (14.7% males, 18.4% females) have been reported only in two studies from the same data set (Locker *et al.* 2001, Thomson *et al.* 2000), but to my knowledge there are no reports on the incidence of dental fear separately for girls and boys. Furthermore, no studies have been reported on the incidence of dental fear separately for girls, boys, mothers, and fathers or on sex differences with respect to change in child dental fear.

## 2.6 Parent/child dyad

### 2.6.1 *Dental fear, association and changes*

Simultaneous influence of family members and other psychosocial environments on child dental fear is barely studied. The influence of the role model is often unconscious, and the more important the role model is to a child, the more intense the effect is. Not only socialization, role behavior, and emotional relations (Bandura 1977) but also fear can be learned through vicarious learning (Rachman 1977).

It has been suggested that parents transfer their dental fear to their children either through vicarious learning (Milgrom *et al.* 2009) or at a subconscious level (Klingberg & Berggren 1992, Kinirons & McCabe 1995, Townend *et al.* 2000, Arnrup *et al.* 2002, ten Berge *et al.* 2002, Rantavuori *et al.* 2009, Olak *et al.* 2013), or cognitively (Tuutti & Lahti 1987, Lahti *et al.* 1989). For example, a child can hear the parents' negative conversation about dental care or see the parents' negative reaction to dental care.

Because of the parents' behavior, the child may learn that dental situations are intimidating. However, to my knowledge, there are no reports on the association of dental fear changes between children and their parents.

The results of association between child and parental dental fear are mainly based on cross-sectional data (Tuutti & Lahti 1987, Lahti *et al.* 1989, Folayan *et al.* 2002, Rantavuori *et al.* 2002, Arnrup *et al.* 2003, ten Berge *et al.* 2003, Arnrup *et al.* 2004, Balmer *et al.* 2004, Peretz *et al.* 2004, Rantavuori *et al.* 2004, Klaassen *et al.* 2007, Lara *et al.* 2012, Crego *et al.* 2013, Olak *et al.* 2013, Coric *et al.* 2014). According to a structured review and meta-analyses by Themessl-Huber *et al.* (2010), the results on the association between child and parental dental fear are contradictory and vary based on the methods used to evaluate dental fear, as well as the source of information for child dental fear. Child dental fear was child-reported in majority of these studies (Tuutti & Lahti 1987, Folayan *et al.* 2002, Balmer *et al.* 2004, Peretz *et al.* 2004, Rantavuori *et al.* 2004, Lara *et al.* 2012, Crego *et al.* 2013, Olak *et al.* 2013, Coric *et al.* 2014). In the other studies, parents – mainly mothers – were used as a source of information for child dental fear (Rantavuori *et al.* 2002, Arnrup *et al.* 2003, ten Berge *et al.* 2003, Arnrup *et al.* 2004, Klaassen *et al.* 2007). Half of the studies reported a positive association between the dental fear of the parents and the children (Tuutti & Lahti 1987, Rantavuori *et al.* 2002, Peretz *et al.* 2004, Rantavuori *et al.* 2004, Klaassen *et al.* 2007, Lara *et al.* 2012, Crego *et al.* 2013, Olak *et al.* 2013, Coric *et al.* 2014). The other half reported a negative association between the dental fear of the parents and the children (Folayan *et al.* 2002, Arnrup *et al.* 2003, ten Berge *et al.* 2003, Arnrup *et al.* 2004, Balmer *et al.* 2004). The positive association appears to be stronger among younger than older children. The different roles of mothers and fathers have been suggested to vary at the different developmental stages of children (Lara *et al.* 2012, Crego *et al.* 2013). Children under 13 years of age have been reported to show an association between child dental fear and paternal dental fear, while child dental fear and maternal dental fear has been reported to have association among children over the age of 13 (Crego *et al.* 2013). A child may also learn from the father's behavior whether dental care is something to be afraid of, and paternal dental fear is reported to predict the dental fear of the child and the mother, whereas the dental fear of the mother has no statistical significance for predicting the child dental fear. (Lara *et al.* 2012) Furthermore, caries experience of children has been reported to be positively associated with parental dental fear (Tuutti &

Lahti 1987). In addition, a negative association between caries experience of children and paternal dental fear has been reported where maternal dental fear was not statistically significantly associated to child dental fear. Children were found to have lower df-scores when their fathers had dental fear and a lower socioeconomic status. (Lahti *et al.* 1989)

### **2.6.2. Measurements**

There are several instruments that can be used to measure child dental fear, such as psychometric scales, projective measures, and behavioral ratings. These are partly based on the psychological development of children. Psychometric scales are most often used to measure child dental fear, and the questionnaires are mainly child-reported or parental versions. According to a review by Klingberg & Broberg (2007), the most commonly used psychometric scale is the Children's Fear Survey Schedule – Dental Subscale (CFSS-DS) by Cuthbert & Melamed (1982). Other psychometric scales include, for example, the Dental Fear Scale (DFS) (Kleinknecht *et al.* 1973), Corah Dental Anxiety Scale (DAS) (Corah 1969), Modified Dental Anxiety Scale (MDAS) (Humphris *et al.* 1995), and faces version of the Modified Child Dental Anxiety Scale (MCDASf) (Howard & Freeman 2007). Projective measures include, for example, Venham Picture Test (VPT) (Venham *et al.* 1977) and Children's dental fear picture test (CDFP) (Klingberg & Hwang 1994), and behavioral rating measures, such as Francl Scale (Francl *et al.* 1962), are also used to measure child dental fear, according to the review by Klingberg & Broberg (2007).

### **2.6.3. Source of information**

In many studies, parents reported the state of their child's dental fear on behalf of the child (Alwin 1991, Klingberg *et al.* 1994a, Klingberg *et al.* 1994b, Arnrup *et al.* 2002b, ten Berge *et al.* 2002, ten Berge *et al.* 2002b, Wogelius *et al.* 2003, Klaassen *et al.* 2008, Krikken & Veerkamp 2008, Versloot *et al.* 2008, Tickle *et al.* 2009). Maternal and paternal dental fear have been suggested to play different roles in child dental fear in previous cross-sectional studies (Lara *et al.* 2012, Crego *et al.* 2013), but majority of the parents who evaluated the state of their child's dental fear consisted of mothers (Rantavuori *et al.* 2002, Arnrup *et al.* 2003, ten Berge *et al.* 2003, Arnrup *et al.* 2004, Klaassen *et al.* 2007). There are also studies of

child dental fear where the dental fear is child-reported (Murray *et al.* 1989, Chellapah *et al.* 1990, Bedi *et al.* 1992, Bergius *et al.* 1997, Carson & Freeman 1997, Thomson *et al.* 1997, Skaret *et al.* 1998, Folayan *et al.* 2002, Balmer *et al.* 2004, Peretz *et al.* 2004, Rantavuori *et al.* 2004, Taani *et al.* 2005, Cinar & Murtomaa 2007, Lara *et al.* 2012, Crego *et al.* 2013, Olak *et al.* 2013, Coric *et al.* 2014). Nevertheless, only a few longitudinal studies of child dental fear are child-reported (Thomson *et al.* 1997, Thomson *et al.* 2009), especially by children under 16 years of age (Murray *et al.* 1989). There are also some studies where both the parent and the child reported the state of the child dental fear (Alvesalo *et al.* 1993, Carson & Freeman 2000, Carson & Freeman 2001).

Previously, it has been assumed that parents can be used as reliable proxies of child dental fear. However, in the field of the psychiatry, it has been observed already since the 1980s that parents' estimations of the mental conditions of their children are not entirely reliable (Achenbach *et al.* 1987, Verhulst & van der Ende 1992, De Los Reyes & Kazdin 2004). Similar observations have also been reported recently in child dental fear research (Gustafsson *et al.* 2010). In addition, parents' evaluations of their children's dental fear appear to reflect more their own state of dental fear and experiences than the actual dental fear of the child (Carson & Freeman 2001). Furthermore, it has been indicated that dental fear can be studied reliably with self-report questionnaires among children between the ages of 6 and 15 years (Rantavuori *et al.* 2008).

To my knowledge, no studies have reported on whether children can correctly evaluate the dental fear of their parents. In addition, no one has yet studied to what extent does the dental fear of the parent influence their evaluation of their child's dental fear, or vice versa. There are also no reports on the association of dental fear changes between children and their parents.

## **2.7 Oral health-related quality of life**

Reduced quality of life is a major outcome of many conditions. In 2016, the World Dental Federation (FDI) defined oral health to be "...multi-faced and includes, but is not limited to, the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and free from pain or discomfort, and disease of the craniofacial complex. ...is a fundamental component of

health and physical and mental wellbeing, which exists along a continuum influenced by the values and attitudes of individuals and communities, reflects the physiological, social and psychological attributes that are essential to the quality of life, is influenced by the individual's changing experience, perceptions, expectations and ability to adapt to circumstances."

Oral health has multidimensional effects on the quality of life (Locker 1988, Jokovic *et al.* 2005) and affects, for example, functional wellbeing, emotional wellbeing, expectations of and satisfaction with care, self-image, oral symptoms, and social wellbeing. Oral health-related quality of life (OHRQoL) of children can be measured by using several instruments that comprise a wide variety of dimensions (Table 6).

**Table 6. The most frequently used child-reported children's oral health-related quality of life measures and their dimensions**

| CPQ   | C-OIDP                        | COHIP                      |
|---|-------------------------------|----------------------------|
| Oral symptoms   | Socio-dental health indicator | Oral health                |
| Functional limitations  |                               | Functional wellbeing       |
| Emotional wellbeing   |                               | Social-emotional wellbeing |
| Social wellbeing  |                               | School environment         |
| Opinion of teeth and mouth affect life overall and perceived oral health status |                               | Self-image                 |

CPQ, Child Perceptions Questionnaire (Jokovic *et al.* 2002)

C-OIDP, Child Oral Impacts on Daily Performances Index (Gherunpong *et al.* 2004)

COHIP, Child Oral Health Impact Profile (Broder *et al.* 2007)

Of the instruments, the Child Perceptions Questionnaire (CPQ) is the first and the most frequently used instrument to measure children's quality of life (Gilchrist *et al.* 2014). Because the patient is the best source to evaluate the quality of his/her own life and symptoms and children aged 11–14 years can reliably complete condition-specific questionnaires (Jokovic *et al.* 2002), it has become a standard to use child-reported questionnaires when measuring the oral health of school children (Genderson *et al.* 2013, Gilchrist *et al.* 2014).

Dental fear, avoidance of dental care, and untreated infections of the mouth can have major effect on the quality of life at the latest when symptoms begin to cause pain. For instance, eating and speaking may become more difficult to perform and may have negative aesthetic effects. (Locker 1988) Even normally developing children have fears, but when one tries to avoid fear-induced situations whenever possible, the fear degenerates into pathological fear and starts to restrict the child's life. Severe dental fear can make social situations more difficult to handle. Fearful children tend to avoid social interactions with peers, have only a few friends, are more likely to be bullied by peers, are socially less adequate (Rubin *et al.* 2009), and have difficulties with school attendance (Buss *et al.* 2013, Wood 2006). Dental fear has psychological and social consequences. Thus, the use of instruments measuring oral health-related quality of life is essential in dental fear research.

Among adults, those with dental fear have been found to have an impaired oral health-related quality of life (McGrath & Bedi 2004, Mehrstedt *et al.* 2007, Ng & Leung 2008, Vermaire *et al.* 2008, Pohjola *et al.* 2009, Vermaire *et al.* 2016). The difference between the quality of life of fearful and non-fearful adults can be seen in psychological disability and psychological discomfort (Pohjola *et al.* 2009, Vermaire *et al.* 2016). Other differences between the quality of life of fearful and non-fearful adults concern, for example, handicap, social disability, physical disability, and physical pain and discomfort (Pohjola *et al.* 2009). However, there were no previous published results on the association between dental fear and oral health-related quality of life among children before the publishing of Study IV. Since Study IV, new results of the association between the dental fear of children and OHRQoL have been reported. Fearful 8–10-years-olds (Schuch *et al.* 2015) and 12-year-olds (El Osta *et al.* 2015) have been reported to have poorer OHRQoL compared to non-fearful children. In addition, child dental fear among girls aged 7–14 years has been reported to be associated with oral health-related emotional wellbeing,

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while among boys, dental fear has not been found to be associated with emotional wellbeing (Carrillo-Diaz *et al.* 2013). Furthermore, the dental fear of 10–13-year-olds has been reported to predict a poor OHRQoL better than the need for orthodontic treatment or malocclusion (Dimberg *et al.* 2016). Among 12–15-year-olds, dental fear has been reported to have a stronger impact on the OHRQoL among non-school going children than among school going children (Goyal *et al.* 2014). Furthermore, children with a cleft lip and/or palate have been reported to have higher dental fear scores (Pousette Lundgren *et al.* 2015) and poorer OHRQoL (Pousette Lundgren *et al.* 2015, Broder *et al.* 2014) compared to healthy children. However, in Finland the association between the OHRQoL and child dental fear has not been studied previously.

### 3 AIMS OF THE STUDY

The overall aim of this work is to increase the knowledge and understanding about self-reported child and parental dental fear, as well as about the evaluation and outcomes of dental fear among parent/child dyads.

More specifically, the objective is to study:

1. The association between dental fear among parent/child dyads and children and parent's evaluation of each other's dental fear (I, II);
2. Changes in dental fear and the association between changes in dental fear of parent/child dyads (I–IV);
3. The association between child dental fear and oral health-related quality of life (IV).

The hypotheses of the study are: (1) children of parents with dental fear have more likely dental fear than children of parents without dental fear; (2) parents and children are able to evaluate correctly each other's dental fear; (3) younger children and girls are more likely to have dental fear than older children and boys; and (4) children with dental fear have poorer oral health-related quality of life than children with no dental fear.

## 4 MATERIALS AND METHODS

### 4.1 Study population

The data for this study were collected in Finland using questionnaire surveys. In Studies I–III, the data were collected as part of a larger project from the city of Pori and from the city of Rauma, which acted as a control. The project in Pori concerned an oral health promotion program (OHP) among all 5th and 6th graders in the baseline and people in their lives, and a randomized clinical trial (RCT) on controlling caries which included all fifth and sixth grade students who had at least one active initial caries lesion at the baseline. Table 7 provides a detailed description of the data. In Study IV, the data were collected from the city of Oulu and from the Northern Ostrobothnia Hospital District.

**Table 7. Number of participants in different phases of Studies I–III**

| Year | Questionnaires        | Pori  |       |       | Rauma |     |     | Article |       |                                      |
|------|-----------------------|-------|-------|-------|-------|-----|-----|---------|-------|--------------------------------------|
|      |                       | C     | P     | D     | C     | P   | D   | I*      | II**  | III***                               |
| 2001 | Sent                  | 1,691 | 1,691 |       | 807   | 807 |     |         |       |                                      |
|      | Returned              | 1,649 | 1,527 |       | 734   | 693 |     |         |       |                                      |
|      | Properly filled out   | 1,529 | 1,500 | 1,456 | 693   | 680 | 668 |         |       |                                      |
|      | Included in the study |       |       |       |       |     |     | 817     | 2,124 | 1,181 <sup>C</sup> /616 <sup>P</sup> |
| 2003 | Sent                  | 1,651 | 1,651 |       | 850   | 850 |     |         |       |                                      |
|      | Returned              | 1,537 | 1,346 |       | 757   | 620 |     |         |       |                                      |
|      | Properly filled out   | 1,346 | 1,151 | 1,066 | 620   | 402 | 396 |         |       |                                      |
|      | Included in the study |       |       |       |       |     |     |         | 1,462 | 1,181 <sup>C</sup> /616 <sup>P</sup> |
| 2005 | Sent                  | 1,659 | 1,659 |       | 827   | 827 |     |         |       |                                      |
|      | Returned              | 1,598 | 1,292 |       | 749   | 528 |     |         |       |                                      |
|      | Properly filled out   | 1,292 | 1,276 | 1,248 | 523   | 518 | 468 |         |       |                                      |
|      | Included in the study |       |       |       |       |     |     | 817     | 1,716 | 1,181 <sup>C</sup> /616 <sup>P</sup> |

C = Child, P = Parent, D = Dyads

\* = Longitudinal setup in Pori, same parent in years 2001 and 2005, children and parents studied as dyads

\*\* = Cross-sectional setup, all dyads in Pori and Rauma

\*\*\* = Longitudinal setup in Pori, children (C) and parents (P) studied as individuals in years 2001, 2003 and 2005

The study population in Studies I–III was composed of 11–16-year-old school children (except children with intellectual or physical disabilities attending special schools) and one of their parents from the city of Pori ( $n=1,691$ ). In Study II, 11–16-year-old school children (except children with intellectual or physical disabilities attending special schools) and one of their parents from the city of Rauma ( $n=807$ ) were also included in the study population. The data were gathered at three time-points which fell within the last phase of cognitive development (formal operational phase) in child growth (Piaget & Inhelder 1958, 1966). The time-points were fall 2001, when the children were 11–12 years of age; spring 2003, when the children were 13–14 years of age; and spring 2005, when the children were 15–16 years old. The parents' mean age was 40 years, with the age range of 26–57 years. The age and sex of the participants were enquired in all the questionnaires of the original studies, except for the study population of Rauma, where due to an error, the baseline questionnaire for 2001 did not include the question about the child's sex. Since the Rauma population acted as a control group, only cross-sectional data was gathered at each three time-points, identifying only current child-parent dyads. In Pori, the number of returned questionnaires filled out by the children and by their parents in 2001 was 1,649 (97.5%) and 1,527 (90.3%), respectively. In 2003, the corresponding numbers were 1,537 (93.1%) and 1,346 (81.5%), and in 2005, 1,598 (96.3%) and 1,292 (77.9%), respectively. In Rauma, the number of returned questionnaires filled out by the children and by their parents in 2001 was 734 (90.1%) and 693 (85.9%), respectively. In 2003, the corresponding numbers were 757 (89.0%) and 620 (72.9%), and in 2005, 749 (90.6%) and 528 (63.8%), respectively.

The data of Study I were collected by using a longitudinal design of around 3 years and 5 months. In the study, children and parents from Pori were identified and studied as parent/child dyads. The analyzes only included the dyads where the responding parent was the same at the first time-point in 2001 and at the final time-point in 2005 and the questionnaires were properly filled out at both time-points. The dyads where one or both of the participants responded "Do not know" to the question about their own dental fear were omitted from the analyzes. The number of eligible parent/child dyads was 817, of which 55.0% were parent/son dyads and 45.0% parent/daughter dyads.

The data of Study II consisted of three sets of cross-sectional data from the years 2001, 2003 and 2005 and participants were studied at group level. All children and their parents from Pori and Rauma who filled out

properly the questionnaire of dental fear of their own and each other's at least once during the study were included in the analyzes. The participants responding "Do not know" to the question of each other's dental fear were kept along in the analyzes. The number of eligible parent/child dyads in 2001, 2003 and 2005 were 2,124 (85.0%), 1,462 (58.5%) and 1,716 (69.0%), respectively.

The data of Study III were also collected by using a longitudinal design of around 3 years and 5 months. In the study, children and parents from Pori were identified and studied at the individual level in the years 2001, 2003, and 2005. All children and their parents who properly filled out the questionnaire on their dental fear at every three time-points during the study were included in the analyzes. The participants responding "Do not know" to the question about their own dental fear were omitted from the analyzes. The number of eligible participants was 1,181 children (52.2% girls and 47.8% boys) and 616 parents.

During the same period, a randomized clinical trial (RCT) on controlling caries and an oral health promotion program (OHP) were also carried out in Pori. In 2001–2005, the RCT was conducted among all fifth- and sixth-graders who had at least one active caries lesion at the baseline. Children with intellectual or physical disabilities attending special schools were not included in the study. In the RCT, the children were randomly assigned to one of two groups: Children in the experimental group (n=250) were offered individualized recall intervals and caries preventive treatments, such as fluoridation and chlorhexidine cleansings, along with products to improve oral health. Children in the control group (n=247) received the ordinary Finnish dental care. The RCT and the conservative dental care have been described in detail elsewhere (see Hausen *et al.* 2007). All the children who participated in the RCT in Pori were also exposed to the OHP. During the course of the RCT, the OHP was implemented among all fifth and sixth grader students (11- and 12-year-olds) in Pori at the baseline, except among children attending special schools. The participants from Rauma acted as a control group. The OHP was targeted at school children and their family members and included various approaches through schools, the local health organization, and media. The aim of the OHP was to provide social support for the children in Pori, increase their knowledge of oral health, and to change their oral health-related behavior. For details about the OHP, see Tolvanen *et al.* (2009).

The study population in Study IV consisted of a convenience sample of fifth, sixth and seventh grader students from two schools in the Finnish

city of Oulu (n=82), as well as all 11–14-year-olds in the Oulu University Hospital cleft lip and/or palate treatment register (n=51). All the participants were aged from 11 to 14 years, and the school children from urban (two classes of seventh-graders) and rural (one class of fifth-graders and one class of sixth-graders) schools were representing a normal child population, while the children with a cleft lip and/or palate were representing a child population with poor oral health-related quality of life. The data consisted of one set of cross-sectional data gathered in the fall of 2006. Completed and properly filled out questionnaires were received from 71 (87.0%) school children and 26 (51.0%) children with a cleft lip and/or palate and were included in the analyzes. Of the children, 53.7% were girls and 46.3% were boys.

## 4.2 Questionnaires

### 4.2.1 *Data of school children from Pori and Rauma*

In Studies I–III, oral health personnel administered all the questionnaires to the children at their school and the children delivered the questionnaires to their parents. The children and one of their parents were asked to answer the questionnaires independently of each other: the children filled out the questionnaires at the school, and the parents filled out their questionnaires at home and returned the questionnaires in a sealed envelope to the school. The details of the baseline survey have been reported previously (see Poutanen *et al.* 2005), and in the follow-up surveys, the procedure was similar.

In Studies I–III, both the children and their parents were requested to evaluate their own dental fear, but they were also asked to evaluate each other's dental fear by answering the single-item question: "There might live people in your home who are afraid of going to the dentist. Please estimate how much they are afraid of dentistry." The alternatives for the children were "Mother", "Father", "Myself", "Some of my siblings", and "Someone else – who", and the alternatives for the parents were "Mother", "Father", "The child who brought the questionnaire from school", "Other sibling", and "Someone else – who". The single question on fear had six response alternatives, which were: "Not afraid" (1), "A little afraid" (2), "Afraid to some degree" (3), "Quite afraid" (4), "Very afraid" (5), and "Do not know". In Studies I–III, the only option to measure the dental fear was

to use the single-item question because of the large number of the other questions in the OHP, and also because there is no questionnaire which has been tested to be valid and reliable to measure both dental fear of children and their parents and the evaluation of each other's dental fear. The weakness of the single-question used was the lack of testing of the psychometric properties due to a tight schedule. The questionnaires for the children and the parents (wherein Question 16 in the questionnaire for the children and Question 19 in the parents' questionnaire is the dental fear question) are presented in Appendices 1 and 2, respectively.

#### ***4.2.2. Data concerning the school children and children with a cleft lip and/or palate***

In Study IV, dental students and/or schoolteachers administered the questionnaires for the school children at their schools. The children with a cleft lip and/or palate received the questionnaire with filling instructions by mail. The school children filled out the questionnaire at the school, and the children with a cleft lip and/or palate filled out the questionnaire at home with the help of their parents, if needed.

The child dental fear was measured by using the Finnish version of the modified Children's Fear Survey Schedule – Dental Subscale (MCFSS-DS). The MCFSS-DC has been found to be reliable among Finnish children, and the factor structure used in this study was for 9-year-olds, which has been found to be suitable for children in all age groups (Rantavuori *et al.* 2005, Rantavuori *et al.* 2012). The questionnaire comprised a total of eleven questions and had six response alternatives for each question. The response alternatives were: "Not afraid" (1), "A little afraid" (2), "Afraid to some degree" (3), "Quite afraid" (4), "Very afraid" (5), and "No experience of this particular matter" (1). The MCFSS-DS can be used to measure two different dimensions of dental fear: treatment of dental decay (TDD) and attending the dentist (AD). Additionally, the MCFSS-DC includes a single question measuring general dental fear (GF). The TDD section consisted of dental fear questions related to the invasive treatments of dental decay, and the AD section comprised dental fear questions related to less invasive situations and dental admissions in general (Table 8). The general fear (GF) section consisted of the value of the single question "Are you afraid of dental treatment in general?"

**Table 8. Dimensions of dental fear in the MCFSS-DS**

|                               |  |
|-------------------------------|--|
| Treatment of dental decay     | Attending the dentist                  |
| Pain                          | Dentist                                |
| Drilling                      | Teeth being cleaned by a dentist/nurse |
| Hearing the sound of drilling | Keeping mouth open                     |
| Local anesthetic              | Suction in the mouth                   |
| Being unable to breath        |  |
| Instruments in the mouth      |  |

MCFSS-DS, Modified Children's Fear Survey Schedule – Dental Subscale

Previous experience of dental care procedures, such as extractions or local anesthetic, orthodontics, or fillings, were also enquired from the children. The three response alternatives were: "Have had in the previous 3 months", "Have not had in the previous 3 months, but have had sometime earlier", and "Have never had". The questionnaire is presented in Appendix 3.

The oral health-related quality of life (OHRQoL) was measured using the Finnish version of the Child Perceptions Questionnaire (CPQ<sub>11-14</sub>). The original CPQ<sub>11-14</sub> has been tested for validity and reliability (Jocovic *et al.* 2002), and the Finnish version of the CPQ<sub>11-14</sub> has also been reported to be valid and reliable among 11–14-year-old children in Finland (Kortelainen *et al.* 2016). The CPQ<sub>11-14</sub> can be used to measure four different dimensions of OHRQoL: oral symptoms, functional limitations, emotional wellbeing, and social wellbeing. The oral symptoms section consisted of six questions, the functional limitations and emotional wellbeing sections both of nine questions, and the social wellbeing section consisted of thirteen questions (Table 9). The questionnaire had a total of 37 questions, each with the following five response alternatives: "Never" (0), "Once or twice" (1), "Sometimes" (2), "Often" (3), and "Every day/almost every day" (4). The questionnaire is presented in Appendix 4.

**Table 9. The questions of CPQ<sub>11-14</sub> for each dimension separately**

| Oral wellbeing                           | Functional wellbeing  | Emotional wellbeing   | Social wellbeing   |
|--|---|---|--|
| Pain in your teeth, lips, jaws or mouth? | Breathed through your mouth?  | Felt irritable or frustrated?   | Missed school because of pain, appointments, or surgery?   |
| Bleeding gums?                           | Had trouble sleeping?   | Felt unsure of yourself?  | Had a hard time paying attention in school?  |
| Sores in your mouth?                     | Difficult to open your mouth wide?                                    | Felt shy or embarrassed?  | Had difficulty doing your homework?  |
| Bad breath?                              | Difficult to say any words?   | Been concerned what other people think about your teeth, lips, mouth or jaws? | Not wanted to speak or read out loud in class?   |
| Food stuck in or between your teeth?     | Taken longer than others to eat a meal?                               | Worried that you are not as good-looking as others?                           | Avoided taking part in activities like sports, clubs, drama, music, school trips?  |
| Food stuck in the top of your mouth?     | Difficult to bite or chew food like apples, corn on the cob or steak? | Been upset?   | Not wanted to talk to other children?  |
|  | Difficult to eat foods you would like to eat?                         | Felt nervous or afraid?   | Avoided smiling or laughing when around other children?  |
|  | Difficult to drink with a straw?                                      | Worried that you are not as healthy as others?                                | Had difficulty playing a musical instrument such as a recorder, flute, clarinet, trumpet?  |
|  | Difficult to drink or eat hot or cold foods?                          | Worried that you are different than other people?                             | Not wanted to spend time with other children?<br>Argued with other children or your family?<br>Other children teased you or called you names?<br>Other children made you feel left out?<br>Other children asked you questions about your teeth, lips, jaws or mouth? |

## 4.3 Methods

### 4.3.1 Categorization of variables

The single-item dental fear question was dichotomized by using two different cut-off points: less stringent and more stringent. Of the less stringent cut-off point, the participants with values 1–2 (“Not afraid” or “A little afraid”) were categorized as non-fearful, and participants with values 3–5 (“Afraid to some degree”, “Quite afraid” or “Very afraid”) were categorized to have moderate dental fear. The less stringent cut-off point was named as “Moderate dental fear”. Of the more stringent cut-off point, the participants with values 1–3 (“Not afraid”, “A little afraid” or “Afraid to some degree”) were categorized as non-/low-fearful, and participants with values 4–5 (“Quite afraid” or “Very afraid”) were categorized to have high dental fear. The more stringent cut-off point was named as “High dental fear”. (I–III)

Two different dental fear change variable scales were formed on the basis of the single-item dental fear question. The dichotomized dental fear responses from the years 2001 and 2005 were combined into the 4-category variable scale on dental fear change (“Decreased dental fear”, “Stable no/low dental fear”, “Stable high dental fear”, and “Increased dental fear”). The 9-category variable scale (ranging from -4 to 4) was calculated by using the original 5-point scale and subtracting the 2005 responses from the 2001 responses. (I)

For the modified Children’s Fear Survey Schedule – Dental Subscale (MCFSS-DS), the total score of the questions (ranging from 11 to 55) and the sum scores of the dental fear dimensions TDD and AD were calculated. To facilitate the interpretation in the analyzes concerning TDD and AD –which were revealed based on factor analyzes performed in a previous study (Rantavuori *et al.* 2005)– the means of the summary values for the TDD questions and AD questions were calculated. (IV) All dental fear measures concerning the MCFSS-DS were dichotomized as non-fearful and fearful. The children with TDD and AD mean values from 1 to 1.99 were considered to be non-fearful, and the children with mean values from 2 to 5 were considered as fearful. For the GF questions, the children with values from 1 to 2 were considered as non-fearful, and the children with values from 3 to 5 as fearful. The children who had responded “No experience of this particular matter” to the MCFSS-DS questions were

considered as non-fearful, and their responses were encoded by the numeral 1 (Rantavuori *et al.* 2009). (IV)

The self-reported experiences of dental care procedures were categorized into four treatment experience groups: (1) no dental treatment experience ever, (2) experience of fillings, (3) experience of orthodontics, and (4) experience of both fillings and orthodontics some time in life. (IV)

For the OHRQoL questionnaire (CPQ<sub>11-14</sub>), the total score of the questions (ranging from 0 to 148) and the sum scores of each of the four dimensions were calculated (the ranges for oral symptoms, functional limitations, emotional wellbeing, and social wellbeing were 0–24, 0–36, 0–52, and 0–36, respectively) (Jokovic *et al.* 2002). (IV)

The sex of the children and the parents were determined and used as a background variable, except for the participants in Rauma in 2001.

#### **4.3.2 Statistical analyzes**

In the statistical analyzes of Study I, both the high dental fear and the moderate dental fear cut-off points were used and reported. In the statistical analyzes of Study II, the sensitive analyzes indicated that the results were not dependent on the cut-off point used. Thus, the results of Studies I and III were reported using only the high dental fear cut-off.

The dichotomized dental fear variables were analyzed in three different ways: (1) The associations between child and parental dental fear were analyzed using cross-tabulations, and the statistical significances of the associations between the dental fears were analyzed using chi-square tests. (2) Kappa statistics and sensitivity and specificity statistics were used to study the evaluations of dental fear separately for girls and boys, and for mothers and fathers. (3) Binary logistic regression analyzes were conducted by using child dental fear and child's evaluation of parental dental fear as the dependent variable and parental dental fear, the sex of the child, and the child's evaluation of the parental dental fear and child dental fear as the independent variables. Children who had answered "I don't know" to the question about their parents' dental fear were omitted from the binary logistic regression analyzes.

Changes in dental fear were analyzed in six different ways: (1) Spearman's rho ( $r$ ) was used to analyze the correlation of the changes in parental

dental fear and child dental fear when the change in dental fear was measured with the abovementioned 4-category and 9-category variable scales. (2) Mean change scores of dental fear were computed separately for girls and for boys, and for mothers and fathers, with 95% CI, where negative values represented decreased dental fear. (3) Percentages of the participants with decreased, increased, or stable dental fear were computed separately for parents, girls, and boys, and on the scale, a difference of two or more points was considered as a change. (4) To denote clinical cases of dental fear, the responses to the fear questions were dichotomized and Cochran's Q test across time-points was used to evaluate the statistical significance of the change in dichotomized dental fear. The dichotomized dental fear was analyzed for the parent/child dyads separately for both 2001 and 2005 to determine the changes in child dental fear and parental dental fear. (5) The prevalence and incidence of dental fear were computed. (6) The association between the changes in child dental fear and the sex of the child were analyzed using a chi-square test.

The differences in sex, age, group (school children vs. children with a cleft lip and/or palate), and self-reported experience of dental treatment were compared between children with and without dental fear. The differences concerning the OHRQoL were measured by comparing the children with and without dental fear on three fear measures. Chi-square and Mann-Whitney tests were used to evaluate the statistical significances of the differences. Binary logistic regression analyzes were conducted by using the total CPQ<sub>11-14</sub> and four dimensions as the dependent variables, and the measures concerning dental fear, sex, and treatment experienced during the last three months as the independent variables.

The data management and analyzes were conducted using the SPSS versions 17.0–21.0.

#### **4.4 Ethical aspects**

Studies which can be performed at schools as part of the normal school day do not require obtaining the parental consent, provided that the principal of the school considers the study to be functional and to provide useful information to the school and that the study can be carried out as part of the normal class work. For studies where personal information such as the name, identification number, or home address are not saved,

it is not necessary to obtain the parental consent, but the parents should be informed of the study. Studies involving (invasive) treatments require obtaining the parental consent in writing. The participants have also the right to interrupt or decline the participation at any time.

Studies involving children under 15 years of age may be carried out without the parental consent, as long as the children are estimated to be mature enough to decide about the participation by themselves and the parents are informed of the study. If the children are estimated to be too immature to decide about the participation by themselves, a written consent must be obtained from the parents. If the parents are not informed, the Ethics Committee must approve the study. The agreement to participate in the study can be given orally or in writing, or in some other way deemed as an agreement. For example, answering the questionnaire can be interpreted as an agreement to participate, if the child is estimated to be mature enough to understand the meaning of the study.

Participating in the original studies was voluntary and the children were provided with the opportunity to decline their participation. Children who chose not to participate were given alternative school work to do during the class, or they could just return an unfilled questionnaire. A written consent from the parents for their child's participation was obtained in the RCT (Studies I–III), since the trial involved treatments. Since the OHP (which also included the dental fear question; Studies I–III) did not involve any invasive treatment, a filled questionnaire was considered as a consent, and the parents were informed of the study in writing. Although the Study IV among the fifth- and sixth-graders in Oulu did not involve any invasive treatment either, a written consent from the parents was still obtained because of the developmental state of the children. The seventh grader participants (Study IV), however, were considered to be mature enough to decide themselves whether to participate in the study, and the parents were only informed of the study in writing.

The Ethics Committee of the Northern Ostrobothnia Hospital District and the City of Pori approved the original studies (Appendix 5). Each person who participated in the studies was given a covering letter approved by the Ethics Committee of the Northern Ostrobothnia Hospital District, indicating the purpose of the study.

## 5 RESULTS

### 5.1 Association of dental fear among parent/child dyads and children and parent's evaluation of each other's dental fear (I, II)

A positive association between child and parental dental fear was found in the early adolescence, when the children were 11–12 years of age. In the mid-adolescence (15–16 years of age), the positive association between child and parental dental fear was found only between girls and their parents (mainly mothers) (I).

The children and parents' evaluations of the level of each other's dental fear were more accurate when the children were in their mid-adolescence than in their early adolescence. However, according to the weighted kappa values, the participants' ability to evaluate correctly each other's dental fear (cut-off: moderate dental fear responses 3–5 vs. non-fearful responses 1–2) remained poor throughout the study, the results being the worst among fearful parents and children (Table 10).

**Table 10. Kappa statistics for the evaluation of moderate dental fear among children and parents**

| Who evaluated  | Whose fear was evaluated | 2001   | 2003   | 2005   |
|----------------|--------------------------|--------|--------|--------|
| Mother         | Child                    | 0.353  | 0.305  | 0.404  |
| Child          | Mother                   | 0.155  | 0.229  | 0.316  |
| Father         | Child                    | 0.164  | 0.223  | 0.313  |
| Child          | Father                   | 0.241  | 0.118  | 0.264  |
| Fearful parent | Child                    | 0.020  | -0.004 | 0.008  |
| Fearful child  | Parent                   | -0.456 | -0.363 | -0.248 |

Moderate dental fear, responses 3–5 "afraid to some degree", "quite afraid" or "very afraid"  
 No dental fear, responses 1–2 "not afraid" or "a little afraid"

When the analyzes using the more stringent cut-off point (high dental fear, cut-off point 1–3/4–5) were conducted, the results were similar, or the ability to evaluate correctly each other's dental fear was slightly better compared to the analyzes concerning moderate dental fear (II). However, the children and parents' ability to correctly evaluate each other's dental fear was even worse among children and parents with high dental fear than among children and parents with moderate dental fear (II).

Parents were more likely to correctly evaluate the level of dental fear of non-/low-fearful children than high-fearful children, and the specificity values for correctly evaluating non-/low-fearful children were  $\geq 0.93$  among both mothers and fathers. The sensitivity values, among both mothers and fathers, for correctly evaluating high dental fear of the children were  $\leq 0.39$ . (Tables 11 and 12) Even when considering child dental fear as a confounder, parental dental fear and parents' evaluation of the dental fear of their children were associated. The association was stronger at the beginning of the study (OR=3.12, 95% CI 1.73–5.63) than at the end of the study (OR=1.84, 95% CI 1.01–3.35).

**Table 11. Mothers' evaluations of their child's dental fear separately for non-/low-fearful and high-fearful children in different years**

|                        |                                 | 2001     | 2003     | 2005     |
|------------------------|---------------------------------|----------|----------|----------|
| Non-/low-fearful child | All (n)                         | 1,587    | 1,089    | 1,178    |
|                        | Mother's correct evaluation (n) | 1,508    | 1,036    | 1,121    |
|                        | Specificity                     | 0.95     | 0.95     | 0.95     |
| High-fearful child     | All (n)                         | 181      | 120      | 204      |
|                        | Mother's correct evaluation (n) | 63       | 42       | 80       |
|                        | Sensitivity                     | 0.35     | 0.35     | 0.39     |
| Mother's evaluation    | Do not know (n)                 | 10       | 9        | 11       |
|                        | Do not know/incorrect n (%)     | 207 (12) | 140 (11) | 192 (14) |

High dental fear, responses 4–5 "quite afraid" or "very afraid"

No/low dental fear, responses 1–3 "not afraid", "a little afraid" or "afraid to some degree"

**Table 12. Fathers' evaluations of their child's dental fear separately for non-/low-fearful and high-fearful children in different years**

|                        |                                 | 2001    | 2003    | 2005    |
|------------------------|---------------------------------|---------|---------|---------|
| Non-/low-fearful child | All (n)                         | 220     | 166     | 204     |
|                        | Father's correct evaluation (n) | 214     | 154     | 198     |
|                        | Specificity                     | 0.97    | 0.93    | 0.98    |
| High-fearful child     | All (n)                         | 33      | 13      | 35      |
|                        | Father's correct evaluation (n) | 10      | 4       | 13      |
|                        | Sensitivity                     | 0.30    | 0.31    | 0.37    |
| Father's evaluation    | Do not know (n)                 | 3       | 4       | 7       |
|                        | Do not know/incorrect n (%)     | 32 (13) | 25 (14) | 35 (14) |

High dental fear, responses 4–5 "quite afraid" or "very afraid"

No/low dental fear, responses 1–3 "not afraid", "a little afraid" or "afraid to some degree"

Children were more likely to correctly evaluate the level of dental fear of non-/low-fearful parents than high-fearful parents, and the specificity values for correctly evaluating non-/low-fearful parents were  $\geq 0.95$ . Among children, the sensitivity values for correctly evaluating high dental fear of the parents were  $\leq 0.38$ . In addition, high paternal dental fear was more likely to be correctly evaluated than high maternal dental fear. (Tables 13 and 14) When modeling if child dental fear, parental dental fear, and the sex of the child were associated with the children's evaluation of their parent's dental fear, child dental fear was statistically significantly associated with the children's evaluation of the dental fear of their parents. The association was stronger when the children were in their early adolescence (OR=6.26, 95% CI 2.62–14.96) than when the children were in their mid-adolescence (OR=3.47, 95% CI 1.86–6.47).

**Table 13. Children's evaluations of their mother's dental fear separately for non-/low-fearful and high-fearful mothers in different years**

|                         |                                | 2001     | 2003     | 2005     |
|-------------------------|--------------------------------|----------|----------|----------|
| Non-/low-fearful mother | All (n)                        | 1,290    | 895      | 967      |
|                         | Child's correct evaluation (n) | 1,272    | 834      | 917      |
|                         | Specificity                    | 0.99     | 0.97     | 0.95     |
| High-fearful mother     | All (n)                        | 331      | 225      | 251      |
|                         | Child's correct evaluation (n) | 34       | 41       | 70       |
|                         | Sensitivity                    | 0.10     | 0.18     | 0.28     |
| Child's evaluation      | Do not know (n)                | 200      | 175      | 224      |
|                         | Do not know/incorrect n (%)    | 515 (28) | 420 (32) | 455 (32) |

High dental fear, responses 4–5 "quite afraid" or "very afraid"

No/low dental fear, responses 1–3 "not afraid", "a little afraid" or "afraid to some degree"

**Table 14. Children's evaluations of their father's dental fear separately for non-/low-fearful and high-fearful fathers in different years**

|                         |                                | 2001    | 2003    | 2005    |
|-------------------------|--------------------------------|---------|---------|---------|
| Non-/low-fearful father | All (n)                        | 208     | 135     | 176     |
|                         | Child's correct evaluation (n) | 204     | 132     | 171     |
|                         | Specificity                    | 0.98    | 0.98    | 0.97    |
| High-fearful father     | All (n)                        | 14      | 15      | 24      |
|                         | Child's correct evaluation (n) | 4       | 2       | 9       |
|                         | Sensitivity                    | 0.27    | 0.13    | 0.38    |
| Child's evaluation      | Do not know (n)                | 34      | 37      | 55      |
|                         | Do not know/incorrect n (%)    | 48 (19) | 53 (28) | 75 (29) |

High dental fear, responses 4–5 "quite afraid" or "very afraid"

No/low dental fear, responses 1–3 "not afraid", "a little afraid" or "afraid to some degree"

Both parents and children with high dental fear were also more likely to correctly evaluate non-/low-fearful individuals than high-fearful individuals. Among high-fearful parents, the specificity values for correctly evaluating non-/low-fearful children were  $\leq 0.94$ , and among high-fearful children, the specificity values for correctly evaluating non-/low-fearful parents were  $\leq 0.93$ . Among high-fearful parents, the sensitivity values for correctly evaluating the high dental fear of the children were  $\leq 0.50$ , and among high-fearful children, the sensitivity values for evaluating correctly the high dental fear of the parents were  $\leq 0.46$ . (Tables 15 and 16)

Along the study, 11–14% of the mothers and 13–14% of the fathers failed to correctly evaluate the level of their children's dental fear. Among children, 28–32% did not correctly evaluate the level of their mothers' dental fear and 19–29% did not evaluate correctly the level of their fathers' dental fear. (Tables 11–14)

**Table 15. High-fearful parents' evaluations of their child's dental fear separately for non-/low-fearful and high-fearful children in different years**

|                        |  | 2001 | 2003 | 2005 |
|------------------------|--|------|------|------|
| Non-/low-fearful child | All (n)                                      | 302  | 243  | 240  |
|                        | High fearful parent's correct evaluation (n) | 273  | 216  | 218  |
|                        | Specificity                                  | 0.90 | 0.94 | 0.91 |
| High-fearful child     | All (n)                                      | 57   | 35   | 68   |
|                        | High-fearful parent's correct evaluation (n) | 27   | 15   | 34   |
|                        | Sensitivity                                  | 0.47 | 0.43 | 0.5  |

High dental fear, responses 4–5 "quite afraid" or "very afraid"

No/low dental fear, responses 1–3 "not afraid", "a little afraid" or "afraid to some degree"

**Table 16. High-fearful children's evaluations of their parent's dental fear separately for non-/low-fearful and high-fearful parents in different years**

|                         |   | 2001 | 2003 | 2005 |
|-------------------------|---|------|------|------|
| Non-/low-fearful parent | All (n)                                     | 148  | 86   | 148  |
|                         | High-fearful child's correct evaluation (n) | 138  | 73   | 128  |
|                         | Specificity                                 | 0.93 | 0.85 | 0.87 |
| High-fearful parent     | All (n)                                     | 53   | 29   | 57   |
|                         | High-fearful child's correct evaluation (n) | 13   | 5    | 26   |
|                         | Sensitivity                                 | 0.25 | 0.17 | 0.46 |

High dental fear, responses 4–5 "quite afraid" or "very afraid"

No/low dental fear, responses 1–3 "not afraid", "a little afraid" or "afraid to some degree"

Based on the results concerning the children and parents' ability to correctly evaluate each other's dental fear, it was also examined whether the children's evaluation of their parents' dental fear affected the association between child and parental dental fear. However, when taking into account the children's evaluation of the parental dental fear in the logistic regression model, the association between child and parental dental fear was no longer statistically significant. Child dental fear was more likely to be associated with the children's evaluation of the parental dental fear than the correct level of parental dental fear. The association between child dental fear and the children's evaluation of the parental dental fear was lower among children in their mid-adolescence than among children in their early adolescence. (Table 17)

**Table 17. Final logistic regression models for the factors associated with the children's high dental fear (2001 n=763, 2005 n=735)**

| Year |  | Crude OR (p)  | OR   | p      | 95 % CI    |
|------|--|---------------|------|--------|------------|
| 2001 | Parent's high dental fear                        | 2.16 (0.001)  | 1.69 | 0.052  | 1.00–2.86  |
|      | Child's sex*                                     | 0.61 (0.025)  | 0.54 | 0.009  | 0.34–0.86  |
|      | Child's evaluation of the parent's dental fear** | 7.47 (<0.001) | 6.14 | <0.001 | 2.57–14.67 |
| 2005 | Parent's high dental fear                        | 1.92 (0.005)  | 1.20 | 0.530  | 0.68–2.12  |
|      | Child's sex *                                    | 0.34 (<0.001) | 0.31 | <0.001 | 0.18–0.52  |
|      | Child's evaluation of the parent's dental fear** | 3.79 (<0.001) | 3.57 | <0.001 | 1.88–6.80  |

\*1 = boy; \*\*1 = evaluated as high-fearful

## 5.2 Changes in dental fear and the association between changes in dental fear of parent/child dyads (I, II, III, IV)

In general, the level of dental fear was stable among majority of the participants, and the prevalence of high dental fear among all the participants remained rather similar throughout the study.

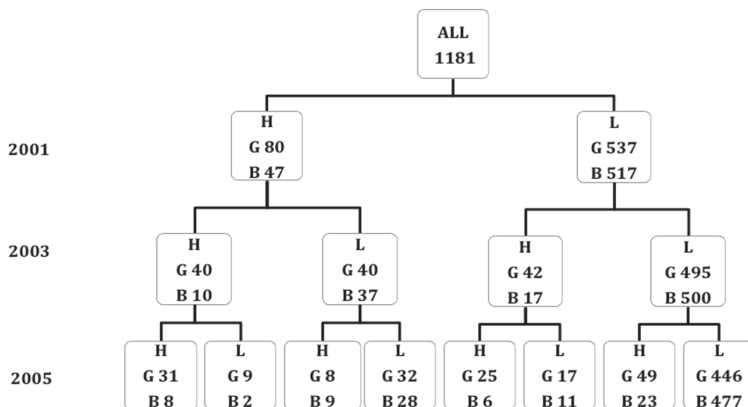
Majority of the dyads were mother/daughter dyads (51%) or mother/son dyads (43%). Fathers were in a minority: 2.7% and 3.3% of the dyads were father/daughter dyads and father/son dyads, respectively. Throughout the study, 86% of the initially no/low fearful dyads continued to have no/low dental fear (both child and the parent), and 35% of the initially high dental fear dyads continued to have high dental fear throughout the study (I). However, there was no statistically significant correlation between changes in dental fear of the children and their parents. (Table 18)

**Table 18. Spearman's correlation ( $r$ ) of the changes in dental fear between children and parents on a 9-category and on a 4-category variable scale ( $p>0.05$ )**

| Dyads        | 9-category | 4-category |
|--------------|------------|------------|
| Parent/child | 0.065      | 0.018      |
| Parent/girl  | 0.082      | 0.012      |
| Parent/boy   | 0.037      | 0.028      |

### 5.2.1 Child dental fear

Despite the level of the parental dental fear, high dental fear of children decreased over the course of the study: 56% of the children (51% of the girls and 64% of the boys) who initially at the age of 11–12 years had high dental fear were non-/low-fearful at the age of 15–16 years at the end of the follow-up. In addition, despite the level of the parental dental fear, for 92% of the children who initially were non-/low-fearful, the level of dental fear remained the same throughout the study. Of all the children, 5% of the girls and 2% of the boys had high dental fear throughout the study. (Figure 1)



**Figure 1. Numbers of the high-dental-fear (H) and no/low-dental-fear (L) children separately for girls (G) and boys (B) in years 2001, 2003 and 2005.**

When considering the different measures of child dental fear of the school children and children with a cleft lip and/or palate, the prevalence was the highest for the fear of treatment of dental decay (treatment of dental decay 20%, attending the dentist 7%, and general fear 11%). Fear of attending the dentist had an association with self-reported treatment experience ( $p=0.017$ ); children reporting experience of only orthodontics or orthodontics and fillings reported having dental fear the least often (0% and 3%, respectively), and children with experience only of fillings reported having dental fear the most often (22%). Children reporting no experience of any dental treatments reported dental fear more often than children reporting experience of orthodontics (8% vs. 0–3%). (IV) There was no statistically significant difference in any dimensions of dental fear between children with a cleft lip and/or palate and children without a cleft lip and/or palate ( $p$ -values for general fear, fear of attending the dentist, and fear of treatment of dental decay were 0.447, 0.320, 0.271, respectively).

The prevalence of the children's high dental fear changed slightly. When considering the prevalence of high dental fear separately for girls and for boys, the prevalence of girls' high dental fear increased during the study. Among boys, the prevalence of dental fear fluctuated over the course of the study. Between the ages of 11–12 and 13–14 years, 9% of the children had high dental fear, whereas at the end of the study, when the children were 15–16 years of age, 13% of the children had high dental fear. Throughout the study, the incidence of high dental fear of the children slightly increased. Nevertheless, when looking at the incidences separately for girls and boys, the incidence of boys' high dental fear doubled during the study, although it remained low throughout the study. Among girls, the incidence increased by slightly over a third. (Table 19)

Furthermore, children in Pori had oral health promotion throughout the study, while their parents were not included in the OHP until at the later part of the study. Thus, the OHP may have had more positive influence on the children's dental fear than on the parents' dental fear. As the OHP increased the knowledge of oral health (Tolvanen *et al.* 2009), it may have also influenced the better response rate in Pori than in Rauma, which had no oral health promotion.

**Table 19. Prevalence and incidence of individually studied high dental fear of mothers and fathers and high dental fear of children separately for girls and boys between the years 2001 and 2005**

| Respondent* | n     | Prevalence (%) |      |      |        | Incidence (%) |           |
|-------------|-------|----------------|------|------|--------|---------------|-----------|
|             |       | 2001           | 2003 | 2005 | p      | 2001–2003     | 2003–2005 |
| Mother      | 586   | 18             | 22   | 20   | 0.043  | 8             | 5         |
| Father      | 30    | 7              | 17   | 10   | 0.174  | 11            | 4         |
| Children    | 1,181 | 11             | 9    | 13   | <0.001 | 6             | 8         |
| Girls       | 617   | 13             | 13   | 26   | <0.001 | 8             | 11        |
| Boys        | 564   | 8              | 5    | 8    | 0.061  | 3             | 6         |

The sex of the child had an independent association with child dental fear throughout the study (I–IV). This was also the case with different measures of dental fear: girls were more likely to have dental fear than boys (p-values for general fear, the fear of treatment of dental decay, and fear of attending the dentist were 0.010, 0.024, 0.026, respectively).

The level of child dental fear tended to increase more among girls than among boys between the years 2001 and 2003, when the children were 11–14 years old (increased by 6% vs. 3%) and between the years 2003 and 2005, when the children were 13–16 years of age (increased by 10% vs. 6%) (III). Statistically significant differences between the girls and the boys also occurred in changes in dental fear ( $p=0.001$ ). Generally, between the ages from 11 to 16 years, the girls' level of dental fear tended to increase more than the boys' did (increased by 11% vs. 4%), while the boys' level of dental fear tended to remain more stable at the level of no/low dental fear than the girls' did (stable no/low dental fear was 86.7% vs. 74.9%, respectively) (I).

### 5.2.2 Parental dental fear

Despite the level of child dental fear, among majority of the parents the level of parental dental fear remained at the same level throughout the study. High parental dental fear changed only among mothers: 24% of the mothers who initially in 2001 had high dental fear were non-/low-fearful at the end of the follow-up in 2005. The level of dental fear of the fathers who initially in 2001 had high dental fear did not change during the 3.5-year study. Of all the responding parents, 13% of the mothers and 7% of the fathers reported high dental fear throughout the study (Figure 2). During the study, the prevalence of high dental fear of mothers and fathers fluctuated, but unlike among mothers, the change in high paternal dental fear was not statistically significant (Table 19). The incidence of high dental fear decreased notably among the fathers and slightly among the mothers during the study (Table 19).

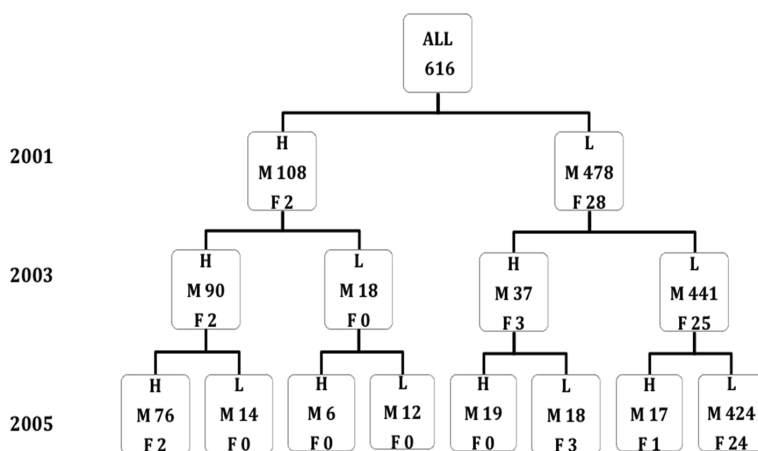


Figure 2. Numbers of the high-dental-fear (H) and no/low-dental-fear (L) parents separately for mothers (M) and fathers (F) in years 2001, 2003 and 2005.

### 5.3 The association between child dental fear and the oral health-related quality of life (IV)

Fearful children had poorer overall oral health-related quality of life compared to non-fearful children. In addition, when looking at the different dimensions of OHRQoL, children with dental fear had poorer social wellbeing and emotional wellbeing than non-fearful children.

For the general fear, dimensions of dental fear, and dimensions of OHRQoL, only the fear of treatment of dental decay was associated with social wellbeing ( $p=0.040$ ) and emotional wellbeing ( $p=0.036$ ). The association between the fear of treatment of dental decay and the OHRQoL was modified by the self-reported experiences of orthodontics. The children without any self-reported experience of orthodontics but who had fear of treatment of dental decay had higher mean total scores of OHRQoL, i.e. poorer OHRQoL (21.8 vs. 11.4) and its dimensions of social wellbeing (5.5 vs. 1.6) and oral symptoms (5.2 vs. 4.2), compared to non-fearful children (all  $p$ -values  $<0.05$ ).

A statistically significant modifying effect on social wellbeing was found between experiences of orthodontic treatments and dental fear. TDD increased the risk of having poor social wellbeing among children with no experiences of orthodontics, but not among children with orthodontic experience (ORs 16.57 and 0.57, respectively). A similar modifying effect between experience of orthodontic treatments and dental fear was found on emotional wellbeing among fearful children: TDD increased the risk of having poor emotional wellbeing among children with no experiences of orthodontics, but not among children with orthodontic experience (ORs 5.59 and 0.48, respectively). (Table 20)

**Table 20. Factors associated with the children's quality of life**

|                            | p     | OR    | 95% CI      |
|----------------------------|-------|-------|-------------|
| <b>Social wellbeing</b>    |       |       |             |
| TDD                        | 0.011 | 16.57 | 1.88–145.79 |
| TDD and orthodontics       | 0.011 | 0.03  | 0.01–0.47   |
| <b>Emotional wellbeing</b> |       |       |             |
| TDD                        | 0.033 | 5.59  | 1.14–27.32  |
| TDD and orthodontics       | 0.029 | 0.09  | 0.01–0.78   |

TDD, Treatment of Dental Decay

## 6 DISCUSSION

In general, the level of dental fear was stable among majority of the participants, and the prevalence of high dental fear remained rather similar throughout the study. The incidence of high dental fear of the children slightly increased compared to the parents, whose incidence of high dental fear decreased notably among fathers and slightly among mothers. Girls were more likely to have dental fear than boys, and girls' dental fear increased more often than boys' dental fear did. There was no statistically significant correlation between the changes in dental fear of the children and their parents. A positive association between child and parental dental fear was found, but the association was lost when adjusted with the children's evaluation of parental dental fear. Child dental fear was more likely to be associated with the children's evaluation of the parental dental fear than with the correct level of parental dental fear. The children and parents' evaluations of the level of each other's dental fear were poor throughout the study, and the results were the worst among fearful participants. Parents and children were more likely to correctly evaluate the level of dental fear of non-fearful individuals than of fearful ones, independent of whether they themselves had dental fear. Children with dental fear related to the treatment of dental caries had poorer oral health-related quality of life, and especially social and emotional wellbeing, than non-fearful children. A modifying effect was found between experiences of orthodontic treatments and dental fear on social and emotional wellbeing.

### 6.1 Methodological considerations

The study sample in Studies I–III was drawn primarily for the RCT. It represented the child population of Finnish cities of that size (Pori had 76,000 and Rauma 40,000 inhabitants) but not entire Finland. The sample was recruited through schools, as practically all Finnish children attend publicly funded schools. Thus, the dataset was large and representative of the population. There was no follow-up on child non-responders in Studies I and III because there were only a few of them: at the beginning of 2001  $n=1,649$  ( $N=1,691$ ), and of those children, the number of drop-outs was 166 in the year 2005 (at the end of the study). The loss of parent/child dyad responders was low, and was mainly due to the "Do not know" answers and/or different parents answering the questionnaires.

This explains the drop in the number of responders in the original longitudinal Studies I and III. In addition, the level of dental fear and the sex distribution among those children not included in the analyzes was similar to those included. If the longitudinal set-up had also been used in Study II, only the respondents from Pori would have been eligible for the analyzes, which would have caused the study sample being less representative. Furthermore, as the RCT's multiple caries preventing measures prevented caries among caries-active children in Pori (Hausen *et al.* 2007), it may have had positive influence on the level of dental fear in caries-active children. However, only the children who had active initial caries lesions at the baseline were accepted as participants in the RCT. Since the RCT covered only a part of the study population, the association of dental fear between the participants in the RCT was not studied.

The weakness of Studies I–III was the low number of fathers, because we did not require both parents to answer the questionnaires. In addition, the responding parent was not required to be the same at every three time-points. Due to this weakness, the number of eligible parent/child dyads decreased in Studies I and III. Mothers formed a majority, and due to the low number of fathers, parents were studied as a combined group in Studies I and II. This decision may result in a selection bias. In Study III mothers and fathers were studied separately, but the results concerning fathers should be interpreted with caution. Although maternal and paternal dental fear may play different roles in child dental fear, as suggested in the studies (Lahti *et al.* 1989, Lara *et al.* 2012, Crego *et al.* 2013), mothers are still the main source for parental information, and the importance of fathers' role in child dental fear has been studied to a lesser extent. Thus, studies where both maternal and paternal dental fear is studied along with their children's dental fear are needed.

The study population in Study IV was selected from urban and rural schools, as well as from a cleft lip and palate treatment register. The school children were representing a normal child population, while the children with a cleft lip and/or palate were representing a child population with poor oral health-related quality of life. Having 11-year-olds answering quite long questionnaires can be problematic. If the children are unable to concentrate well enough on answering the whole questionnaire, the lack of concentration may result in improperly filled questionnaires and thus decrease the number of eligible respondents. The school children had a better response rate than the children with a cleft lip and/or palate. The low response rate among the children with a cleft

lip and/or palate may be a result of the children being too severely disabled to answer the questionnaire properly. The questionnaires were also sent by mail to the children with a cleft lip and/or palate, which may have increased the probability of not filling out the questionnaire compared to the school children, who answered the questionnaire during their school lessons. Thus, possible attrition bias owing to the high number of non-participants mainly among children with a cleft lip and/or palate should be acknowledged. The possible bias might have resulted in better oral health-related quality of life among children with a cleft lip and/or palate who responded the questionnaire than among all children with cleft a lip and/or palate. Anyhow, the oral health-related quality of life among children with a cleft lip and/or palate was found to be poorer compared to children without a cleft lip and/or palate (Kortelainen *et al.* 2016). The results of Study IV should be interpreted with caution because the data was a convenience sample, the number of participants was rather small, and the experienced treatments were self-reported. Thus, broad 95% CI might have been affected by the sample size and a larger sample size might have led to a better estimate of the population parameter. Nevertheless, Study IV serves as a basis for future research on the multidimensionality of child dental fear.

Multi-item questions for measuring dental fear can certainly capture different aspects of dental fear better than single-item question scales. Nevertheless, the single-question approach has been found to be valid enough when measuring dental fear in Finnish and Norwegian adult population (Neverlien 1990, Viinikangas *et al.* 2007). In Studies I–III the only option to measure dental fear was to use a single-item question because of the large number of the other questions in the OHP, and also because there is no previous questionnaire which has been tested to be valid and reliable to measure the dental fear of both children and their parents, as well as how well children and parents can evaluate each other's dental fear. The weakness of the single-question used was the lack of testing of the psychometric properties due to a tight schedule. Other dental fear researchers were consulted about the use of the single-item question. Furthermore, because there are several options for categorizing dental fear, the results of Study I were reported with and without cut-off points. The results of Studies I–III were found not to be conditional of the cut-off point used in the categorization.

The strengths of this study are the longitudinal data (Studies I and III) consisting of a large and representative population (Studies I–III). In

addition, all the questionnaires were self-reported (Studies I–IV) and gathered in non-dental environments to avoid/minimize drop-outs of fearful respondents.

There are several instruments that can be used to measure child dental fear. According to Klingberg & Broberg (2007), the most commonly used psychometric scale to measure dental fear is the Children's Fear Survey Schedule – Dental Subscale (CFSS-DS) by Cuthbert & Melamed (1982). The modified Children's Fear Survey Schedule – Dental Subscale (MCFSS-DC) has also been found to be reliable and valid among Finnish children. The factor structure used in this study was for 9-year-olds, which has been found to be suitable for children in all age groups (Rantavuori *et al.* 2005, Rantavuori *et al.* 2012). The MCFSS-DS enables studying two different dimensions of dental fear in addition to general dental fear. The Finnish version of the MCFSS-DS was selected for Study IV because it enabled using a more wide-ranging questionnaire than in Studies I–III, and the only validated dental fear questionnaire in Finnish was the MCFSS-DS.

The oral health-related quality of life of the children can be measured using several instruments that consist of a wide variety of dimensions. The CPQ is the most frequently used measurement of child oral health-related quality of life (Gilchrist *et al.* 2014). Because there were no validated CPQ instruments available in Finnish at the beginning of Study IV, CPQ<sub>11–14</sub> was chosen to be translated and validated in Finnish. The original CPQ<sub>11–14</sub> has been tested for validity and reliability (Jocovic *et al.* 2002), and the Finnish version of the CPQ<sub>11–14</sub> has also been reported to be valid and reliable among Finnish children aged 11–14 years (Kortelainen *et al.* 2016). However, it is not certain whether the measure is valid and reliable among children who are under or over the age of 11–14 years.

Ethical aspects in relation to performing research involving children can be difficult when the study is performed during school hours. Children may consider the questionnaire as a school assignment. Thus, it may cause forced answering of the questionnaire among some children who are afraid to decline any kind of school assignments, and children may answer the questionnaire based on social norms and expectations and not according to their own opinion. Also, some children may answer the questionnaire under pressure because they do not want to stand out from their peers by declining their participation. Nevertheless, in this study, none of the children were neither compelled nor persuaded to answer the questionnaire.

## 6.2 Results in relation to earlier studies

### *6.2.1 The association of dental fear among parent/child dyads and children and parent's evaluation of each other's dental fear*

A bivariate association between child and parental dental fear was found in this study among all children aged 11–12 years and among 15–16-year-old girls, which is in accordance with previous reports on the association between parental dental fear and dental fear of younger children (Tuutti & Lahti 1987, Rantavuori *et al.* 2002, Peretz *et al.* 2004, Rantavuori *et al.* 2004, Klaassen *et al.* 2007, Lara *et al.* 2012, Crego *et al.* 2013, Olak *et al.* 2013, Coric *et al.* 2014). The results concerning 15–16-year-old boys are in accordance with the previous result of child and parental dental fear not having an association (Folayan *et al.* 2002, Arnrup *et al.* 2003, Ten Berge *et al.* 2003, Arnrup *et al.* 2004, Balmer *et al.* 2004). However, it was found that children and parent's evaluation of each other's dental fear affected the association between child and parental dental fear. When taking into account the children's evaluation of their parents' dental fear, the association between the dental fears was no longer statistically significant. Child dental fear seems to be more strongly associated with the children's evaluation of their parent's dental fear than with the parent's real state of dental fear. However, because Study II was cross-sectional, it is not certain whether the dental fear of the child makes the child assume the parent to have dental fear as well, or whether the child's assumption of the parent's dental fear can make the child more likely fearful. The results of this study are in accordance with the previous results where dental fear is reported to be in association with previous dental treatments (ten Berge *et al.* 2002, Milsom *et al.* 2003, Karjalainen *et al.* 2003, Rantavuori *et al.* 2004), especially experiences on fillings (Lahti *et al.* 1989, ten Berge *et al.* 2002, Karjalainen *et al.* 2003, Milsom *et al.* 2003, Rantavuori *et al.* 2004).

To my knowledge, no studies have previously reported whether children can correctly evaluate the dental fear of their parents. Children and parents' ability to correctly evaluate the each other's dental fear remained poor throughout the study. The results concerning parents are in accordance with previous results (Gustafsson *et al.* 2010) and support the results, according to which parents' estimations of the mental condition of their children are not entirely reliable (Achenbach *et al.* 1987, Verhulst & Van Der Ende 1992, De Los Reyes & Kazdin 2004). Fearful parents and fearful children were least successful in correctly evaluating each other's

dental fear. Parents' evaluation of their children's dental fear seems to reflect both the parent's and the child's state of dental fear. The parent's dental fear may affect his/her evaluation of the child's dental fear, which is in accordance with previous results (Carson & Freeman 2001). Thus, the results of studies where child dental fear is reported by parents must be interpreted with caution. On the other hand, the results of this study revealed that the same effect can be seen in children, but in reverse: if the child evaluates the parent to have dental fear, the child has dental fear more likely independent of whether the parent actually has dental fear. Fearful children are more likely to evaluate their parents to have dental fear than non-fearful children. As for non-fearful children, they may not realize that their parents can even have dental fear. Since the results of Study II are cross-sectional, it is not possible to state whether children evaluate their parents to have dental fear because of their own fear or whether parental dental fear causes the child to have dental fear. As family members are often unaware of the correct state of each other's dental fear, these results support the previous suggestions concerning transmission of fear at a subconscious level (Klingberg & Berggren 1992, Kinirons & McCabe 1995, Townend *et al.* 2000, Arrrup *et al.* 2002, ten Berge *et al.* 2002, Rantavuori *et al.* 2009, Olak *et al.* 2013). However, transmission of dental fear at a subconscious level may also have occurred before the ages 11–16 years, but this calls for further study.

### ***6.2.2 Changes in dental fear and the association between changes in dental fear of parent/child dyads***

Contrary to previous results (Milgrom *et al.* 1995, Raadal *et al.* 1995, Wogelius *et al.* 2003), in this study, older children reported more often dental fear than younger children did. In addition, contrary to previous studies where the prevalence of dental fear decreased between the ages of 15 and 18 year (Thomson *et al.* 1997), in the present study, the prevalence of dental fear remained rather constant between the ages of 11 and 16 years. However, these results are in accordance with a previous study conducted on Finnish children, where dental fear was found to be more common among older (12–15-year-old) children than among younger (3–9-year-old) children (Rantavuori *et al.* 2004). However, because of the variation of the age ranges between the studies, the above comparison of results must be interpreted with caution. As suggested in previous studies, dental fear is associated with the sex, with female preponderance among children (Murray *et al.* 1989, Chellappah *et al.*

1990, Alvesalo *et al.* 1993, Klingberg *et al.* 1994a, Klingberg *et al.* 1994b, Bergius *et al.* 1997, Thomson *et al.* 1997, Thomson *et al.* 2000, ten Berge *et al.* 2002, Wogelius *et al.* 2003, Baier *et al.* 2004, Rantavuori *et al.* 2004, Taani *et al.* 2005, Klaassen *et al.* 2008, Rantavuori *et al.* 2009, Tickle *et al.* 2009, Ray *et al.* 2010, Rantavuori *et al.* 2014) and among adults (Skaret *et al.* 1998, Ragnarsson *et al.* 2003, Schuller *et al.* 2003, Lahti *et al.* 2007, Vika *et al.* 2008, Thomson *et al.* 2009, Pohjola *et al.* 2011, Humphris *et al.* 2013, Liinavuori *et al.* 2016). In contrast to a previous study (Rantavuori *et al.* 2009), the difference between girls' and boys' percentages on reporting dental fear started to show before the age of 15 years, and girls seem more vulnerable to have dental fear than boys. These results are in accordance with previous results (Murray *et al.* 1989) where dental fear increased between the ages 9–12 years among girls. The results concerning boys are in accordance with a previous study where dental fear of boys decreased between 5–8 years and 10–13 years of age (Klaassen *et al.* 2008).

The level of dental fear was stable among majority of the parents: 76% of the mothers and all of the fathers who initially reported being highly fearful were highly fearful throughout the study. This result is in accordance with previous studies where adult dental fear tended to stay stable (Liinavuori *et al.* 2016), especially among older adults (Locker & Liddell 1995, Hägglin *et al.* 1999, Thomson *et al.* 2000, Maggiriias & Locker 2002, Thomson *et al.* 2009, Liinavuori *et al.* 2016). The level of dental fear of the children also remained stable, but only 44% of the children who initially reported having high dental fear were highly fearful throughout the study. To my knowledge, there are no previous results of incidence of child dental fear or longitudinal studies reporting change in child dental fear along with sex differences. The incidence of high dental fear of children between the ages of 11–12 and 15–16 years increased in this study. Girls' incidence of high dental fear increased from 8% to 11%, while boys' incidence of high dental fear increased from 3% to 6%. In this study, the incidence of parents' high dental fear decreased during the study period of 3 years and 5 months, which complies with previous results where the 5-year incidence of people aged 18–24 years was higher (12.2%) than older people's (65 years or over) (1.7%) (Maggiriias & Locker 2002). The results concerning parental dental fear are partly in accordance with previous results where the incidence of female dental fear was higher than the incidence of male dental fear (Locker *et al.* 2001, Thomson *et al.* 2000). Contrary to previous results, in this study the incidence of paternal dental fear was higher in 2001–2003 than maternal dental fear. In

accordance with previous results, the incidence of paternal dental fear was lower in 2003–2005 compared to maternal dental fear, although the difference was small. However, as the number of the fathers was low in this study, the results of the incidences of paternal dental fear must be interpreted with caution.

To my knowledge, there are no previous reports on the association of dental fear changes between children and their parents. In this study, no association between the change in child and parental dental fear was found. The cognitive vulnerability, the sex of the participants, social constructions, epidemiology, and children's maturation and psychological development may also have an influence on the change in child dental fear. Compared to adults, adolescents are still developing, which may explain the divergent change in dental fear between the children and parents. During the adolescence, children confront new challenges, and the cognitive vulnerability of adolescents may differ from the cognitive vulnerability of their parents. Change in adolescent dental fear compared to more stable adult dental fear may be explained by the developing personality of adolescents. In addition, social constructions and sex differences both among adolescents and among adults may affect the responses, as fearfulness is more acceptable for females than for males. This may also appear among parent/child dyads as differences according to the responding parent. The lack of association between the boys' dental fear and parental dental fear when the children were in their mid-adolescence may be explained by Bandura's (1977) social learning theory, where observation, imitation and modeling are the learning pathways to behavior. Boys may imitate the behavior of the father, and girls may imitate the behavior of the mother, but since we did not require both parents to answer the questionnaire and since the number of respondent fathers was low, we found no association to confirm this among father/son dyads. Furthermore, to observe and imitate the social interactions and role behavior from the same sex peers become more important to adolescents (Bandura 1977, Bussey & Bandura 1999), and the importance of the parents as role models may decrease among boys more than among girls. Boys may relate more to their male peers than to their parents. These possible effects should thus be taken account when studying the transfer of dental fear among parent/child dyads in a longitudinal set-up.

### **6.2.3 The association between child dental fear and oral health-related quality of life**

These results are in accordance with previous results concerning fearful children having poorer oral health-related quality of life than non-fearful children (El Osta *et al.* 2015, Schuch *et al.* 2015). Among girls, these results are in accordance with a previous study, which found a positive association between the emotional wellbeing and dental fear of girls aged 7–14 years (Carrillo-Diaz *et al.* 2013). However, contrary to the previous result, this study found a positive association also among boys' dental fear and emotional wellbeing. Since in this study, child dental fear was positively associated with the OHRQoL, and experiences of orthodontics seemed to have a positive effect on fearful children's quality of life, this study also supports the previous results according to which dental fear predicts poor OHRQoL better than the need for orthodontic treatment (Dimberg *et al.* 2016). Contrary to previous results (Pousette Lundgren *et al.* 2015), however, there was no statistically significant difference in any dimensions of dental fear between children with a cleft lip and/or palate and children without a cleft lip and/or palate. In this study, experiences of orthodontics seemed to have a positive effect on fearful children's quality of life. Thus, these results also support also the previous suggestions concerning conditioning and gradual exposure of children to dental treatments as useful tools to prevent dental fear (Poulton *et al.* 2001, Klaassen *et al.* 2008, Nicolas *et al.* 2010). However, Rantavuori *et al.* (2014) have suggested that habituating children to orthodontics may not decrease their dental fear. Nevertheless, by increasing the knowledge of oral health with a non-threatening stimulus, dental care may become more familiar and the fear may reduce by latent inhibition. Latent inhibition has been suggested to have a stronger effect when the pathway is almost similar to the fear-learning pathway (Askew *et al.* 2016). In this study, a fearful child without any self-reported experience of orthodontics had a 17-times higher risk for poor social wellbeing (although the 95% CI was broad probably due to a small sample size) and 6-times higher risk for poor emotional wellbeing than a fearful child with experiences of orthodontics. Due to a mistake during the data analysis phase, the results of Study IV on the modifying effect between orthodontics and social and emotional wellbeing were misrepresented. During the analyzes, the data on self-reported treatment experience from the first measurement point was mistakenly analyzed with the data of quality of life from the second measurement point, where the children with a cleft lip and/or palate were not included. The correct results of the analyzes are presented in this

study. Poor social wellbeing (including social and emotional disorders) with dental fear may cause social withdrawal. (Rubin et al. 2009, Buss et al. 2014) Other studies have suggested that reduction in anxiety is beneficial for children's social outcomes (Wood 2006). However, there is no knowledge whether dental fear affects the social wellbeing, or vice versa.

### 6.3 Implications for further studies

These results indicate that dental fear is not associated between parents and their children at a conscious level. In future studies, a sufficient number of mothers and fathers should be included to avoid bias due to the respondents being mainly mothers, and to see the possible different roles of the parents in the (indirect) transfer of dental fear in a longitudinal design.

Girls are more vulnerable to develop dental fear during early and mid-adolescence than boys, and thus, from the clinical point of view, girls' vulnerability should be considered during dental treatments and in preventive dental care. By applying Rachman's theory of fear (1977) and Bandura's theory of social learning (1977) to dental fear, the difference between girls' and boys' dental fear may also be due to a learned behavior (vicarious learning and imitation). Expressing anxiety is more acceptable for females than for males in many cultures. Girls may overrate and boys may underrate their level of dental fear according to what they think is socially and culturally more acceptable. Thus, these cultural roles should also be investigated in further studies.

Furthermore, dental fear seems to heal better among adolescents and remain the same among adults. As the dominating factor behind dental fear is suggested to be direct classical conditioning, where people display fears due to their negative experiences, latent inhibition, successful prevention, and early intervention strategies during childhood have the potential to help individuals to avoid many years of suffering from dental fear. Even a small change in dental fear can induce positive effects, for example, by increasing the oral health-related quality of life and decreasing the need for emergency care. If children had access to frequent non-traumatic dental experiences, for example, in the form of annual checkups, or gradual exposure to dental treatments, such as orthodontics, it might be less likely that they will ever learn to fear dental care even after a later negative dental care event. In Finland, public oral

health services are provided free of charge for children aged 17 years and younger. Treating dental fear while the services are free could induce individuals to use oral health services regularly throughout their lives. Children's negative experiences and imaginings of dental treatment being a punishment and causing pain may lead to a vicious circle of fear containing negative models and intimidation. The effectiveness of frequent non-traumatic dental experiences on preventing dental fear and on causing a positive change in dental fear and thus increasing the oral health-related quality of life needs further studies. Nevertheless, the results suggesting that children with fear of treatment of dental decay have poorer oral health-related quality of life than non-fearful children provides a basis for future research on the multidimensionality of child dental fear. Future studies should focus on the association between specific dental treatments and dental fear.

Since parents are mostly not capable of correctly evaluating the level of their children's dental fear, in clinical situations, it is very important to always ask about the dental fear from the children themselves. Dentists should not trust in the parents' view only, as a difficult child is not always a fearful child and a quiet, withdrawn child is not always a non-fearful child.

To understand the etiology and prevention of dental fear, one must understand the factors moderating the pathways to dental fear. To avoid causing negative experiences – especially at a young age – and to invest in the feeling of comfort and control during dental treatments should be a basic procedure in preventing dental fear. Solving problems and discussing the possible fear-inducing situations with the child and the parents, considering the cognitive development of the child, may help the cooperation during dental treatment. It may also decrease the negative exchange between the child and the parents, as well as the health care personnel. On the other hand, as a child psychiatric clinical point of view, coexisting psychiatric conditions may complicate the treatment of dental fear. The treatment of dental fear might benefit from a pattern of thought where dental fear is seen as one part of all the psychiatric symptoms. In cases where children have multiple psychiatric symptoms, it could be better to treat dental fear as one of the symptoms and not as a separate and independent symptom. One of the challenges related to the pathways to dental fear is to explain why does everyone not develop dental fear after a negative learning experience. Heritability of dental fear has been studied among twins, and especially among girls, the risk of

having dental fear was reported to be high if the other twin had dental fear (Ray *et al.* 2010). Epigenetics may play a significant part in the development of dental fear. With the help of epigenetics, we may learn to better understand the individual differences in vulnerability or resistance to developing dental fear, and we could more effectively plan and target interventions. When studying child dental fear, the research should start as early as during the pregnancy, and the children should be followed all the way to their adulthood to ensure that data on dental fear is collected over enough number of years, considering the mental and physical development of the children. Thus, a larger parent/child dyad study population and a longer term longitudinal study is still needed to examine the multifactor etiology of dental fear.

## 7 CONCLUSIONS

The association between child and parental dental fear was contradictory. Children of parents with dental fear were more likely to have dental fear than children of parents without dental fear, but the children and parents' dental fear were not associated when adjusted with the children's evaluation of their parent's dental fear. In addition, there was no statistically significant correlation between the changes in dental fear of the children and their parents. These results imply an indirect transfer of dental fear, which needs to be studied in a longitudinal design while considering the possible different roles of mothers and fathers in child dental fear. The children and parents' evaluations of each other's dental fear remained poor throughout the study. Fearful parents and fearful children were the least successful to correctly evaluate each other's dental fear. When studying child dental fear, it is important to inquire the state of the dental fear directly from the children themselves, and parents' evaluations should be interpreted with caution. Females were more likely to have dental fear than males, and girls' dental fear increased more often than boys' dental fear did. The parents' dental fear tended to stay more stable than the children's, but contrary to our hypothesis, older children reported more often dental fear compared to younger children. This indicates that dental fear intervention strategies might be better to carry out during adolescence rather than in adulthood to achieve more successful recovery. Furthermore, it is also important to acknowledge girls' higher risk of developing fear. An association between child dental fear and oral health-related quality of life was found. Children with dental fear related to the treatment of dental caries had poorer oral health-related quality of life, and especially social and emotional wellbeing, than non-fearful children. When treating a child with dental fear, it is important to recognize the association between dental fear related to the treatment of dental caries and social and emotional wellbeing. It is also important to acknowledge the multidimensionality of child dental fear and its effect on the oral health-related quality of life. It would be preferable that the prevention of dental fear and intervention were designed and carried out individually.

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## REFERENCES

Achenbach T, McConaughy S, Howell C. Child/adolescent behavioral and emotional problems: implications of cross-informant correlations for situational specificity. *Psychol Bull* 1987; 101: 213–232.

Alvesalo I, Murtomaa H, Milgrom P, Honkanen A, Karjalainen M, Tay K-M. The Dental Fear Survey Schedule: a study with Finnish children. *Int J Paediatr Dent* 1993; 3: 193–198.

Alwin N. An assessment of dental anxiety in children. *Br Dent J* 1991; 171: 201.

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. Arlington, VA; American Psychiatric Association: 2013

Armfield J, Slade G, Spencer A. Are people with dental fear under-represented in oral epidemiological surveys? *Soc Psychiatry Psychiatr Epidemiol* 2009; 44: 495–500.

Armfield J, Slade G, Spencer A. Cognitive vulnerability and dental fear. *BMC Oral Health* 2008; 8: 2.

Arrrup K, Berggren U, Broberg A, Lundin S-A, Hakeberg M. Attitudes to dental care among parents of uncooperative vs. Cooperative child dental patients. *Eur J Oral Sci* 2002b; 110: 75–82.

Arrrup K, Broberg A, Berggren U, Bodin L. Lack of cooperation in pediatric dentistry – the role of child personality characteristics. *Paediatr Dent* 2002a; 24: 119–128.

Arrrup K, Berggren U, Broberg A, Bodin L. A Short-term follow-up of treatment outcome in groups of uncooperative child dental patients. *Eur J Paediatr Dent* 2004; 5: 216–224.

Arnrup K, Broberg A, Berggren U, Bodin L. Treatment outcome in subgroups of uncooperative child dental patients: an exploratory study. *Int J Paediatr Dent* 2003; 13: 304–319.

Askew C, Reynolds G, Fielding-Smith S, Field A. Inhibition of vicariously learned fear in children using positive modeling and prior exposure. *J Abnorm Psychol* 2016; 125: 279–291.

Baier K, Milgrom P, Russell S, Mancl L, Yoshida T. Children's fear and behavior in private pediatric dentistry practices. *Paediatr Dent* 2004; 26: 316–321.

Balmer R, O'Sullivan E, Pollard E, Curzon M. Anxiety related to dental general anaesthesia: changes in anxiety in children and their parents. *Eur J Paediatr Dent* 2004; 5: 9–14.

Bandura A. *Social learning theory*. Englewood Cliffs, NJ; Prentice Hal: 1977

Bedi R, Sutcliffe P, Donnan P, McConnachie J. The prevalence of dental anxiety in a group of 13- and 14-year-old Scottish children. *Int J Paediatr Dent* 1992; 2: 17–24.

Beesdo-Baum K, Knappe S. Developmental epidemiology of anxiety disorders. *Child Adolesc Psychiatric Clin N Am* 2012; 21: 457–478.

Berggren U. General and specific fears in referred and self-referred adult patients with extreme dental anxiety. *Behav Res Ther* 1992; 30: 395–401.

Bergius M, Berggren U, Bogdanov O, Hakeberg M. Dental anxiety among adolescents in St. Petersburg, Russia. *Eur J Oral Sci* 1997; 105: 117–122.

Buss K, Davis E, Kiel E, Brooker R, Beekman C, Early M. Dysregulated fear predicts social wariness and social anxiety symptoms during kindergarten. *J Clin Child Adolesc Psychol* 2013; 42: 603–616.

Buss K, McDoniel M. Improving the Prediction of Risk for Anxiety Development in Temperamentally Fearful Children. *Curr Dir Psychol Sci* 2016; 25: 14–20.

---

Bussey K, Bandura A. Social cognitive theory of gender development and differentiation. *Psychol Rev* 1999; 106: 676–713.

Broder H, McGrath C, Cisneros G. Questionnaire development: Face validity and item impact testing of the Child Oral Health Impact Profile. *Community Dent Oral Epidemiol* 2007; 35: 8–19.

Carrillo-Diaz M, Crego A, Romero-Maroto M. The influence of gender on the relationship between dental anxiety and oral health-related emotional well-being. *Int J Paediatr Dent* 2013; 23: 180–187.

Carson P, Freeman R. Assessing child dental anxiety: the validity of clinical observations. *Int J Paediatr Dent* 1997; 7: 171–176.

Carson P, Freeman R. Characteristics of children attending for dental general anaesthesia in 1993 and 1997. *Prim Dent Care* 2000; 7: 163–167.

Carson P, Freeman R. Dental caries, age and anxiety: factors influencing sedation choice for children attending for emergency dental care. *Community Dent Oral Epidemiol* 2001; 29: 30–36.

Chellappah N, Vignehsa H, Milgrom P, Lo G. Prevalence of dental anxiety and fear in children in Singapore. *Community Dent Oral Epidemiol* 1990; 18: 269–271.

Cinar A, Murtooma H. A Comparison of Psychosocial Factors Related to Dental Anxiety among Turkish and Finnish Pre-adolescents. *Oral Health Prev Dent* 2007; 5: 173–179.

Corah N. Development of a dental anxiety scale. *J Dent Res* 1969; 48: 596.

Coric A, Banozic A, Klaric M, Vukojevic K, Puljak L. Dental fear and anxiety in older children: an association with parental dental anxiety and effective pain coping strategies. *J Pain Res* 2014; 7: 515–521.

Crego A, Carillo-Diaz M, Armfield J, Romero M. Applying the Cognitive Vulnerability Model to the analysis of cognitive and family influences on children's dental fear. *Eur J Oral Sci* 2013; 121: 194–203.

Cuthbert M, Melamed B. A screening device: children at risk for dental fears and management problems. *ASDC J Dent Child* 1982; 48: 432–436.

Davey G. Dental phobias and anxieties: evidence for conditioning processes in the acquisition and modulation of a learned fear. *Behav Res Ther* 1989; 27: 51–58.

De Los Reyes A, Kazdin A. Measuring informant discrepancies in clinical child research. *Psychol Assess* 2004; 16: 330–334.

Dimberg L, Lennartsson B, Bondemark L, Arnrup K. Oral health-related quality-of-life among children in Swedish dental care: The impact from malocclusions or orthodontic treatment need. *Acta Odont Scand* 2016; 74: 127–133.

El Osta N, Pichot H, Soulier-Peigue D, Hennequin M, Tubert-Jeannin S. Validation of the child oral health impact profile (COHIP) French questionnaire among 12 years-old children in New Caledonia. *Health Qual Life Outcomes* 2015; 13: 176.

Erikson E. *Children and Society*. New York; Norton: 1950

Folayan M, Adekoya-Sofowora C, Otuyemi O, Ufomata D. Parental anxiety as a possible predisposing factor to child dental anxiety in patients seen in a suburban dental hospital in Nigeria. *Int J Paediatr Dent* 2002; 12: 255–259.

Frankl S, Shiere F, Fogels H. Should the parent remain with the child in the dental operatory? *ASDC J Dent Child* 1962; 29: 150–163.

Freud S. Three essays on the theory of sexuality. *Se*, 7: 1905 (also available on <http://www.sigmundfreud.net/three-essays-on-the-theory-of-sexuality-pdf-ebook.jsp>)

Genderson M, Sischo L, Markowitz K, Fine D, Broder H. An overview of children's oral health-related quality of life assessment: from scale development to measuring outcomes. *Caries Res* 2013; 47: 13–21.

Gherunpong S, Tsakos G, Sheiham A. Developing and evaluating an oral health-related quality of life index for children; the CHILD-OIDP. *Community Dent Health* 2004; 21: 161–169.

Gilchrist F, Rodd H, Deery C, Marshman Z. Assessment of the quality of measures of child oral health-related quality of life. *BMC Oral Health* 2014; 23: 14–40.

Goyal A, Sharma A, Gaur T, Singh J, Pachori Y, Chhabra K, Chhabra C. Impact of dental fear on oral health-related quality of life among school going and non-school going children in Udaipur city: A cross-sectional study. *Contemp Clin Dent* 2014; 5: 42–48.

Gustafsson A, Arnrup K, Broberg A, Bodin L, Berggren U. Child dental fear as measured with the children's fear survey schedule: the impact of referral and type of informant (child versus parent). *Community Dent Oral Epidemiol* 2010; 38: 256–266.

Hägglin C, Berggren U, Hakeberg M, Hällstrom T, Bengtsson C. Variations in dental anxiety among middle-aged and elderly women in Sweden: a longitudinal study between 1968 and 1996. *J Dent Res* 1999; 78: 1655–1661.

Howard K, Freeman R. Reliability and validity of a faces version of the Modified Child Dental Anxiety Scale. *Int J Paediatr Dent*. 2007; 17: 281–288.

Hausen H, Seppä L, Poutanen R, Niinimaa A, Lahti S, Kärkkäinen S, Pietilä I. Noninvasive control of dental caries in children with active initial lesions. A randomized clinical trial. *Caries Res* 2007; 41: 384–391.

Humphris G, Crawford J, Hill K, Gilbert A, Freeman R. UK population norms for the modified dental anxiety scale with percentile calculator: adult dental health survey 2009 results. *BMC Oral Health* 2013; 13: 29.

Humphris G, Morrison T, Lindsay S. The Modified Dental Anxiety Scale. Validation and United Kingdom norms. *Community Dent Health* 1995; 12: 143–150.

Jokovic A, Locker D, Guyatt G. What do children's global ratings of oral health and well-being measure? *Community Dent Oral Epidemiol* 2005; 33: 205–211.

Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *J Dent Res* 2002; 81: 459–463.

Karjalainen S, Olak J, Söderling E, Pienihäkkinen K, Simell O. Frequent exposure to invasive medical care in early childhood and operative dental treatment associated with dental apprehension of children at 9 years of age. *Eur J Paediatr Dent* 2003; 4: 186–190.

Kinirons M, McCabe M. Familial and maternal factors affecting the dental health and dental attendance of preschool children. *Community Dent Health* 1995; 12: 226–229.

Klaassen M, Veerkamp J, Hoogstraten J. Changes in children's dental fear: a longitudinal study. *Eur Arch Paediatr Dent* 2008; 9: 29–35.

Klaassen M, Veerkamp J, Hoogstraten J. Dental fear, communication, and behavioural management problems in children referred for dental problems. *Int J Paediatr Dent* 2007; 17: 469–477.

Kleinknecht R, Klepac R, Alexander L. Origins and characteristics of fear of dentistry. *J Am Dent Assoc* 1973; 86: 121–126.

Klingberg G. Dental fear and behaviour management problems in children. A study of measurement prevalence, concomitant factors and clinical effects. *Swed Dent J* 1995; 103: 1–78.

Klingberg G, Berggren U. Dental problem behaviours in children of parents with severe dental fear. *Swed Dent J* 1992; 16: 27–32.

Klingberg G, Berggren U, Norén J. Dental fear in an urban Swedish child population: prevalence and concomitant factors. *Community Dent Health* 1994b; 11: 208–214.

Klingberg G, Broberg A. Dental fear/anxiety and dental behaviour management problems in children and adolescents: a review of prevalence and concomitant psychological factors. *Int J Paediatr Dent* 2007; 17: 391–406.

Klingberg G, Hwang C: Children's dental fear picture test (CDFP): a projective test for the assessment of child dental fear. *ASDC J Dent Child* 1994; 61: 89–96.

Klingberg G, Vannas Löfqvist L, Bjarnason S, Norén J. Dental behavior management problems in Swedish children. *Community Dent Oral Epidemiol* 1994a; 22: 201–205.

Kohlberg L. The Development of Modes of Thinking and Choices in Years 10 to 16. Ph.D. Dissertation, University of Chicago: 1958

Kortelainen T, Tolvanen M, Luoto A, Ylikontiola L, Sándor G, Lahti S. Oral health-related quality of life among cleft lip and/or palate and school children. *Cleft Palate Craniofac J* 2016; 53: 172–176.

Krikken J, Veerkamp J. Child rearing styles, dental anxiety and disruptive behavior; an exploratory study. *Eur Arch Paediatr Dent* 2008; 9: 23–28.

Kruger E, Thomson W, Poulton R, Davies S, Brown R, Silva P. Dental caries and changes in dental anxiety in late adolescence. *Community Dent Oral Epidemiol* 1998; 26: 355–359.

Lahti S, Tuutti H, Honkala E. The relationship of parental dental anxiety and child's caries status. *ASDC J Dent Child* 1989; 56: 191–195.

Lahti S, Vehkalahti M, Nordblad A, Hausen H. Dental fear among population aged 30 years and older in Finland. *Acta Odontol Scand* 2007; 65: 97–102.

Lara A, Crego A, Romero-Maroto M. Emotional contagion of dental fear to children: the fathers' mediating role in parental transfer of fear. *Int J Paediatr Dent* 2012; 22: 324–330.

Liinavuori A, Tolvanen M, Pohjola V, Lahti S. Changes in dental fear among Finnish adults: a national survey. *Community Dent Oral Epidemiol* 2016; 44: 128–134.

Locker D, Liddell A. Stability of dental anxiety scale scores: a longitudinal study of older adults. *Community Dent Oral Epidemiol* 1995; 23: 259–261.

Locker D, Liddell A, Dempster L, Shapiro D. Age of onset of dental anxiety. *J Dent Res* 1999; 78: 790–796.

Locker D. Measuring oral health: a conceptual framework. *Community Dent Health* 1988; 5: 3–18.

Locker D, Poulton R, Thomson W. Psychological disorders and dental anxiety in a young adult population. *Community Dent Oral Epidemiol* 2001; 29: 456–463.

Locker D, Shapiro D, Liddell A. Negative dental experiences and their relationship to dental anxiety. *Community Dent Health* 1996; 13: 86–92.

Locker D, Thomson WM, Poulton R. Psychological disorder, conditioning experiences, and the onset of dental anxiety in early adulthood. *J Dent Res* 2001; 80: 1588–1592.

Lubow R. Latent inhibition. *Psychol Bull* 1973; 79: 398–407.

Maggirias J, Locker D. Five-year incidence of dental anxiety in an adult population. *Community Dent Health* 2002; 19: 173–179.

McGrath C, Bedi R. The association between dental anxiety and oral health-related quality of life in Britain. *Community Dent Oral Epidemiol* 2004; 32: 67–72.

Mehrstedt M, John M, Tönnies S, Micheelis W. Oral health-related quality of life in patients with dental anxiety. *Community Dent Oral Epidemiol* 2007; 35: 357–363.

Milgrom P, Fiset L, Melnick S, Weinstein P. The prevalence and practice management consequences of dental fear in a major US city. *J Am Dent Assoc* 1988; 116: 641–647.

Milgrom P, Weinstein P, Heaton L. Treating fearful dental patients, a patient management handbook. Seattle; *Dent Behav Res*: 2009

Milgrom P, Mancl L, King B, Weinstein P. Origins of childhood dental fear. *Behav Res Ther* 1995; 33: 313–319.

Milsom K, Tickle M, Humphris G, Blinkhorn A. The relationship between anxiety and dental experience in 5-year-old children. *Br Dent J* 2003; 9: 503–506.

Murray P, Liddell A, Donohue J. A longitudinal study of the contribution of dental experience to dental anxiety in children between 9 and 12 years of age. *J Behav Med* 1989; 12: 309–320.

Neverlien P. Assessment of a single-item dental anxiety question. *Acta Odontol Scand* 1990; 48: 365–369.

Ng S, Leung W. A community study on the relationship of dental anxiety with oral health status and oral health-related quality of life. *Community Dent Oral Epidemiol* 2008; 36: 347–356.

Nicolas E, Bessadet M, Collado V, Carrasco P, Rogerleroi V, Hennequin M. Factors affecting dental fear in French children aged 5-12 years. *Int J Paediatr Dent* 2010; 20: 366–373.

Nicolas E, Collado V, Faulks D, Bullier B, Hennequin M. A national cross-sectional survey of dental anxiety in the French adult population. *BMC Oral Health* 2007; 7: 12.

Olak J, Saag M, Honkala S, Nömmela R, Runnel R, Honkala E, Karjalainen S. Children's dental fear in relation to dental health and parental dental fear. *Stomatologija* 2013; 15: 26–31.

Pavlov I. *Conditioned reflexes: An investigation of the physiological activity of the cerebral cortex*. London; Oxford University Press: 1927

Peretz B, Nazarian Y, Bimstein E. Dental anxiety in a students' paediatric dental clinic: children, parents and students. *Int J Paediatr Dent* 2004; 14: 192–198.

Piaget J. *The origins of intelligence in children*. New York; International Universities press, Inc: 1952

Piaget J, Inhelder B. *Psychology of the child*. New York; Basic Books, Inc: 2000 (Originally published in French as *la Psychologie de l'enfant*. Paris; Presses Universitaires de France: 1966)

Piaget J, Inhelder B. *The Growth of Logical Thinking from Childhood to Adolescence*. New York; Basil Books, Inc: 1958

Pohjola V, Lahti S, Suominen-Taipale L, Hausen H. Dental fear and subjective oral impacts among adults in Finland. *Eur J Oral Sci* 2009; 117: 268–272.

Pohjola V, Mattila A, Joukamaa M, Lahti S. Anxiety and depressive disorders and dental fear among adults in Finland. *Eur J Oral Sci* 2011; 119: 55–60.

Poulton R, Waldie K, Thomson W, Locker D. Determinants of early- vs late-onset dental fear in a longitudinal-epidemiological study. *Behav Res Ther* 2001; 39: 777–785.

Pousette Lundgren G, Karsten A, Dahllöf G. Oral health-related quality of life before and after crown therapy in young patients with amelogenesis imperfecta. *Health Qual Life Outcomes* 2015; 13: 197.

Poutanen R, Lahti S, Hausen H. Oral health-related knowledge, attitudes, and beliefs among 11- to 12- year-old Finnish schoolchildren with different oral health behaviors. *Acta Odontol Scand* 2005; 63: 10–16.

Raadal M, Milgrom P, Weinstein P, Mancl L, Cauce A. The prevalence of dental anxiety in children from low-income families and its relationship to personality traits. *J Dent Res* 1995; 74: 1439–1443.

Rachman S. The conditioning theory of fear-acquisition: a critical examination. *Behav Res Ther* 1977; 15: 375–387.

Ragnarsson B, Arnlaugsson S, Karlsson K, Magnusson T, Arnarson B. Dental anxiety in Iceland: an epidemiological postal survey. *Acta Odontol Scand* 2003; 61: 283–288.

Rantavuori K. Aspects and determinants of children's dental fear. Oulu: Oulu University Press; 2008 (<http://urn.fi/urn:isbn:9789514289439>).

Rantavuori K, Lahti S, Hausen H, Seppä L, Kärkkäinen S. Dental fear and oral health and family characteristics of Finnish children. *Acta Odontol Scand* 2004; 62: 207–213.

Rantavuori K, Lahti S, Seppä L, Hausen H. Dental fear of Finnish children in the light of different measures of dental fear. *Acta Odontol Scand* 2005; 63: 239–244.

Rantavuori K, Lahti S, Tolvanen M, Seppä L, Hausen H. Factors associated with different measures of dental fear among children at different ages. *J Dent Child* 2009; 76: 13–19.

Rantavuori K, Sihvonen A, Tolvanen M, Lahti S. The significance of previous invasive and orthodontic treatment experiences on children's dental fear. *Eur J Orthodontics* 2014; 36: 409–413.

Rantavuori K, Tolvanen M, Lahti S. Confirming the factor structure of modified CFSS-DS in Finnish children at different ages. *Acta Odontol Scand* 2012; 70: 421–425.

Rantavuori K, Zerman N, Ferro R, Lahti S. Relationship between children's first dental visit and their dental anxiety in the Veneto Region of Italy. *Acta Odontol Scand* 2002; 60: 297–300.

Ray J, Boman L, Bodin L, Berggren U, Lichtenstein P, Broberg A. Heritability of dental fear. *J Dent Res* 2010; 89: 297–301.

Rodríguez G, Hall G. Human latent inhibition and the density of predictive relationships in the context in which the target stimulus occurs. *Q J Exp Psychol* 2016; 11: 1–9. [Epub ahead of Print]

Roy-Byrne P, Milgrom P, Khoon-Mei T, Weinstein P, Katon W. Psychopathology and psychiatric diagnosis in subjects with dental phobia. *J Anxiety Disord* 1994; 8: 19–31.

Rubin K, Coplan R, Bowker J. Social withdrawal in childhood. *Annual Review of Psychology* 2009; 60: 141–171.

Schuch H, Costa F, Torriani D, Demarco F, Goettens M. Oral health-related quality of life of schoolchildren: impact of clinical and psychosocial variables. *Int J Paediatr Dent* 2015; 25: 358–365.

Schuller A, Willumsen T, Holst D. Are there differences in oral health and oral health behavior between individuals with high and low dental fear? *Community Dent Oral Epidemiol* 2003; 32: 116–121.

Skaret E, Raadal M, Berg E, Kvale G. Dental anxiety among 18-year-olds in Norway. Prevalence and related factors. *Eur J Oral Sci* 1998; 106: 835–843.

Skinner B. *Science and human behavior*. New York; the free Press: 1965

Taani D, El-Qaderi S, Abu Alhaja E. Dental anxiety in children and its relationship to dental caries and gingival condition. *Int J Dent Hyg* 2005; 3: 83–87.

ten Berge M, Veerkamp J, Hoogstraten J. The etiology of childhood dental fear: the role of dental and conditioning experiences. *J Anxiety Disord* 2002; 16: 321–329.

ten Berge M, Veerkamp J, Hoogstraten J, Prins P. Childhood dental fear in relation to parental child-rearing attitudes. *Psychol Rep* 2003; 92: 43–50.

ten Berge M, Veerkamp J, Hoogstraten J, Prins P. Childhood dental fear in the Netherlands: prevalence and normative data. *Community Dent Oral Epidemiol* 2002a; 30: 101–107.

ten Berge M, Veerkamp J, Hoogstraten J, Prins P. The dental subscale of the children's fear survey schedule: predictive value and clinical usefulness. *J Psychopathol Behav Assessment* 2002b; 24: 115–118.

ter Horst G, de Wit C. Review of behavioural research in dentistry 1987-1992: dental anxiety, dentist-patient relationship, compliance and dental attendance. *Int Dent J* 1993; 43: 265–278.

Themessl-Huber M, Freeman R, Humphris G, MacGillivray S, Terzi N. Empirical evidence of the relationship between parental and child dental fear: a structured review and meta-analysis. *Int J Paediatr Dent* 2010; 20: 83–101.

Thomas A, Chess S. *Temperament and development*. New York; Brunner/Mazel: 1977

Thomson W, Broadbent J, Locker D, Poulton R. Trajectories of dental anxiety in a birth cohort. *Community Dent Oral Epidemiol* 2009; 37: 209–219.

Thomson W, Locker D, Poulton R. Incidence of dental anxiety in young adults in relation to dental treatment experience. *Community Dent Oral Epidemiol* 2000; 28: 289–294.

Thomson W, Poulton R, Kruger E, Davies S, Brown R, Silva P. Changes in self-reported dental anxiety in New Zealand adolescents from ages 15–18 years. *J Dent Res* 1997; 76: 1287–1291.

Tickle M, Jones C, Buchannan K, Milsom K, Blinkhorn A, Humphris G. A prospective study of dental anxiety in a cohort of children followed from 5 to 9 years of age. *Int J Paediatr Dent* 2009; 19: 225–232.

Tolvanen M, Lahti S, Poutanen R, Seppä L, Pohjola V, Hausen H. Changes in children's oral health-related behavior, knowledge and attitudes during 3.4-yr randomized clinical trial and oral health-promotion program. *Eur J Oral Sci* 2009; 117: 390–397.

Townend E, Dimigen G, Fung D. A clinical study of child dental anxiety. *Behav Res Ther* 2000; 38: 21–46.

Tuutti H, Lahti S. Oral health status of children in relation to the dental anxiety of their parents. *J Pedod* 1987; 11: 146–150.

Venham L, Bengston D, Cipes M. Children's response to sequential dental visits. *J Dent Res* 1977; 56: 454–459.

Verhulst F, van der Ende J. Agreement between parents' reports and adolescents' self-reports of problem behavior. *J Child Psychol Psychiat* 1992; 33: 1011–1023.

Vermaire J, de Jongh A, Aartman I. Dental anxiety and quality of life: the effect of dental treatment. *Community Dent Oral Epidemiol* 2008; 36: 409–416.

Vermaire J, van Houtem C, Ross J, Schuller A. The burden of disease of dental anxiety: generic and disease-specific quality of life in patients with and without extreme levels of dental anxiety. *Eur J Oral Sci*. 2016; 124: 454–458.

Versloot J, Veerkamp J, Hoogstraten J. Dental anxiety and psychological functioning in children: its relationship with behavior during treatment. *Eur Arch Paediatr Dent* 2008; 9: 36–40.

Viinikangas S, Lahti S, Yuan S, Pietilä I, Freeman R, Humphris G. Evaluating a single dental anxiety question in Finnish adults. *Acta Odontol Scand* 2007; 65: 236–240.

Vika M, Skaret E, Raadal M, Ost L, Kvale G. Fear of blood injury and injections, and its relationship to dental anxiety and probability of avoiding dental treatment among 18-year olds in Norway. *Int J Paediatr Dent* 2008; 18: 163–169.

---

Watson J. *The ways of behaviorism*. New York, NY; Harper & Brothers Pub: 1928

Weiner A, Sheehan D. Etiology of dental anxiety: psychological trauma or CNS chemical imbalance? *Gen Dent* 1990; 38: 39–43.

Wogelius P, Poulsen S, Sørensen H. Prevalence of dental anxiety and behaviour management problems among six to eight years old Danish children. *Acta Odontol Scand* 2003; 61: 178–183.

Wood J. Effect of anxiety reduction on children's school performance and social adjustment. *Developmental Psychol* 2006; 42: 345–349.

World Dental Federation. Oral Health Definition – Executive Summary. [http://www.fdiworldental.org/media/96503/oral\\_health\\_definition-exec\\_summary-en.pdf](http://www.fdiworldental.org/media/96503/oral_health_definition-exec_summary-en.pdf)

World Health Org. Classification of Mental and Behavioral Disorders. <http://apps.who.int/classifications/icd10/browse/2016/en#/F40-F48>

# APPENDICES

## Appendix 1. Questionnaire for children

1

### 1. Besides myself in my home live(s)

1. \_\_\_ sisters
2. \_\_\_ brothers
3. mother
4. father
5. someone else, who \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_

ID tag

### 2. How often do you eat warm meals, snacks, nibbles or special treats?

|                           | 3 to 4<br>times a day<br>or more<br>often | Twice a<br>day | Once a<br>day | 2 to 3<br>times a<br>week | Once a<br>week | Twice a<br>month | Less<br>often or<br>never |
|---------------------------|---|----------------|---------------|---------------------------|----------------|------------------|---------------------------|
| Warm meals                | 1   | 2              | 3             | 4                         | 5              | 6                | 7                         |
| Snacks                    | 1   | 2              | 3             | 4                         | 5              | 6                | 7                         |
| Nibbles or special treats | 1   | 2              | 3             | 4                         | 5              | 6                | 7                         |

### 3. Below is a list of different food items. Think about each of them if you eat them as main meal ("real food"), with the main meal or as a treat or nibbles. Mark the correct alternative. If you eat them in both ways, mark both. Also estimate how often you eat these items by circling the correct alternative.

|   | As main<br>meal<br>("real<br>food") | As a<br>treat or<br>nibbles. | 3 to 4<br>times a day<br>or more<br>often | Twice a<br>day | 2 to 3<br>times a<br>week | Once a<br>week | Twice a<br>month | Twice a<br>month | Less<br>often or<br>never |
|---|-------------------------------------|------------------------------|---|----------------|---------------------------|----------------|------------------|------------------|---------------------------|
| Cereals   | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Sweetened yogurt or<br>sour whole milk                      | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Puddings  | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Dried fruits (like<br>raisins)                              | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Ice-cream, popcicles  | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Fruit juices  | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Soft drink (like<br>Fanta, Coea Cola)                       | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Sugary juices<br>(concentrates,<br>packaged or<br>homemade) | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |

2

|  | As main meal ("real food") | As a delicacy or nibbles. | 3 to 4 times a day or more often | Twice a day | 2 to 3 times a week | Once a week | Twice a month | Twice a month | Less often or never |
|--|----------------------------|---------------------------|----------------------------------|-------------|---------------------|-------------|---------------|---------------|---------------------|
| Chocolate drinks or shakes                                     | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Sports drinks  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Buns, cakes or cookies   | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Crisps, cheese snacks etc.                                     | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Separately sold candies (you can make your own selection)      | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Other candies like chocolate bars, lozenges or packed candies) | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Xylitol-candies  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Ordinary chewing gum   | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Xylitol chewing gum  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Sugar or honey with tea  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Sugar with coffee  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Water to quench thirst   | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Something else, what   | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |

**4. Now we will ask about yesterday. Think about what you did and what you ate or drank in the morning before going to school, at school, after school and in the evening. List all you did, ate or drank in each section. Try to be as precise as possible. For example, in the afternoon after school before six o'clock: did homework, ate crisps, had football practice, drank sports drink**

| time                   | what I did | eating and drinking |
|------------------------|------------|---------------------|
| before going to school |            |                     |
| at school before lunch |            |                     |

3

|   |  |  |
|---|--|--|
| during school lunch                       |  |  |
| at school after lunch                     |  |  |
| afternoon after school before six o'clock |  |  |
| in the evening after six o'clock          |  |  |

**5. What things do you like doing most in your free time? List them in order of preference. Mention also on each occasion whether it involves eating, drinking, smoking, using snuff or something else. (For example, ice-hockey, sports drinks, watching videos with friends, candies and chips, water)**

Way of spending my free time

Eating, drinking, smoking, using snuff or other thing

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

3. \_\_\_\_\_

\_\_\_\_\_

4

**6. How often do you do the following things?**

|                  | 3 to 4 times a day<br>or more often | Twice a<br>day | 2 to 3<br>times a<br>week | Once a<br>week | Twice a<br>month | Twice a<br>month | Less often<br>or never |
|------------------|-------------------------------------|----------------|---------------------------|----------------|------------------|------------------|------------------------|
| Smoke cigarettes | 1                                   | 2              | 3                         | 4              | 5                | 6                | 7                      |
| Use snuff        | 1                                   | 2              | 3                         | 4              | 5                | 6                | 7                      |

**7. How often do you use the items or products listed below?**

|  | 3 to 4 times a<br>day or more<br>often | Twice a<br>day | 2 to 3<br>times a<br>week | Once a<br>week | Twice a<br>month | Twice a<br>month | Less often<br>or never |
|--|--|----------------|---------------------------|----------------|------------------|------------------|------------------------|
| Toothbrush   | 1                                      | 2              | 3                         | 4              | 5                | 6                | 7                      |
| Dental floss   | 1                                      | 2              | 3                         | 4              | 5                | 6                | 7                      |
| Toothpicks   | 1                                      | 2              | 3                         | 4              | 5                | 6                | 7                      |
| Fluoridated toothpaste                                     | 1                                      | 2              | 3                         | 4              | 5                | 6                | 7                      |
| Non-fluoridated<br>toothpaste                              | 1                                      | 2              | 3                         | 4              | 5                | 6                | 7                      |
| Fluoride tablets or<br>lozenges (one or more at a<br>time) | 1                                      | 2              | 3                         | 4              | 5                | 6                | 7                      |

**8. I believe I can keep my own teeth throughout life**

- 1 yes
- 2 I don't know
- 3 no

**9. How important is brushing teeth for you when going to the following situations?**

|                             | very important | rather<br>important | not so<br>important | not important<br>at all |
|-----------------------------|----------------|---------------------|---------------------|-------------------------|
| school                      | 1              | 2                   | 3                   | 4                       |
| a dentist                   | 1              | 2                   | 3                   | 4                       |
| sports, hobbies etc.        | 1              | 2                   | 3                   | 4                       |
| meet my best friend         | 1              | 2                   | 3                   | 4                       |
| a disco                     | 1              | 2                   | 3                   | 4                       |
| meet my boy- /girlfriend    | 1              | 2                   | 3                   | 4                       |
| other situation, what _____ | 1              | 2                   | 3                   | 4                       |

5

**10. Why do you think brushing teeth is important?**

|   | strongly agree | partly agree | partly disagree | strongly disagree |
|---|----------------|--------------|-----------------|-------------------|
| I feel fresh                                    | 1              | 2            | 3               | 4                 |
| My parents are happy                            | 1              | 2            | 3               | 4                 |
| My friends are happy                            | 1              | 2            | 3               | 4                 |
| I would not get caries                          | 1              | 2            | 3               | 4                 |
| My appearance is better                         | 1              | 2            | 3               | 4                 |
| I avoid tooth discoloration                     | 1              | 2            | 3               | 4                 |
| My breath is fresh                              | 1              | 2            | 3               | 4                 |
| My gingiva is healthy/ my gums are not bleeding | 1              | 2            | 3               | 4                 |
| Other, what _____                               | 1              | 2            | 3               | 4                 |

**11. How distressed would you be if you got cavities in your teeth?**

- 1 not at all
- 2 a little
- 3 a lot
- 4 very much

**12. How distressed would you be if any of the following people close to you got cavities in their teeth?**

|             | not at all | a little | a lot | very much |
|-------------|------------|----------|-------|-----------|
| mother      | 1          | 2        | 3     | 4         |
| father      | 1          | 2        | 3     | 4         |
| best friend | 1          | 2        | 3     | 4         |

**13. Do any of the following people close to you have cavities in their teeth?**

|             | yes | no | do not know |
|-------------|-----|----|-------------|
| mother      | 1   | 2  | 3           |
| father      | 1   | 2  | 3           |
| best friend | 1   | 2  | 3           |

**14. What do you think about the following statements?**

|  | strongly agree | partly agree | partly disagree | strongly disagree |
|--|----------------|--------------|-----------------|-------------------|
| I believe I can't prevent dental decay without professional help | 1              | 2            | 3               | 4                 |
| Teeth should be cleaned daily by brushing them twice a day       | 1              | 2            | 3               | 4                 |

|   | strongly agree | partly agree | partly disagree | strongly disagree |
|---|----------------|--------------|-----------------|-------------------|
| A person can prevent caries by using fluoride toothpaste                          | 1              | 2            | 3               | 4                 |
| A person can reduce the risk of caries by omitting one sweet snack daily          | 1              | 2            | 3               | 4                 |
| To assure sufficient fluoride supply, one has to brush teeth at least twice a day | 1              | 2            | 3               | 4                 |
| A person can prevent caries by using xylitol products after meals                 | 1              | 2            | 3               | 4                 |

6

15. What do you think is the main reason that a 5<sup>th</sup> or 6<sup>th</sup> grader gets cavities in his/her teeth?

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16. There might live people in your home who are afraid of going to a dentist. Please estimate how much they are afraid of dentistry.

|                     | not afraid | a little afraid | afraid to some degree | quite afraid | very afraid | do not know |
|---------------------|------------|-----------------|-----------------------|--------------|-------------|-------------|
| Mother              | 1          | 2               | 3                     | 4            | 5           | 6           |
| Father              | 1          | 2               | 3                     | 4            | 5           | 6           |
| myself              | 1          | 2               | 3                     | 4            | 5           | 6           |
| some of my siblings | 1          | 2               | 3                     | 4            | 5           | 6           |
| someone else, who   | 1          | 2               | 3                     | 4            | 5           | 6           |

If you have any other comments on oral health or related issues, you can write them here

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THANK YOU FOR YOUR RESPONSES!

## Appendix 2. Questionnaire for parents

1

**1. Does your child have any illness?**

- 1 No  
2 Yes, what \_\_\_\_\_

ID tag

**2. Does your child use medicines regularly?**

- 1 No  
2 Yes, what \_\_\_\_\_

**3. Person who responded to this questionnaire**

- 1 Mother  
2 Father  
3 Other caregiver, who \_\_\_\_\_

**4. Age of the respondent \_\_\_\_\_ years**

**5. What is the main occupation of the parents/caregivers? PLEASE STATE AS PRECISELY AS POSSIBLE (for example, engineer fitter, class teacher in comprehensive school, builder, typist). Avoid approximate titles like master of arts, municipal counselor. If a parent/caregiver is retired or unemployed, please state this fact and give the previous occupation.**

1. Mother, occupation \_\_\_\_\_  
2. Father, occupation \_\_\_\_\_  
3. Other caregiver, who: \_\_\_\_\_ occupation \_\_\_\_\_  
4. Other caregiver, who: \_\_\_\_\_ occupation \_\_\_\_\_

**6. How often do you use the items or products listed below?**

|  | 3 to 4 times a day or more often | Twice a day | 2 to 3 times a week | Once a week | Twice a month | Twice a month | Less often or never |
|--|----------------------------------|-------------|---------------------|-------------|---------------|---------------|---------------------|
| Toothbrush   | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Dental floss   | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Toothpicks   | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Fluoridated toothpaste                               | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Non-fluoridated toothpaste                           | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |
| Fluoride tablets or lozenges (one or more at a time) | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                   |

**7. How often do you eat warm meals, snacks, nibbles or special treats?**

|                           | 3 to 4<br>times a day<br>or more<br>often | Twice a<br>day | Once a<br>day | 2 to 3<br>times a<br>week | Once a<br>week | Twice a<br>month | Less<br>often or<br>never |
|---------------------------|---|----------------|---------------|---------------------------|----------------|------------------|---------------------------|
| Warm meals                | 1   | 2              | 3             | 4                         | 5              | 6                | 7                         |
| Snacks                    | 1   | 2              | 3             | 4                         | 5              | 6                | 7                         |
| Nibbles or special treats | 1   | 2              | 3             | 4                         | 5              | 6                | 7                         |

**8. Below is a list of different food items. Think about each of them, whether you eat them as a main meal ("real food"), with the main meal or as a treat or nibbles. Mark the correct alternative. If you eat them in both ways, mark both. Estimate also how often you eat these items by circling the correct alternative.**

|   | As main<br>meal<br>("real<br>food") | As a<br>treat or<br>nibbles. | 3 to 4<br>times a day<br>or more<br>often | Twice a<br>day | 2 to 3<br>times a<br>week | Once a<br>week | Twice a<br>month | Twice a<br>month | Less<br>often or<br>never |
|---|-------------------------------------|------------------------------|---|----------------|---------------------------|----------------|------------------|------------------|---------------------------|
| Cereals   | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Sweetened yogurt or<br>sour whole milk                      | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Puddings  | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Dried fruits (like<br>raisins)                              | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Ice-cream, popicles   | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Fruit juices  | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Soft drinks (like<br>Fanta, Coca Cola)                      | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Sugary juices<br>(concentrates,<br>packaged or<br>homemade) | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Chocolate drinks or<br>shakes                               | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Sports drinks   | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Buns, cakes or<br>cookies                                   | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |
| Crisps, cheese<br>snacks etc.                               | <input type="checkbox"/>            | <input type="checkbox"/>     | 1   | 2              | 3                         | 4              | 5                | 6                | 7                         |

|  | As main meal ("real food") | As a delicacy or nibbles. | 3 to 4 times a day or more often | Twice a day | 2 to 3 times a week | Once a week | Twice a month | Twice a month | Less often or never <sup>3</sup> |
|--|----------------------------|---------------------------|----------------------------------|-------------|---------------------|-------------|---------------|---------------|----------------------------------|
| Separately sold candies (you can make your own selection)      | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Other candies like chocolate bars, lozenges or packed candies) | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Xylitol-candies  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Ordinary chewing gum   | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Xylitol chewing gum  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Sugar or honey with tea  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Sugar with coffee  | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Water to quench thirst   | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |
| Something else, what   | <input type="checkbox"/>   | <input type="checkbox"/>  | 1                                | 2           | 3                   | 4           | 5             | 6             | 7                                |

**9. Would you say the conditions of your teeth and the health of your mouth is at present**

- 1 good
- 2 rather good
- 3 moderate
- 4 rather poor
- 5 poor

**10. How many teeth of your own do you have in your mouth?**

\_\_\_\_\_ teeth

**11. I believe I can keep my own teeth throughout life**

- 1 yes
- 2 I don't know
- 3 no

**12. How important is brushing teeth for you when going to the following situations?**

|                             | very important | rather important | not so important | not important at all |
|-----------------------------|----------------|------------------|------------------|----------------------|
| work                        | 1              | 2                | 3                | 4                    |
| a dentist                   | 1              | 2                | 3                | 4                    |
| sports, hobbies etc         | 1              | 2                | 3                | 4                    |
| meet a good friend          | 1              | 2                | 3                | 4                    |
| a party                     | 1              | 2                | 3                | 4                    |
| other situation, what _____ | 1              | 2                | 3                | 4                    |

4

**13. Why do you think brushing teeth is important?**

|   | strongly agree | partly agree | partly disagree | strongly disagree |
|---|----------------|--------------|-----------------|-------------------|
| I feel fresh                                    | 1              | 2            | 3               | 4                 |
| My spouse is happy                              | 1              | 2            | 3               | 4                 |
| My child is happy                               | 1              | 2            | 3               | 4                 |
| I would not get caries                          | 1              | 2            | 3               | 4                 |
| My appearance is better                         | 1              | 2            | 3               | 4                 |
| I avoid tooth discoloration                     | 1              | 2            | 3               | 4                 |
| My breath is fresh                              | 1              | 2            | 3               | 4                 |
| My gingiva is healthy/ my gums are not bleeding | 1              | 2            | 3               | 4                 |
| Other thing, what _____                         | 1              | 2            | 3               | 4                 |

**14. How distressed would you be if you got cavities in your teeth?**

- 1 not at all
- 2 a little
- 3 a lot
- 4 very much

**15. How distressed would you be if any of the following people close to you got cavities in their teeth?**

|               | not at all | a little | a lot | very much |
|---------------|------------|----------|-------|-----------|
| my child      | 1          | 2        | 3     | 4         |
| my spouse     | 1          | 2        | 3     | 4         |
| a good friend | 1          | 2        | 3     | 4         |

**16. Do any of the following people close to you have cavities in their teeth?**

|                | yes | no | do not know |
|----------------|-----|----|-------------|
| my child       | 1   | 2  | 3           |
| my spouse      | 1   | 2  | 3           |
| my good friend | 1   | 2  | 3           |

**17. What do you think is the main reason that a 5<sup>th</sup> or 6<sup>th</sup> grader gets cavities in his/her teeth?**

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**18. What do you think about the following statements?**

|   | strongly<br>agree | partly<br>agree | partly<br>disagree | strongly<br>disagree |
|---|-------------------|-----------------|--------------------|----------------------|
| I believe I can't prevent dental decay without professional help                  | 1                 | 2               | 3                  | 4                    |
| Teeth should be cleaned daily by brushing them twice a day                        | 1                 | 2               | 3                  | 4                    |
| A person can prevent caries by using fluoride toothpaste                          | 1                 | 2               | 3                  | 4                    |
| A person can reduce the risk of caries by omitting one sweet snack daily          | 1                 | 2               | 3                  | 4                    |
| To assure sufficient fluoride supply, one has to brush teeth at least twice a day | 1                 | 2               | 3                  | 4                    |
| A person can prevent caries by using xylitol products after meals                 | 1                 | 2               | 3                  | 4                    |

**19. There might live people in your home who are afraid of going to a dentist. Please estimate how much they are afraid of dentistry.**

|   | not afraid | a little<br>afraid | afraid to<br>some<br>degree | quite<br>afraid | very<br>afraid | do not<br>know |
|---|------------|--------------------|-----------------------------|-----------------|----------------|----------------|
| Mother  | 1          | 2                  | 3                           | 4               | 5              | 6              |
| Father  | 1          | 2                  | 3                           | 4               | 5              | 6              |
| The child who brought the questionnaire from school | 1          | 2                  | 3                           | 4               | 5              | 6              |
| Other sibling                                       | 1          | 2                  | 3                           | 4               | 5              | 6              |
| Someone else, who                                   | 1          | 2                  | 3                           | 4               | 5              | 6              |

**THANK YOU FOR YOUR REPLIES!**

### Appendix 3. The previous experiences of dental care procedures and MCFSS-DS

#### QUESTIONS ABOUT YOUR DENTAL CARE:

Read every question carefully and answer as honestly as you can. Circle the number for the answer that is best for you.

| Have you had the following dental treatments? | Have had in the previous 3 months | Have not had in the previous 3 months, but have had sometime earlier | Have never had |
|---|-----------------------------------|--|----------------|
| 1. Fillings                                   | 1                                 | 2  | 3              |
| 2. Orthodontics                               | 1                                 | 2  | 3              |
| 3. Extractions                                | 1                                 | 2  | 3              |
| 4. Local anesthesia                           | 1                                 | 2  | 3              |

One of the objects of our study is the effect of dental fear on oral health-related quality of life. Next there are questions about dental fear. Read every question carefully and answer as honestly as you can. Circle the number for the answer that is best for you.

|  | Not afraid | A little afraid | Afraid to some degree | Quite afraid | Very afraid | No experience of this particular matter |
|--|------------|-----------------|-----------------------|--------------|-------------|---|
| 1. Dental treatment in general             | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 2. Having to open your mouth               | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 3. Dentist                                 | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 4. Teeth being cleaned by a dentist/ nurse | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 5. The dentist drilling                    | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 6. Local anesthetic                        | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 7. Hearing the sound of drilling           | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 8. Being unable to breath                  | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 9. Instruments in your mouth               | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 10. Suction in the mouth                   | 1          | 2               | 3                     | 4            | 5           | 6                                       |
| 11. Pain                                   | 1          | 2               | 3                     | 4            | 5           | 6                                       |

**There might live people in your home who are afraid of going to a dentist. Please estimate how much they are afraid of dentistry.**

|                              | Not<br>afraid | A little<br>afraid | Afraid to<br>some<br>degree | Quite<br>afraid | Very<br>afraid | Do not<br>know |
|------------------------------|---------------|--------------------|-----------------------------|-----------------|----------------|----------------|
| 12. Mother                   | 1             | 2                  | 3                           | 4               | 5              | 6              |
| 13. Father                   | 1             | 2                  | 3                           | 4               | 5              | 6              |
| 14. Myself                   | 1             | 2                  | 3                           | 4               | 5              | 6              |
| 15. Some of my siblings      | 1             | 2                  | 3                           | 4               | 5              | 6              |
| 16. Someone else, who: _____ | 1             | 2                  | 3                           | 4               | 5              | 6              |

## Appendix 4. Child Perceptions Questionnaire (CPQ11-14)

Thanks for agreeing to help us with our study!

This study is being done so that there will be more understanding about problems children may have because of their teeth, mouth, lips and jaws. By answering the questions, you will help us learn more about young people's experiences.

Please remember, this is not a test and there are no right or wrong answers. Answer as honestly as you can. Read every question carefully and follow the given instructions when you answer. Circle the number for the answer that is best for you.

1. Are you a boy or a girl?
  1. Boy
  2. Girl
2. When were you born? \_\_\_/\_\_\_/\_\_\_\_(dd/mm/yyyy)
3. Would you say the health of your teeth, lips, jaws and mouth is:
  1. Excellent
  2. Very good
  3. Good
  4. Fair
  5. Poor
4. How much does the condition of your teeth, lips, jaws or mouth affect your life overall?
  1. Not at all
  2. Very little
  3. Some
  4. A lot
  5. Very much

### QUESTIONS ABOUT ORAL PROBLEMS:

| <b>In the past 3 months, how often have you had:</b> | Never | Once or twice | Sometimes | Often | Every day or almost every day |
|--|-------|---------------|-----------|-------|-------------------------------|
| 5. Pain in your teeth, lips, jaws or mouth?          | 1     | 2             | 3         | 4     | 5                             |
| 6. Bleeding gums?                                    | 1     | 2             | 3         | 4     | 5                             |
| 7. Sores in your mouth?                              | 1     | 2             | 3         | 4     | 5                             |
| 8. Bad breath?                                       | 1     | 2             | 3         | 4     | 5                             |
| 9. Food stuck in or between your teeth?              | 1     | 2             | 3         | 4     | 5                             |
| 10. Food stuck in the top of your mouth?             | 1     | 2             | 3         | 4     | 5                             |

For the next questions...

Has this happened because of your teeth, lips, jaws or mouth?

| <b>In the past 3 months, how often have you:</b>                          | Never | Once or twice | Sometimes | Often | Every day or almost every day |
|---|-------|---------------|-----------|-------|-------------------------------|
| 11. Breathed through your mouth?  | 1     | 2             | 3         | 4     | 5                             |
| 12. Taken longer than others to eat a meal?                               | 1     | 2             | 3         | 4     | 5                             |
| 13. Had trouble sleeping?   | 1     | 2             | 3         | 4     | 5                             |
| 14. Difficult to bite or chew food like apples, corn on the cob or steak? | 1     | 2             | 3         | 4     | 5                             |
| 15. Difficult to open your mouth wide?                                    | 1     | 2             | 3         | 4     | 5                             |
| 16. Difficult to say any words?   | 1     | 2             | 3         | 4     | 5                             |
| 17. Difficult to eat foods you would like to eat?                         | 1     | 2             | 3         | 4     | 5                             |
| 18. Difficult to drink with a straw?                                      | 1     | 2             | 3         | 4     | 5                             |
| 19. Difficult to drink or eat hot or cold foods?                          | 1     | 2             | 3         | 4     | 5                             |

#### **QUESTIONS ABOUT FEELINGS:**

Have you had the feeling because of your teeth, lips, jaws or mouth? If you feel this way for another reason, answer "Never".

| <b>In the past 3 months, how often have you:</b>                                  | Never | Once or twice | Sometimes | Often | Every day or almost every day |
|---|-------|---------------|-----------|-------|-------------------------------|
| 20. Felt irritated or frustrated?   | 1     | 2             | 3         | 4     | 5                             |
| 21. Felt unsure of yourself?  | 1     | 2             | 3         | 4     | 5                             |
| 22. Felt shy or embarrassed?  | 1     | 2             | 3         | 4     | 5                             |
| 23. Been concerned what other people think about your teeth, lips, mouth or jaws? | 1     | 2             | 3         | 4     | 5                             |
| 24. Worried that you are not as good-looking as others?                           | 1     | 2             | 3         | 4     | 5                             |
| 25. Been upset?   | 1     | 2             | 3         | 4     | 5                             |
| 26. Felt nervous or afraid?   | 1     | 2             | 3         | 4     | 5                             |
| 27. Worried that you are not as healthy as others?                                | 1     | 2             | 3         | 4     | 5                             |
| 28. Worried that you are different than other people?                             | 1     | 2             | 3         | 4     | 5                             |

**QUESTIONS ABOUT SCHOOL:**

Have you had these experiences because of your teeth, lips, jaws or mouth? If it was for another reason, answer "Never".

| <b>In the past 3 months, how often have you:</b>             | Never | Once or twice | Sometimes | Often | Every day or almost every day |
|--|-------|---------------|-----------|-------|-------------------------------|
| 29. Missed school because of pain, appointments, or surgery? | 1     | 2             | 3         | 4     | 5                             |
| 30. Had a hard time paying attention in school?              | 1     | 2             | 3         | 4     | 5                             |
| 31. Had difficulty doing your homework?                      | 1     | 2             | 3         | 4     | 5                             |
| 32. Not wanted to speak or read out loud in class?           | 1     | 2             | 3         | 4     | 5                             |

**QUESTIONS ABOUT YOUR SPARE-TIME ACTIVITIES & BEING WITH OTHER PEOPLE:**

Have you had these experiences because of your teeth, lips, jaws or mouth? If it was for another reason, answer "Never".

| <b>In the past 3 months, how often have you:</b>  | Never | Once or twice | Sometimes | Often | Every day or almost every day |
|---|-------|---------------|-----------|-------|-------------------------------|
| 33. Avoid taking part in activities like sports, clubs, drama, music, school trips?           | 1     | 2             | 3         | 4     | 5                             |
| 34. Not wanted to talk to other children?   | 1     | 2             | 3         | 4     | 5                             |
| 35. Avoided smiling or laughing when around other children?                                   | 1     | 2             | 3         | 4     | 5                             |
| 36. Had difficulty playing a musical instrument such as a recorder, flute, clarinet, trumpet? | 1     | 2             | 3         | 4     | 5                             |
| 37. Not wanted to spend time with other children?   | 1     | 2             | 3         | 4     | 5                             |
| 38. Argued with other children or your family?  | 1     | 2             | 3         | 4     | 5                             |
| 39. Other children teased you or called you names?  | 1     | 2             | 3         | 4     | 5                             |
| 40. Other children made you feel left out?  | 1     | 2             | 3         | 4     | 5                             |
| 41. Other children asked you about your teeth, lips, jaws or mouth?                           | 1     | 2             | 3         | 4     | 5                             |

## Appendix 5. Approval letters from Ethics Committee of the Northern Ostrobothnia Hospital District and the City of Pori

POHJOIS-POHJANMAAN SAIRAANHOITOPIIRIN  
HOITOPIIRIN KUNTAYHTYMÄ  
Hallintokeskus

EETTISEN TOIMIKUNNAN  
LAUSUNTO

1.11.2000

Professori Hannu Hausen

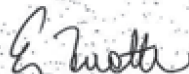
### EETTISEN TOIMIKUNNAN LAUSUNTO 115/2000

Pohjois-Pohjanmaan sairaanhoitopiirin eettinen toimikunta on kokouksessaan 23.10.2000 tutustunut tutkimussuunnitelmaan

#### Karieksen hallinta nykyoloissa

Suunnitelman mukaan suoritettuna tutkimustyö täyttää lain lääketieteellisestä tutkimuksesta (488/1999) edellytykset, minkä johdosta päätettiin antaa puoltava lausunto.

01 / 11 / 2000



Bija Ruottinen, opintosihteerin  
sihteerin

#### Varsinaiset jäsenet

Professori Matti Isohanni, psykiatria, puh.joht.  
Professori Olavi Lükkarinen, kirurgia, varapj.  
Rovasti Heikki Pankkunen, maallikkojäsen  
Läänin poliisineuvos Erkki Haikola, maallikkojäsen  
Professori Jaakko Leisti, perinnöllisyyslääket.  
Professori Vuokko Kinnula, sisätaudit  
Docentti Jorma Kokkonen, lastentaudit  
Docentti Merja Nikkonen, hoitot./terv.hallinto  
Opintosihteerin Bija Ruottinen, maallikkojäsen, siht.  
Apulaisopettaja Jukka Hakkola, farmakologia  
Projektisuunnittelija Majja-Leena Pönkkö, sihteerin

#### Varajäsenet

Professori Matti Joukamaa, psykiatria  
Professori Aune Raustia, hammaislääket.  
Rovasti Markku Niku, maallikkojäsen  
Apul.poliisipääll. Timo Saarela, maallikkojäsen  
Professori Juha Tapanainen, naistent.  
Professori Matti Hillbom, neurolog.  
Docentti Heikki Rantala, lastentaudit  
Professori Juhani Nikkila, hoitot./terv.hallinto  
DI Erkki Seppänen, maallikkojäsen  
Docentti Arja Rautio, farmakologia

PORIN KAUPUNKI  
Terveyslautakunta

PÖYTÄKIRJA  
OTE

11/13.12.2000

|                                 |  |   |
|---------------------------------|--|---|
| Kokousaika                      | 13.12.2000 klo 18:00 – 19:23   |   |
| Kokouspaikka                    | Pääterveysasema, ruokasali, Maantiekatu 31   |   |
| Päättökäsitteijät               | Raija Parkkali<br>Tauno Hakanen<br>Marlene Höglund<br>Marjatta Kaartinen<br>Reijo Lhtinen<br>Laila Närhinen<br>Into Salonen<br>Rauno Vesivalo<br>Liisa Virtanen                          | puheenjohtaja<br>Jussi Mäkelä   |
| Muut Esittelijät                | Pekka Satoman<br>Esko Karra<br>Raija Hildén<br>Aino Ojansuu<br>Raili Kankaanpää<br>Ilpo Pietilä<br>Lauri Merivirta<br>Seppo Sairanen<br>Teuvo Elo<br>Aulis Laaksanen<br>Riitta Uusivuori | terveysjohtaja<br>avoterveyshuollon johtava lääkäri<br>avoterveyshuollon johtava hoitaja<br>va. sairaalan johtava lääkäri<br>sairaalan johtava hoitaja<br>johtava hammaslääkäri<br>johtava hygieenikko<br>va. talouspäällikkö<br>KHM-ohutaja<br>apulaiskaupunginjohtaja<br>hallintosihtööri, sihteeri |
| Allekirjoitukset                | Raija Parkkali<br>puheenjohtaja  | Riitta Uusivuori<br>sihteeri  |
| Käsitellyt asiat                | §:t 186 - 208  |   |
| Pöytäkirjan tarkastus           | 18.12.2000 klo 11.00 – 16.15   |   |
| Tarkastajat                     | Laila Närhinen   | Liisa Virtanen  |
| Pöytäkirjan yleisesti nähtävänä | Terveysviraston kirjaamossa, Maantiekatu 31<br>20.12.2000 klo 8.00 – 16.15   |   |
| Todistaa                        | Sihteeri   |   |
| Otteen oikeaksi todistaa        | Pori 19.04.2001<br>Sihteeri Riitta Uusivuori   |   |

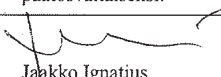

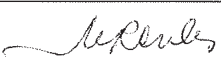
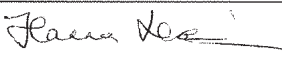


POHJOIS-POHJANMAAN SAIRAAN-  
HOITOPUIRIN KUNTAYHTYMÄ

PÖYTÄKIRJA

5/2006

Ettinen toimikunta

|                                      |   |   |
|--------------------------------------|---|---|
| Kokousaika                           | 22.5.2006 klo 14.00 – 16.25   |   |
| Kokouspaikka                         | Hallintorakennus, neuvotteluhuone G 340   |   |
| Osallistujat                         | <p><b>Varsinaiset jäsenet</b><br/>         Ylilääkäri Jaakko Ignatius, perinnöllisyyslääketiede, puheenjohtaja<br/>         Läänin poliisineuvos Erkki Haikola, maallikkojäsen, 1. varapj. (poistui klo 16.00, läsnä §:t 156-167)<br/>         Dosentti Marjo Renko, lastentaudit, 2. varapj.<br/>         Professori Jyrki Mäkelä, kirurgia (saapui klo 15.30, läsnä 162-185)<br/> <del>Rovasti Heikki Paukkunen, maallikkojäsen</del><br/>         Professori Helvi Kyngäs, hoitotiede<br/> <del>Apulaisopettaja Jukka Hakola, farmakologia</del><br/>         Professori Pirkko Räsänen, psykiatria (saapui klo 14.10, läsnä 159-185)<br/>         Professori Timo Mäkikallio, sisätaudit<br/>         Apulaisopettaja Riitta Veijola, lastentaudit<br/> <del>Koulutuspäällikkö Eija Ruottinen, maallikkojäsen</del><br/>         Professori Matti Lehtihalmes, logopedia<br/>         Kunnanjohtaja Kyösti Tornberg, maallikkojäsen</p> <p><b>Varajäsenet</b><br/>         Poliisipäällikkö Timo Saarela, maallikkojäsen<br/> <del>L.T. Kaisa Riala, psykiatria</del><br/>         Professori Aune Raustia, hammaslääketiede<br/>         Sairaalapastori Seppo Viljamaa, maallikkojäsen<br/>         Professori Juha Tapanainen, naistentaudit<br/>         Professori Juhani Nikkilä, hallintotiede<br/>         Yliassistentti Hanna Leskinen, farmakologia<br/>         Osastonylilääkäri Timo Saarela, lastentaudit<br/>         Professori Matti Hillbom, neurologia<br/>         Diplomi-insinööri Tapio Tuuttila, maallikkojäsen<br/>         Professori Markku Savolainen, sisätaudit<br/>         Professori Leena Syrjälä, kasvatustiede</p> |   |
| Muut osallistujat                    | Maija-Leena Pönkkö, projektisuunnittelija, sihteeri   |   |
| Asiat                                | §:t 156 - 185   |   |
| Laillisuus ja päätösvaltaisuus,      | Puheenjohtaja totesi kokouksen laillisesti koolle kutsutuksi ja päätösvaltaiseksi.  |   |
| Allekirjoitus                        | <br>Jaakko Ignatius<br>Puheenjohtaja   | <br>Maija-Leena Pönkkö<br>Pöytäkirjanpitäjä |
| Pöytäkirja on tarkastettu            | <br>Marjo Renko<br>Pöytäkirjantarkastaja   | <br>Hanna Leskinen<br>Pöytäkirjantarkastaja |
| Pöytäkirja on tarvittaessa nähtävänä | Pohjois-Pohjanmaan sairaanhoitopiiri<br>Ettinen toimikunta<br>Ettisen toimikunnan sihteerin toimistossa   |   |

POHJOIS-POHJANMAAN SAIRAAAN-  
HOITOPIIRIN KUNTAYHTYMÄ

PÖYTÄKIRJANOTE

5/2006

4

Eettinen toimikunta

EETTMK:67/2006

160 § LASTEN SUUN TERVEYTEEN LIITTYVÄ ELÄMÄNLAATU - YLIASSISTENTTI  
SATU LAHTI**Lausuntohakemus 34**

Tutkimus on kansallinen monikeskustutkimus, joka tehdään kysely- ja poik-  
kileikkaustutkimuksena. Tutkimuksesta vastaavana henkilönä toimii HLT  
Satu Lahti (OYS).

Tutkimuskeskukset ja tutkijat ovat Oulussa (HLT Satu lahti, HLK Anni  
Luoto ja HLK Terhi Nevanperä / Oulun yliopisto ja OYS) ja Porissa (johta-  
va Hammaslääkäri Ilpo Pietilä ja HLT Terttu Pietilä / Porin terveysvirasto).

Tutkimus tehdään pääasiassa virkatyönä ja mahdollisella apurahalla.

Liitteenä ovat lausuntohakemus (3.5.2006), rekisteriseloste (3.5.2006), tut-  
kimussuunnitelman lyhennelmä (versio 1/3.5.2006), tutkittavan tiedote  
(3.5.2006), suostumusasiakirja x 2 (versio 1/3.5.2006) ja lasten suunterveys  
-kyselylomake (versio 1/3.5.2006).

Tutkimussuunnitelman esitteli ylilääkäri Jaakko Ignatius.

22.5.2006  
Eettmk 160 §

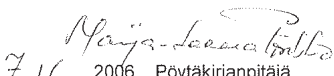
Toimikunnassa käytiin keskustelua siitä, että tutkittavan tiedotetta tulee  
vähän stilisoida. Tutkittavien puhuttelu tulisi olla koko tekstissä sama. Esi-  
merkiksi kahdessa viimeisessä kappaleessa on käytetty teitittelymuotoa ja  
muuten sinuteltu tutkittavaa. Lisäksi tiedotteesta puuttui maininta tutkimuk-  
sen vapaaehtoisuudesta esimerkiksi seuraavasti: ”Sinulla on oikeus kieltäy-  
tyä tutkimuksesta ja myöhemminkin halutessasi syytä ilmoittamatta peruut-  
taa suostumuksesi ja kieltäytyminen tai osallistumisen peruuttaminen eivät  
vaikuta mitenkään tarvitsemaasi hoitoon nyt tai tulevaisuudessakaan.”

**Päätös:** Muuten suunnitelman mukaan suoritettuna tutkimustyö täyttää  
lain lääketieteellisestä tutkimuksesta (488/1999 ja 295/2004)  
edellytykset, minkä johdosta päätettiin antaa puoltava lausun-  
to.

Tutkimusta ei saa aloittaa ennen kuin toimikunnan pyytämät  
korjaukset tutkittavan tiedotteeseen on tehty ja hyväksytyt.

Toimikunta valtuutti puheenjohtajan ja sihteerin hyväksymään  
potilastiedote- ja suostumusasiakirjan korjatun version.

STM:n asetuksen (N:o 1396/2004) mukainen lausantomaksu:  
maksua ei peritä.

|  |  |   |
|--|--|---|
| Pöytäkirjan tarkastajien nimikirjaimet |  | Asianmukaisesti allekirjoitetusta ja tarkastetusta<br>pöytäkirjasta annetun otteen oikeaksi todistaa                |
| Eettinen toimikunta                    |  |   |
|  |  | <br>7 16 2006 Pöytäkirjanpitäjä |

POHJOIS-POHJANMAAN SAIRAAN-  
HOITOPIIRIN KUNTAYHTYMÄ

PÖYTÄKIRJANOTE

5/2006

5

Eettinen toimikunta

2.6.2006

Tutkija on korjannut tutkittavan tiedotteen toimikunnan vaatimalla tavalla. Liitteenä ovat tutkijan lähete (1.6.2006) ja korjattu versio (1.6.2006) tutkittavan tiedotteesta.

**Päätös:** Hyväksyttiin ja merkittiin tiedoksi.

Jaakko Ignatius  
Puheenjohtaja

Maija-Leena Pönkkö  
Sihteeri

|  |  |   |
|--|--|---|
| Pöytäkirjan tarkastajien nimikirjaimet |  | Asianmukaisesti allekirjoitetusta ja tarkastetusta pöytäkirjasta annetun otteen oikeaksi todistaa |
| Eettinen toimikunta                    |  |   |
|  |  | <p>7 16 2006 Pöytäkirjanpitäjä</p> <p><i>Maija-Leena Pönkkö</i></p>                               |

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