

# **On fluoride toothpaste – knowledge, attitudes and behaviour**

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# Abstract

## On fluoride toothpaste – knowledge, attitudes and behaviour

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**Objective:** This thesis focuses on people's knowledge of, attitudes to, and behaviour regarding the use of fluoride toothpaste when brushing. The aims were: a) to investigate the fluoride toothpaste-related knowledge, attitudes and behaviour among adolescents, adults, older adults and the elderly in the population, b) to explore oral health professionals' knowledge, attitudes and behaviour regarding fluoride toothpaste, and their strategies for teaching patients how to use fluoride toothpaste, and c) to evaluate whether an intervention had a positive effect on fluoride toothpaste-related knowledge and behaviour among older adults. **Design:** Both qualitative (Papers I and III) and quantitative (Papers II and IV) research methods were used. Paper I was based on 15 individual in-depth interviews with participants from three age groups: 15 to 16, 30 to 35 and 60 to 65 years old. Paper II was a randomised cross-section study, based on a questionnaire sent to 3200 individuals from four age groups: 15 to 16, 31 to 35, 61 to 65 and 76 to 80 years old. Paper III was based on five focus group interviews with a total of 23 oral health professionals. Paper IV was a longitudinal study where 68 individuals in a municipality in the western part of Sweden received an intervention, while 151 individuals in another municipality in the eastern part of Sweden served as controls. Both the intervention and the control groups answered the same questionnaire used in Study II. In Papers I and III the interviews were analysed using qualitative content analysis. **Results:** In Paper I participants described toothbrushing with fluoride toothpaste as a priority, despite a lack of knowledge about how to use toothpaste effectively and its positive effect on oral health. In Paper II the majority of the 2023 participants stated that they brushed twice a day, but only 10.8% of them showed to have good toothpaste behaviour, identified as: brushing twice a day, using 1 cm of toothpaste or more, brushing for two minutes or longer and using only a handful of water when rinsing. In Paper III oral health professionals described health promotion and having the patients' best interests at heart, as their driving forces. The focus of the oral health information and instruction was toothbrushing technique and plaque control, and very little attention was paid to how to use fluoride toothpaste. Oral health professionals took for granted that adults already knew about fluoride in toothpaste and the best way to use it. In Paper IV the intervention seemed to be effective in improving the use of fluoride toothpaste when brushing among older adults. **Conclusion:** The state of knowledge and behaviour concerning the use of fluoride toothpaste need to be improved both in the population as a whole and among oral health professionals.

**Key words:** Attitudes, Behaviour, Dental Caries, Fluoride Toothpaste, Intervention, Knowledge, Oral Health, Prevention, Promotion



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## Original Papers

This thesis is based on the following four papers, which will be referred to in the text by their Roman numerals (I-IV):

- I. Jensen O, Gabre P, Moberg Sköld U, Birkhed D. Fluoride toothpaste and toothbrushing; knowledge, attitudes and behaviour among Swedish adolescents and adults. *Swed Dent J* 2011;35:203-13.
- II. Jensen O, Gabre P, Moberg Sköld U, Birkhed D. Is the use of fluoride toothpaste optimal? Knowledge, attitudes and behaviour concerning fluoride toothpaste and toothbrushing in different age groups in Sweden. *Community Dent Oral Epidemiol* 2012;40:175-84.
- III. Jensen O, Gabre P, Moberg Sköld U, Birkhed D, Povlsen L. “I take for granted that patients know” – oral health professionals’ strategies, considerations and methods when teaching patients how to use fluoride toothpaste. *Int J Dent Hyg* 2013 Jul 11. doi: 10.1111/idh.12041. [Epub ahead of print].
- IV. Jensen O, Moberg Sköld U, Birkhed D, Gabre P. Self-reported Changes in Using Fluoride Toothpaste among Older Adults in Sweden – an Intervention Study. Manuscript.

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## Abbreviations and Definitions

The following terminologies are used in this thesis:

Fluoride – F

Oral Health Professionals – OHPs

Health Literacy – HL – The WHO (1998) has defined HL as “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health”.

Self-efficacy – the belief in one’s own ability to successfully perform a behaviour (Nutbeam et al. 2010)

Empowerment – According to the WHO empowerment is “a process through which people gain greater control over decisions and actions affecting their health.”

Grounded Theory – Qualitative research method based on theory development with respect to social and psychological processes (Huston and Rowan, 1998).

Qualitative Content Analysis – Qualitative research method based on a process whereby the content of written, spoken, and visual information is described and systematically analyzed (Huston and Rowan, 1998).

Triangulation – using different methods, data sources, investigators, or theories to validate the data and their interpretation (Huston and Rowan, 1998).



## Introduction

Dental caries is still a major public oral health problem, affecting people of all ages in most countries. When fluoride (F) toothpaste was introduced in the 1960s, caries had declined in Sweden as well as in the rest of the western world. However, after several decades of reduced caries incidence, there are indications that caries is increasing again (Bagramian et al., 2009), especially among the growing elderly population (Hänsel Petersson et al., 2003; Holmén et al., 2012).

Fluoride toothpaste is considered to be the main reason for the worldwide decline in caries prevalence (Brathall et al., 1996; Marinho et al., 2003; Buzalaf et al., 2011; ten Cate, 2013). However, knowledge is limited as to whether people in different age groups are aware of the benefits of F toothpaste, and there is also a lack of knowledge about people's daily oral care habits and whether they use F toothpaste efficiently.

## Caries in the 21<sup>st</sup> century

Affecting 60 to 90% of schoolchildren and the vast majority of adults, dental caries remains a major public health problem in most industrialized countries (WHO, 2003). This disease remains largely untreated (WHO, 2006). It is also anticipated that caries has increased in many of the developing countries over recent years, mostly due to changing living conditions and dietary habits, i.e. growing sugar consumption and the vast consumption of soft drinks, but also inadequate exposure to fluorides (WHO, 2007).

According to the World Oral Health Report (2003), oral disease is the fourth most expensive disease to treat in most industrialized countries and it is estimated that these countries spend 5 to 10% of their national public health resources on dental care. Dental caries is anticipated to become more common with the increase of the elderly population. The WHO reported in 2007 that the burden of oral disease is especially high among older people globally and impaired oral health has a negative effect on their quality of life. The United Nations estimates that by 2025 there will be about 1200 million people aged 65 years (Petersen and Yamamoto, 2005). In Sweden in 2012, the number of people aged 65 years and older was above 1,8 million, 19% of the population, and this number will increase to 31% by the year 2030 (Statistics Sweden, 2012). Elderly people have an increased risk of developing caries (Hänsel Petersson et al., 2003), therefore, the growing elderly population and the fact that they retain more natural teeth today than 20 to 30 years ago, brings new challenges for the individual and society when it comes to preventing tooth decay (Hugoson et al., 2005b; Petersen, 2005; Holmén et al., 2012).

Dental caries begins with the localised destruction of dental hard tissue caused by the bacterial acid production in plaque (Leach, 1959; Larsen and Jensen, 1989; ten Cate, 2013). Caries can be prevented, as risk factors are mostly related to lifestyle factors such as dietary habits, the use of fluorides and oral hygiene habits (Selwitz et al., 2007). In addition to lifestyle factors, caries is also influenced by biological, socio-behavioural and socio-environmental factors (Petersen, 2005). Therefore, different strategies, or a combination of strategies, must be used when preventing caries (Marinho et al., 2003; Longbottom et al., 2009; Twetman, 2010).

## Fluoride toothpaste

The role of F is well documented in the caries process when it is present in the oral cavity. The topical effect on the tooth surface had been studied both clinically and in laboratory experiments (Rølla, 1988; Featherstone et al., 1990; ten Cate, 1990; 1991; Featherstone, 2004). According to ten Cate (2013) there is a consensus that F is mainly effective by inhibiting demineralisation that could lead to caries initiation and progression, by enhancing remineralisation of initial caries lesions (Lynch et al., 2004), and by inhibiting bacterial metabolism (Hamilton, 1990; Marquis et al., 1995). However, bacterial metabolism is affected only by fluoride concentrations exceeding about 10 ppm and in the oral cavity such levels are limited to a very short period of time after using F products (ten Cate, 2013). Despite the positive effects of F, large ingestion of F can cause fluorosis during the period when the permanent dentition is formed. Dental fluorosis in young children is associated with fluoridated communities and the swallowing of toothpaste (Davies et al., 2003). On the contrary, no adverse effects of F in adults have been reported and the use of F is considered to be both safe and effective in preventing tooth decay (Marinho et al., 2004; Petersen and Lennon 2004; Wong et al., 2011; ten Cate, 2013).

WHO emphasises the prevention of dental caries through the effective use of F, for example, water fluoridation and the use of F toothpaste. Research about the effects of F on dental caries started more than 100 years ago (Petersen and Lennon, 2004). Today, there are a large number of studies carried out on the positive effects of using F toothpaste when brushing. The consensus among experts is that the use of F toothpaste has significantly reduced the prevalence of caries (Bratthall et al., 1996; Marinho et al., 2004; Petersen and Lennon, 2004; ten Cate, 2013). However, according to the WHO, only 20% of the global population knows that F in toothpaste has a caries preventive effect.

Fluoride toothpaste is considered to be the most significant tool in preventing caries (Twetman et al., 2003; Marinho et al., 2009). Today, in both Sweden and other countries, the primary prevention of caries for all people is the use of F toothpaste twice a day (Twetman et al., 2003). However, there are some important factors that play a role in the caries preventive effect of F toothpaste when brushing. These factors are the brushing frequency and the concentration of F in the toothpaste (Twetman et al.,

2003; Marthaler, 2004). Other influential behavioural factors are the brushing time, the amount of toothpaste applied to the brush and subsequent water rinsing or post-brushing behaviour (Sjögren and Birkhed, 1994; Zero et al., 2010; Walsh et al., 2010). Watson et al. (2005) showed that plaque grown in situ and exposed in vivo to 1,000 ppm F, absorbed more F after 120 sec than after 30 sec. Long brushing time increases the amount of F supplied to the oral cavity and Zero et al. (2010) showed that brushing time up to three minutes increased the F concentration in saliva. In addition, caries activity is reported to be significantly correlated to brushing time (Wikén and van Dijken, 2010). A larger amount of toothpaste applied to the brush also increases the F recovery in saliva. The study by Zero et al. (2010) showed that 1.5 g toothpaste on the brush, compared with 0.5 g toothpaste, more than doubled the F recovered in saliva after brushing, and also increased the enamel F uptake. On the other hand, a review by Davies et al. (2003) concluded that the efficacy of small amounts of toothpaste was comparable with large amounts. A study by Duchworth et al. (1989) found no correlation between plaque F and the amount of toothpaste used per application. Instead it found a correlation between plaque F and increasing F concentrations when comparing 1,000, 1,500 and 2,500 ppm F toothpastes. No caries reduction was reported in individuals who covered more than half of the brush head with toothpaste compared to those who covered less than half the brush head (Ashley et al., 1999), although Den Besten and Ko (1996) showed higher levels of F in saliva in schoolchildren when using 1.0 g of toothpaste compared to 0.25 g.

Using only a small amount of water after brushing has been reported to prolong the retention time of F in saliva and strengthen the anti-caries benefit of F toothpaste (Richards et al., 1992; Sjögren and Birkhed, 1993). Other studies have not found any relation between the F concentration in saliva, caries incidence and post-brushing behaviour (Machiulskiene et al., 2002; Richards et al., 2013). However, an expert group has evaluated scientific reports and concluded that rinsing with water after brushing can reduce the benefits of F toothpaste (Pitts et al., 2012). In addition to these behavioural factors, the F concentration in the toothpaste itself is a determining factor in its caries-reducing effectiveness. Several reviews show that the toothpaste should contain at least 1,000 ppm F, preferably 1,500 ppm F, for both schoolchildren and adults (Davies et al., 2003; Twetman, 2009; Walsh et al., 2010). Several RCT studies on F concentrations in toothpastes have shown a positive dose response where toothpaste containing 1,000-1,500 ppm F gave 23 % caries reduction and 2,500 ppm F achieved a 36% reduction (ten Cate, 2013). Toothpastes with higher concentrations of F have been shown to be significantly effective in reversing root caries in adults (Baysan et al., 2001). A study by Nordström and Birkhed (2010) found that adolescents with a high caries risk, when using 5,000 ppm F toothpaste had 40% lower caries progression than those using standard toothpaste.

## Views on knowledge

Throughout the centuries many philosophers have tried to define knowledge, but there is still no definite definition of knowledge. The classical definition by Plato (*Meno* 87-8 and *Theaetetus* 200D-201C, for review see Armstrong, 2008) is that knowledge is a “justified true belief” (Armstrong, 2008). Knowledge can be acquired through experience or education and through complex cognitive processes, such as perception, communication, association and reasoning. It can refer to a theoretical or practical understanding of a subject which can include facts, information, descriptions or skills. Writing is the most universal form of recording and transmitting knowledge, while verbal communication is the second. However, verbal communication is stated to be easily filled with falsehood, as neither the source nor the content can be verified (Anderson et al., 2001; Chalmers, 2003; Armstrong, 2008; Säljö, 2010).

There are many different types of knowledge and terms to describe them. Objectivism and individualism are two perspectives on human knowledge. From an individualistic perspective, knowledge is regarded as a set of ideas/beliefs an individual holds, and they are localised in the individuals’ consciousness and mind, and so are innate. However, objectivists see knowledge as something outside the individual (Chalmers, 2003). Two main traditions have arisen within the theory of knowledge: empiricism and rationalism. Individuals can acquire knowledge in two ways, through thinking and through observing. The scientific view of knowledge is defined as a method of inquiry to collect data through observation and experimentation, and involves the formulation and testing of hypotheses. Knowledge is not something static, it changes as new ideas and evidence are continuously presented and accepted (Chalmers, 2003; Armstrong, 2008; Säljö, 2010).

## Views on attitudes

The definition of an attitude can vary; it is partly described as being an expression of favour or disfavour toward a person, place, subject, thing or event. Within health psychology, attitudes refer to a person’s cognition (beliefs), affective/emotional (feelings) or behavioural (intended action) relation to an object (Morrison and Bennet, 2012). People’s attitudes can be conflicted or ambivalent, being both positive and negative depending on different time and place (Fishbein and Ajzen, 2010; Fiske et al., 2010). Attitudes can both be conscious or explicit (i.e. deliberately formed), and unconscious or implicit (i.e. subconscious). Attitudes can be difficult to measure as they can not be observed directly (Fishbein and Ajzen, 2010). Explicit attitudes are measured through self reports or easily observed behaviour and tend to involve bipolar scales such as good-bad, favorable-unfavorable and desirable-undesirable. Implicit attitudes are seen as more reliable and valid, but they are more difficult to

measure because it is stated that a person may not be aware of, or want to show, attitudes depending on the situation and whether they are socially desirable (Fishbein and Ajzen, 2010; Fiske et al., 2010).

Attitudes can be changed through communication. It is stated that the credibility of a message is a key variable and depends on the source of the message. For example, if someone reads a health report and believes it came from a professional medical journal, he or she may be more easily persuaded than if the message comes from a popular newspaper (Fishbein and Ajzen, 2010; Nutbeam et al., 2010). Most of the attitudes we hold are learned from experiences and it is expected that they change as we learn from new experiences. Attitudes are among the most important determinants of intentions and behaviour and many social psychologists have used attitudes to predict and explain social behaviour (Fishbein and Ajzen, 2010; Fiske et al., 2010).

## Views on behaviour

Behaviours are observable events and often directed at some target. Human social behaviour may be seen as extremely complex, where each behaviour is determined by a large number of unique factors (Fishbein and Ajzen, 2010; Fiske et al. 2010). Or behaviours may be seen as less complicated, where people approach different kinds of behaviour in the same way (Fishbein and Ajzen, 2010). Behaviours are composed of four elements: action, target, context and time. Since 1991, there has been an agreement among some theoreticians that a set of key variables is assumed to underlie behaviour and that for a person to perform a specific behaviour one or more of the following statements must be true (Fishbein and Ajzen, 2010):

1. A strong positive intention (or a commitment) to perform the behaviour.
2. No environmental constraints make the behaviour impossible.
3. Has skills necessary to perform the behaviour.
4. Believes that the advantages of performing the behaviour outweigh the disadvantages (i.e. having a positive attitude toward performing the behaviour).
5. Perceives more social pressure to perform the behaviour than not to.
6. Perceives that performance of the behaviour is more consistent than inconsistent with self-image.
7. Emotional reaction to performing the behaviour is more positive than negative.
8. Perceives self as having the capabilities to perform the behaviour; having self-efficacy to execute the behaviour.

Behavioural changes are an individual's actions and reactions and can be common or unusual, acceptable or unacceptable and deliberate/conscious or subconscious/instinctive. The acceptability of behaviour is evaluated using social norms, which refer to what is acceptable behaviour in a group or

society (Fishbein and Ajzen, 2010; Fiske et al., 2010). Human social behaviour follows from the information or beliefs people possess about a specific behaviour (Fishbein and Ajzen, 2010). Beliefs originate from different sources such as personal experiences, formal education, media, and interactions with family and friends. Beliefs serve to guide the decision to perform the behaviour or not. Self-efficacy is the belief in one's own ability to successfully perform a behaviour and it is considered to be the most important prerequisite for behaviour change (Bandura, 1986, for review, see Nutbeam et al., 2010).

Habits are defined as "routines of behaviour that are repeated regularly and tend to occur subconsciously" or "a more or less fixed way of thinking, willing, or feeling acquired through previous repetition of a mental experience" (Andrews, 1903). Habituation is the simplest form of learning, does not require cognitive engagement from the performer, often goes unnoticed and becomes automatic. For behaviour to become a habit the person must have control over the behaviour (Fiske et al., 2010). However, old habits are hard to break and new habits are hard to form, but through repetition it is possible to form new habits (Fiske et al., 2010). Good intentions seem to override the negative effect of bad habits. Fishbein and Ajzen (2010) do not agree with the definition above, as it implies that intentions become irrelevant as behaviour becomes routine. They state that there are few empirical findings to support this automatic habit hypothesis. Instead they acknowledge that behaviour can become routine with repeated performance and minimal conscious effort or attention, so called habitual behaviour. In everyday life there are many behaviours of this kind, including toothbrushing.

## Behavioural change theories

Behavioural change theories and models have been used to influence health behaviour, including health promotion, health education and interventions. These theories help to identify the targets for change and methods for accomplishing it. They also explain health behaviour and health behaviour change by focusing on individual characteristics, beliefs and values that are associated with different health behaviours. In addition, they support health promotion practitioners in developing, planning, implementing and evaluating health promotion interventions (Glanz et al., 2008; Nutbeam et al., 2010). Four such theories/models are discussed below.

### *The theory of reasoned action and the theory of planned behaviour*

Ajzen and Fishbein (1980, for review, see Nutbeam et al., 2010) developed the theory of reasoned action to explain human behaviour that is under "voluntary" control. It is based on the assumptions that people are rational and will make predictable decisions in well-defined circumstances and that intention to act is the most immediate determinant of behaviour. A person's attitudes and subjective norms form his or her behavioural intentions. The theory predicts that an individual is likely to adopt,



perform, maintain or change a behaviour under certain circumstances. These include if he or she believes that the behaviour will lead to a positive outcome, for example, will benefit their health; believes the behaviour is socially desirable or important; feels that others support its performance; feels social pressure; feels that there will be facilitating factors and that potential barriers can be overcome. The theory has been found to be useful in identifying key factors that influence behaviour and may be targets for intervention. It also provides indications of the importance of perceived social norms and an understanding of short-term consequences in shaping health behaviour (Glanz et al., 2008; Nutbeam et al., 2010).

The theory of planned behaviour was developed and added to the previous theory by Ajzen (1985). It describes the behavioural process from intentions to action, the link between beliefs and behaviour, by adding the concept of perceived behavioural control as a third influence on behavioural intentions. This theory indicates that if a person feels that he or she has greater control over the behaviour, then intentions will become significantly stronger. The theory has been criticized, meaning that behavioural intentions do not always lead to actual behaviour.

### *The social cognitive theory*

The theory focuses both on the underlying determinants of health behaviour and methods of promoting change, and is therefore one of the most applied theories in health promotion. It was designed by Albert Bandura (1986, for review, see Glanz et al., 2008) to understand the interaction that occurs between an individual and his/her environment. According to this theory the perception of the environment can be influenced through social influence and that the modification of social norms can affect behaviour, a very important insight into how behaviour can be modified through health promotion interventions. Three factors are highlighted in the theory: 1) observational learning (the capacity to learn by the behaviour of others and the rewards received for different behaviours), 2) expectations (the capacity to anticipate and place value on the outcomes of different behaviours), 3) self-efficacy (belief in one's own ability to successfully perform a behaviour) [Nutbeam et al., 2010].

Factors such as motivation, performance and negative feelings, like fear of failure, will affect behavioural reactions. People's behaviour is strongly influenced by their confidence in their ability to perform the behaviour. Both self-efficacy and outcome expectancy are important preconditions for behavioural change as they determine the initiation of coping behaviour (Bandura, 1986, for review, see Glanz et al., 2008). Bandura proposed using both observational learning and participatory learning (supervised practice and repetition) as tools to promote self-confidence and self-efficacy. Setting goals and giving feedback in relation to behaviour change and social support in maintaining change is essential (Bandura, 2004; Glanz et al., 2008; Fishbein and Ajzen, 2010; Nutbeam et al., 2010).

### *The health belief model*

This theoretical model was designed to explain health behaviour by understanding individuals' beliefs about health (Glanz et al., 2008; Nutbeam et al., 2010). According to this model an individual is likely to take action to protect, promote or improve health related to a given health problem, based on the interaction between four different types of belief: 1) perceived susceptibility to problem (perceived treat), 2) perceived serious consequences of problem (perceived treat), 3) perceived benefits of a course of action, and 4) perceived barriers to taking action.

Additional refinements to this model were later made, as important modifying factors were acknowledged such as personal characteristics, social circumstances, the influence of media publicity and personal experience. The concept of self-efficacy was added to the analysis. The health belief model has been found to be useful in predicting why individuals adopt or fail to adopt different health behaviours. It is regarded as an extremely useful tool for health education programmes that promote greater compliance with preventive health behaviours and healthcare recommendations. The model illustrates the importance of individual beliefs about health, cost and benefits of action designed to protect and improve health, and is essential in the development of messages to improve knowledge and change beliefs (Glanz et al., 2008; Nutbeam et al., 2010).

### *The transtheoretical (stages of change) model*

This theory was developed by Prochaska and DiClemente (1983, fore review, see Nutbeam et al., 2010) to describe and explain the different stages of change that seem to be present in most behaviour change processes. According to this model, behaviour change is a process, not an event, and individuals have different levels of motivation or readiness to change. The model has also two dimensions: the stages of change and the process of change. Prochaska and DiClemente identified five basic stages of change: 1) precontemplation – not considering change, 2) contemplation – considering change, 3) determination (or preparation) – making serious commitment to change, 4) action – initiating behavioural change, and 5) maintenance – sustaining change and achievement of health gains. The theory behind this model states that people move in predictable ways through these stages, and it can be applied both to people who self-initiate change and those who respond to advice from health professionals or health campaigns. Factors identified as influencing progression between stages of change are a person's confidence in their ability to change, to overcome perceived barriers, and decisional balance. The model is useful in describing how interventions can be organised and tailored for different populations or individuals, needs and circumstances. It also emphasizes the need to research the characteristics of the target population, and the realization that not all people are at the same stage of change (Glanz et al., 2008; Nutbeam et al., 2010).

## Health promotion and education

The WHO (1997) states that: “Good health is essential to human welfare and to sustained economic and social development.” In 1946, WHO made the first attempt to define health: “Health is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity” (Hallberg, 2002). The WHO Ottawa conference in 1986 replaced the earlier definition of health from 1946 with the following: “Health is seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasising social and personal resources, as well as physical capacities”. An individual’s experience of health, however, varies from situation to situation and the meaning of health is often deeply personal. Health promotion practice concerns both the individuals’ behaviour and the ways in which society is organised, including welfare and policies. The WHO (1998) highlights improvements in the health and well-being of people as the ultimate aim of social and economic development.

The Ottawa Charter 1986 defined health promotion as “the process of enabling people to increase control over, and to improve, their health...a commitment to dealing with the challenges of reducing inequities, extending the scope of prevention, and helping people to cope with their circumstances...create environments conducive to health, in which people are better able to take care of themselves...”. The Ottawa Charter outlines five key areas for health promotion: building healthy public policy, creating supportive environments, strengthening community action, developing personal skills and reorienting health services. Today health professionals are challenged as there is heavy promotion of unhealthy lifestyles in society in the form of tobacco use, alcohol use, fast food and candy consumption (Petersen, 2003). Thus, the WHO emphasises the importance of national health programmes that include health promotion and measures at individual, professional and community levels (Petersen, 2005; Glanz et al., 2008). Health promotion programmes should recognize criteria as empowering, participatory and equality (Watt, 2005).

In education, the importance of political, economic and social factors as determinants of health have been stressed (Glanz et al., 2008). The aim of health education has been described as closing the gap between what is known about desired health practice and what is practiced (Griffiths, 1972, for review, see Glanz et al., 2008). The term health education has been defined as “any combination of health education and related organizational, economic, and environmental supports for behaviour of individuals, groups, or communities conducive to health” (Green and Kreuter, 1991, for review, see Glanz et al., 2008). Health behaviour is the main concern of health education. Health education should not only be directed at changing personal lifestyle or improving compliance with disease management, but should be used to rise awareness of social determinants of health and the promotion of personal and social actions that lead to modification of these determinants. Health education - communication –

should draw upon personal experience, invite interaction, participation and critical analysis (Glanz et al., 2008).

### *Empowerment*

The concept of “empowerment” means that an individual is the master of his/her own life (Tones and Tilford, 1994). According to the WHO, empowerment is defined as “a process through which people gain greater control over decisions and actions affecting their health.” Empowerment is seen as a fundamental resource that can be used to improve opportunities for health (Nutbeam et al., 2010). Therefore, the basis of patient health education is to mediate knowledge, making it comprehensible to patients so that he or she can develop own strategies to manage health challenges. Health professionals can work with individuals in ways that increase their confidence in being able to act to bring about change. Empowerment is an action-oriented concept that focuses on the process whereby individuals, communities and organizations remove barriers and gain power and mastery over their lives in order to create desired changes and improve the quality of life (Glanz et al., 2008).

### *Health literacy (HL)*

The WHO (1998) has defined HL as, “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health”. This rather new concept is described as being a model which guides communication to bring behaviour change (Nutbeam et al., 2010). HL helps to shape the content and delivery of health education and is seen both as a prerequisite for learning and as an outcome of health education or intervention. In the literature, HL is described as being a polarized phenomenon, functional, task and skill-based, a permanent condition, difficult to improve. At the same time it is also described as a complex phenomenon, dynamic, possible to improve, depending on the individual, situation, culture and environment (Mårtensson and Hensing, 2012). Low HL is associated with poor reading, writing and numerical skills, and with short or no education. High HL, on the other hand, is associated with higher education, good knowledge about disease and health and good self-care. Skills can be developed through formal education and informal personal experiences (Nutbeam et al., 2010; Mårtensson and Hensing, 2012). People with low HL are found to be less responsive to health education, less successful in self-management and use disease prevention services at a greater extent. People with high HL are able to promote health, solve health problems (capability), are active participant (take actions) and can make appropriate health decision.

## Oral health promotion and education

Oral health is seen by the WHO as an integral part of general health because both share major, common behavioural health risk factors related to diet habits, and the use of tobacco and alcohol

(WHO, 2003). National health programmes directed at both individual and society levels are recommended by the WHO as they are cost-effective in preventing oral diseases, reducing the burden of oral diseases and maintaining oral health and quality of life (Petersen, 2005; Glanz et al., 2008). In addition, the aging of the population is also a concern because of the increased risk of deteriorating oral health among the elderly, and the estimated rise in health care costs in society (Petersen, 2005; Glanz et al., 2008). Therefore, there is a great need for implementing effective health promotion, health education programmes and interventions aiming at changing oral health behaviours at both individual and population levels. In Sweden, government documents based on the Dental Act (Ministry of Health and Social Affairs, 1985) include guidelines on Swedish dental care. Dental care should attach great importance to preventive measures, respect the patient's autonomy and design care together with the patient.

Oral health promotion to prevent caries can target the whole population or individuals. Oral health promotion programmes based on F are the most effective in reducing caries incidence (Kay and Locker, 1998). Population-based prevention strategies were widely used in Sweden from 1960s to the 1980s. As the prevalence of caries declined in the population in Sweden, in the middle of the 1980s a high-risk strategy was adopted focusing on high-risk individuals in most need of preventive measures (Moberg Sköld et al., 2005a; 2005b). However, the high-risk strategy showed limited effects on dental health at population level, as predictive methods for identifying caries-risk individuals have been of limited success. These facts, and lifestyle factors like changes in dietary habits (high consumption of sugar and soft drinks), have led to the return to population-based prevention promoted by the Swedish Council on Health Technology Assessment (SBU 2002, 2007). The recommendation to use F toothpaste two times a day is an example of such a population-based primary prevention measure (SBU, 2002).

Fluoride interventions are examples of population-based preventive treatment strategies. F can be administered in several ways and two common methods are F rinses and F varnish administered to all children at schools. Both methods reduce caries incidence, but they do not appear to be more effective at reducing tooth decay in children and adolescents than F toothpaste (Marinho et al., 2009). However, two Swedish studies by Moberg Sköld et al. (2005a; 2005b) showed that both F varnish and F mouth rinsing significantly reduced caries incidence on approximal surfaces among adolescents, when administered as a supplement to home care use of F toothpaste. However, large groups of schoolchildren are not regularly using toothpaste twice a day (Klock et al., 1989; Koivusilta et al., 2003). Therefore, topical F treatment in school, implemented as a population-based measure, is an effective action.

When caries affects a smaller proportion of the population, proportionally more caries lesions will be found among those at low caries risk (Batchelor and Sheiham, 2002). Rose (1993) described this in terms of general health as “the burden of ill comes more from the many who are exposed to low inconspicuous risk than from the few who face an obvious problem”. Thus, from a public health perspective, the prevention of oral diseases should be performed as preventive strategies aimed at the whole population. From socio-demographic or epidemiological data, groups in society may be chosen for oral health promotion (Burt, 2005) and this promotion should be tailored to socio-economic characteristics (Tseveenjav et al., 2012). There is a continuous need of population-based health promotion programs both world wide and here in Sweden. However, before new oral health promotion strategies are planned it is important to explore levels of oral health-related knowledge, attitudes, behaviour of the targeted population, as both favourable and unfavourable health habits seem to accumulate.

Educational programmes aim to increase knowledge, influence attitudes and, in the next step, change oral health behaviour. The level of oral health knowledge can be improved relatively easily, but behavioural change is more difficult to achieve (Kay and Locker, 1998). School lessons where professionals communicate and interact with the children, and where the message is supported by pedagogical aids, can improve knowledge about oral health among adolescents (Hedman, 2012).

## Knowledge, attitudes, behaviour and oral health

Knowledge about oral health influences attitudes and behaviour. Studies have shown that oral health education and promotion can increase an individual’s knowledge about oral health and change attitudes towards it, thus improving behaviour. However, maintaining changes in behaviour over a longer time period seems to be difficult (Kay and Locker, 1998; Hugoson et al., 2003; Hugoson et al., 2005a). Knowledge about the willingness and abilities of oral health professionals to transfer knowledge to their patients has been very little described in the literature. There is no study which shows dental professionals levels of knowledge of F toothpaste, or reveals their ways of sharing this knowledge with their patients. A study by Hedman et al. (8) showed that dental care professionals involved in oral health promotion in schools focused more on signs of diseases than on the individuals’ views of their own oral health.

Changing attitudes seems to be more difficult than changing behaviour. A review by Brown (1994) evaluating the effectiveness of interventions in altering individual’s behaviour with regard to dental health, concluded that dental health education had limited success in changing attitudes. Another survey of oral health promotion in adolescents showed that only slight or no improvements in attitude

could be reported (Bunkiene and Aleksejuniene, 2009). On the other hand, several studies report that adolescents at least have a positive attitude to oral health. Hedman et al. (2006) found that 96-99% of the teenagers stated that oral health was very or fairly important. The same proportions were reported in a recently published study of 19-year-olds in Sweden (Ericsson et al., 2012). The latter study also found an association between a high prevalence of dental plaque and gingivitis, and negative attitudes to oral health.

Few studies describe toothbrushing and toothpaste habits among adults in Sweden. Nevertheless, the habit of brushing twice a day seems to be widespread amongst adults in Sweden. In two studies, 73-95% of adults in Sweden reported that they brushed their teeth at least twice a day (Hugoson et al., 2005a; Wikén and van Dijken, 2010). On the other hand, a Finnish study showed that only 47% of the men and 79% of the women brushed their teeth at least twice a day (Tseveenjav et al., 2011). Furthermore, some studies showed that 25% of 14-year-olds did not brush their teeth daily (Klock et al., 1989; Koivusilta et al., 2003). In the study by Ericsson et al. (2012), 70% of male 19-year-olds stated toothbrushing twice per day compared with 81% of females. In a Swedish study of elderly people dependent on daily support, only 69% stated toothbrushing twice a day (Strömberg et al., 2012). Knowledge about how long people brush their teeth is limited. In Switzerland, two populations were studied when brushing and their brushing time was on average 73 and 83 secs, while the participants themselves estimated the brushing time to be approximately 140 secs (Saxer et al., 1998). On the contrary, in a Swedish study, subjects were observed during toothbrushing and the brushing time was reported to be two minutes or longer among almost half of the participants. One third of them brushed one minute or less (Wikén and van Dijken, 2010).

Several factors influence people's oral health behaviour, such as socioeconomic status, educational level and knowledge about, and attitudes towards oral health (Wendt et al., 1994; Hugoson et al., 2005a; Hedman et al., 2006; Alm et al., 2008). Regular toothbrushing is associated with high education (Koivusilta et al., 2003) and Tseveenjav et al. (2012) found that less favourable oral health-related behaviour was more common among adults with low education and the unemployed. Adolescents' oral health behaviour is influenced by knowledge, attitudes and beliefs (Poutanen et al., 2005), while the frequency of toothbrushing seems to be influenced by lifestyle and social norms (Macgregor et al., 1996). In early adolescence, frequent toothbrushing is related to not using tobacco and alcohol, as well as to having a regular bedtime. When parents teach their children regular toothbrushing, they also transmit ideals of goal-directed behaviour (Paunio et al., 1993). By the age of 16, toothbrushing habits have become quite firmly settled and low toothbrushing frequency reflects a lifestyle in which education is not an important value. In addition, the increased consumption of sweets is associated with a decrease in toothbrushing frequency (Koivusilta et al. 2003).

A difference in oral health behaviour related to gender has been reported. Males (adolescents and adults) have less favourable oral health habits, since they reported less frequent toothbrushing and higher consumption of sweetened beverages (Östberg et al., 2010; Tseveenjav et al., 2011). The latter study also reports worse oral status among men. In addition, lower levels of oral health-related knowledge have been reported among male adolescents (Hedman et al., 2006).

As described earlier, many activities we perform in everyday life are without much cognitive effort; instead they are habits, and are performed automatically. Toothbrushing with F toothpaste is an example of such habit formation. A study by Wendt et al. (1994) showed that if daily brushing was established as early as the age of 1 year, children were more likely to be free of caries by 3 years. Other studies show that such habits as toothbrushing are strongly influenced not only by social behaviour and lifestyle, but also by self-esteem (Macgregor et al., 1996; Flinck et al., 1999; Bruno-Ambrosius et al., 2005; Poutanen et al., 2005; Tseveenjav et al., 2010).

#### *Knowledge, attitudes, behaviour and F toothpaste*

As described earlier, several behavioural factors seem to be of great importance for the preventive effect of F toothpaste: i) brushing frequency, ii) F concentration in the toothpaste, iii) amount of toothpaste on the brush, iv) brushing time, and v) post-brushing behaviour or subsequent rinsing with water (Richards et al., 1992; Sjögren and Birkhed, 1994; Sjögren et al., 1995; Davies et al., 2003; Twetman et al., 2003; Zero et al., 2010).

Frequent toothbrushing is well adopted among adults in Sweden. Furthermore, it is believed that F toothpaste is used when brushing. Almost all adults, 93-100% stated that they always or often use F toothpaste (Hugoson et al., 2005a). However, in the oldest age group, 80 years and older, only 82% used F toothpaste regularly. As elderly people have a high caries risk, this unfavourable behaviour is undesired. Daily use of F toothpaste was reported by 86% of males and 96% of females in Finland (Tseveenjav et al., 2011). In the study by Wikén and van Dijken (2010) all participants used F toothpaste, with half of them using toothpaste with 1,450 ppm F and the other part using toothpaste with lower F concentration. Only one of the 53 participants was aware of the F concentration and looked deliberately for toothpaste with a high F concentration. Since the use of F toothpaste is widespread, it can be assumed that knowledge about the advantages of F toothpaste is well-known in the population. Hugoson et al. (2005a) reported that 80 % of the participants in their study knew that F strengthens the teeth. At the same time another Swedish study reported a low awareness of effective toothbrushing habits and use of F toothpaste (Wikén and van Dijken, 2010). Participants who liked the taste of the toothpaste brushed longer and it seems that the use of toothpaste is strongly connected with a fresh feeling and social norms.



Few studies have focused on the amount of F toothpaste used when brushing. In Switzerland, a study had been performed where the participants used on average 1 g toothpaste (Saxer et al., 1998) and in a Swedish study 0.9 g toothpaste was used (Wikén and van Dijken, 2010). Zero et al. (2010) have shown that increasing the amount of toothpaste from 0.5 to 1.5 g more than doubles the F recovered in saliva.

Brushing time has been studied in a few studies, as described above. Brushing time up to three minutes increases the F concentration in saliva (Zero et al., 2010). Since brushing times were considerably shorter in the two published studies, there is room for potential improvements with regards to brushing time (Saxer et al., 1998; Wikén and van Dijken, 2010).

Post-brushing behaviour has also been reported to have an impact on the caries-reducing effect of F toothpaste (Sjögren and Birkhed, 1994). Few studies have investigated peoples' behaviour regarding the use of water after brushing. In the study by Wikén and van Dijken (2010) 75% of the participants reported rinsing with water after brushing. Only 9% used a small amount of water after brushing, i.e. the toothpaste slurry method. Sixty percent of the participants spat out the toothpaste during brushing (Wikén and van Dijken, 2010).

The intention of this thesis was to gain knowledge about the use of F toothpaste among people of different ages, and to investigate the factors that control the use of F toothpaste when brushing. The hypothesis was that an increased knowledge about the benefits of F toothpaste could positively affect an individual's behaviour when using F toothpaste.



## General Aims

The overall aim of this thesis was to gain insight into levels of knowledge, attitudes and behaviour concerning the use of fluoride toothpaste in different age groups in the Swedish population, and among oral health professionals. In addition, the aim was to investigate whether an oral health promotion intervention affected levels of knowledge and the toothpaste behaviour of older adults.

The specific aims of this thesis were:

- to identify knowledge, attitudes and behaviour concerning toothbrushing and the use of fluoride toothpaste in three age strata in a Swedish population (Study I)
- to investigate knowledge, attitudes and behaviour concerning fluoride toothpaste and brushing habits among adolescents, adults and the elderly (Study II)
- to explore the oral health professionals' perspectives regarding their strategies, considerations and methods when teaching their patients the most effective way of toothbrushing with fluoride toothpaste (Study III)
- to investigate the possibility of increasing knowledge about the caries-reducing effect of fluoride toothpaste and initiating an effective way of using fluoride toothpaste among older adults through an intervention, whereby information and instruction were given by a dental hygienist (Study IV)



# Materials and methods

## Ethical considerations

The Ethics Committee at the University of Gothenburg, Sweden, reviewed and approved all four studies (Study I ref. 593-09; Study II ref. 315-10; Study III ref. 551-10; Study IV ref. 011-12). Written information regarding the aims and procedures was given to all participants in all studies. In addition, verbal information was given to those who were interviewed in Studies I and III. Informed consent was obtained from all participants before the interviews in Study I and prior to the intervention described in Study IV. Consent from the respondents to the questionnaire in Studies II and IV was considered to be received when the questionnaire was sent back. Prior to the interviews in Studies I and III, and the interventions in Study IV, participants were also reminded of their rights to withdraw from participation at any time. During Studies I, III and IV the importance of a respectful attitude was especially emphasised, as some of the questions during the interviews and parts of the intervention could be regarded by the participants as invading their privacy and as being overly personal as they concerned their knowledge, attitude and behaviour.

## Study designs and participants

Both qualitative (Studies I and III) and quantitative (Studies II and IV) research methods were used in this thesis. Studies II and IV were conducted in two municipalities in Sweden: Stenungsund, Västra Götaland Region, and Enköping, Uppsala County. Study I was conducted in Stenungsund and Study III in both Västra Götaland Region and Uppsala County. Table 1 shows the design, sample/participants and data collection methods in the four studies.

**Table 1.** The design, sample and data collection methods for all four studies.

Study	Design	Sample	Data collection method	Analyses
I	Qualitative	15 individuals in three age groups	Individual in-depth interviews	Qualitative Content analysis
II	Quantitative Cross-sectional	2023 individuals in four age groups in two municipalities	Questionnaire	Descriptive, bivariate and multivariate statistical analysis
III	Qualitative	23 OHPs in five groups from two counties	Focus-group interviews	Qualitative Content analysis
IV	Quantitative Intervention Longitudinal	219 individuals: 68 intervention and 151 control group	Questionnaire	Descriptive, Bivariate statistical analysis

## Study I

### **Subjects and procedures**

A qualitative research method was used and data were collected through in-depth interviews with the purpose of obtaining a rich and diverse description of the factors that affect individuals' intentions, attitudes, ability and actions when taking responsibility for their own oral health and oral health habits. The informants were selected from three age groups: 15 to 16, 30 to 35 and 60 to 65 years old. In order to obtain the greatest possible variation in data, the informants were selected as representing different stages in life, gender, different levels of education and experience of dental care (Trots, 2004). Fifteen individuals, five from each age group, were interviewed. All informants lived in the municipality of Stenungsund in Västra Götaland Region, and came from both rural and urban areas.

The first two interviews were conducted by a dentist (author PG), and the others were performed by a dental hygienist (author OJ). All interviews were digitally recorded and later transcribed verbatim by a secretary. An interview guide composed of two sections was used as a support during the interviews. One section consisted of opening questions relating to personal background and the other consisted of open-ended questions about self-care and oral hygiene habits focusing on use of toothpaste when brushing. Follow-up questions were asked when needed (Glauser, 1967). Saturation was achieved when no new further views emerged. The analysis was based on qualitative content analysis, and on the performance of both manifest and latent analysis of the text.

The objective of this method is to gain a deeper understanding of, and to describe and interpret the informants' own descriptions of their thoughts, feelings and actions, at various levels of depth and abstraction (Graneheim and Lundman, 2004). The initial analysis and coding of the text was conducted by two of the authors (OJ and PG). Later, all authors analysed and discussed the interviews and reached a consensus about the emerging subcategories and categories. All categories were grounded in the data by the selection of explorative text quotations from all participants.

## Study II

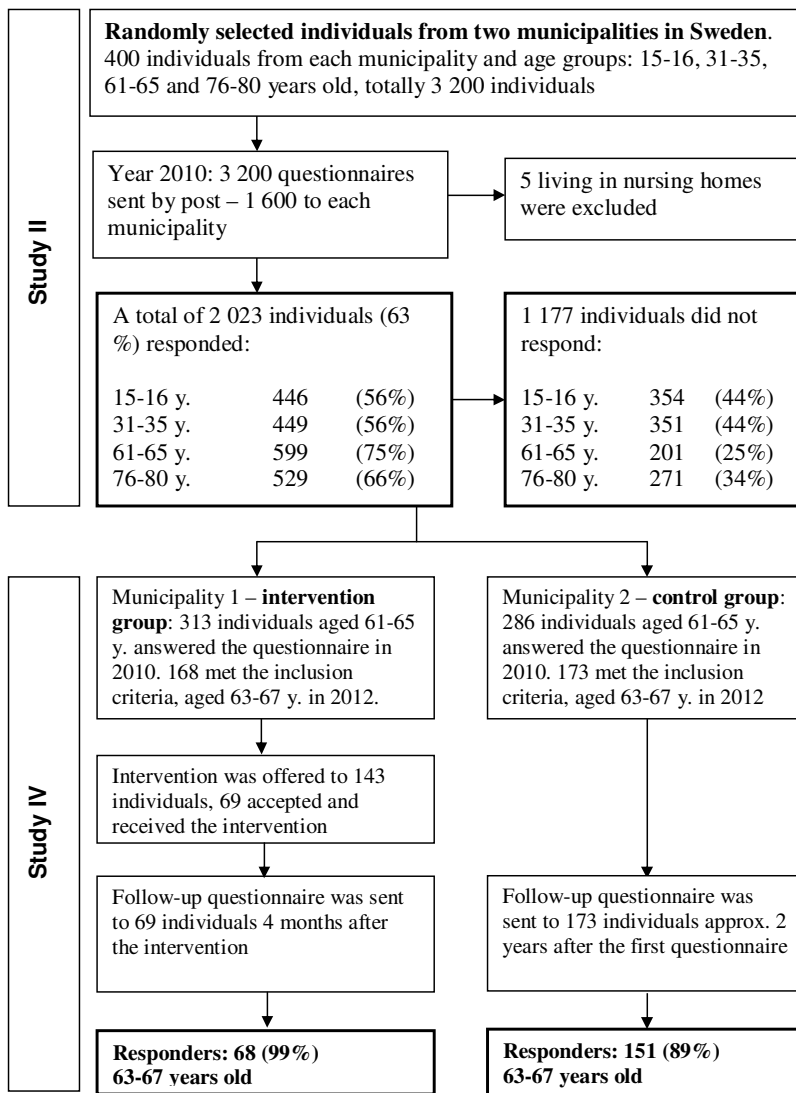
### **Subjects and procedure**

To achieve a more complete view of knowledge, attitudes and behaviour regarding F toothpaste when performing oral hygiene procedures, a questionnaire of 26 questions was sent to 3200 people in two different municipalities, Stenungsund and Enköping, in Sweden. Four age groups, 15 to 16, 31 to 35, 61 to 65, 76 to 80 years, representing different stages in life, were selected to respond to the questionnaire. The individuals were selected from the population register by the random selection of birth dates (Fig.1). The two municipalities were selected because they were similar in size and socioeconomic structure, and included both rural and urban areas. They were situated far from each other, since an intervention was later planned in one of the municipalities with the other serving as control.

A questionnaire with 26 questions was constructed based on the results from study I. The validity of the questionnaire was tested on a small group of ten individuals, and the questions were then finalized. Age, gender and education provided the background data. Three questions dealt with knowledge of toothpaste and fluoride, five questions with attitudes to toothbrushing, toothpaste and oral health; twelve questions dealt with oral hygiene behaviour and four questions were specifically about toothpaste habits. One VAS scale (Aitken, 1969) and 25 multiple-choice questions were used, and all age groups completed the same questionnaire.

A database was created for the analysis and a manual drawn up for transferring the data, in order to facilitate the registering of the answers in the database. All participants received an identification code to preserve anonymity, but also to make it possible to send reminders and plan for an intervention in Study IV. All answers were entered in the database by two secretaries and one of the authors (OJ), who also subsequently verified all transferred data.

A variable, "Good toothpaste behaviour", was constructed based on the most important factors affecting F toothpaste efficiency when brushing (Richards et al., 1992; Sjögren and Birkhed, 1994; Davies et al., 2003; Zero et al., 2010). The variable consisted of: (i) brushing twice a day or more, (ii) using one centimetre or more of toothpaste on a regular brush or putting toothpaste twice on an electric toothbrush, (iii) brushing for two minutes or longer and (iv) using no more than a handful of water for the post-brushing rinse.



**Figure 1.** Flowchart showing the study design, number of respondents and some characteristics of the respondents in the studies II and IV.



## Study III

### **Subjects and procedure**

In order to explore oral health professionals' (OHP) knowledge of F toothpaste and their attitudes and strategies when teaching patients the effective use of F toothpaste, a qualitative research method was adopted to collect data using focus groups. To bring out the personal opinions of the participants and to stimulate interactivity between them, the interviews were performed in focus groups (Morgan, 1997). Twenty-three OHPs, dental nurses, dental hygienists and dentists, were selected through purposive sampling to participate in the interviews. To achieve credibility, the participants were of different gender, professions and had different professional experience. Five focus groups were interviewed in two Swedish regions, Västra Götaland Region and Uppsala County. OHPs were chosen to represent both Public and Private Dental Services and one group included OHPs working as heads of Public Dental Services.

The interviews were performed by a moderator (author PG) and an observer (author OJ) in accordance with the principles of this method (Denzin and Lincoln, 2000). The interviews were digitally recorded and later transcribed verbatim. An interview guide was used to collect background data about the informants' profession and years of experience in the profession. Data concerning the OHP's knowledge of F toothpaste, attitudes to caries prevention, use of effective toothpaste technique and strategies regarding the way to teach patients how to use F toothpaste, were explored through open-ended questions, with follow-up questions when necessary. Three quotation vignettes from participants in Study I were used to further stimulate the discussions and to achieve feed-back on key findings in Study I. Qualitative Content Analysis (Graneheim and Lundman, 2004) was used to analyse the interviews. Two of the authors (OJ and PG) started the analysis of the text and at a later stage all authors have contributed with their analyses. The analytical process contained the following steps: i) identification of statements relating to the same central meaning, i.e. meaning units, ii) interpretation at a higher level of logic – abstractions, iii) meaning units were labelled and codes were created, and iv) codes with similar content were sorted into subcategories and summarised into categories with an abstract label.

Three of the authors (OJ, PG and LP) discussed and revised the subcategories and categories until consensus was achieved and all authors agreed on the final results. A selection of exploratory quotations presented in the text show that the manifest and latent areas were grounded in the data.

## Study IV

### Subjects and procedure

Respondents from Study II, age group 61 to 65 years, were selected to participate in this study. The aim was to increase knowledge of F toothpaste and to initiate an effective way of using F toothpaste when brushing, through an intervention. Two years after the first questionnaire, respondents, who were now 63 to 67 years old, were invited to participate in an intervention in Stenungsund, with respondents in Enköping serving as controls. Based on their first response to the questionnaire in 2010, areas of improvements for the optimal use of F toothpaste were identified, and respondents could have between 0 and 7 areas that could be improved. The inclusion criteria were: i) all respondents who stated brushing  $\leq$  once per day, and/or ii) respondents who had 3 to 7 areas for improvements, i.e. using  $\leq$  one cm toothpaste, brushing for less than two minutes, using extensive water during brushing, stating “always” rinsing with water after brushing, using extensive water after brushing, and having the following brushing patterns during the day: brushing before breakfast and brushing after dinner. In Stenungsund, 168 individuals met the inclusion criteria and were invited to take part in this intervention. Of those, it was possible to reach 143 individuals with the offer to participate, of which 69 accepted and received the intervention. A follow-up questionnaire was sent four months after the intervention was performed. In the control group, 173 individuals met the inclusion criteria and all were sent the questionnaire. In Figure 1 a flow chart of Studies II and IV is shown.

#### *The intervention*

A letter with an invitation to participate in an intervention was sent to 168 individuals between the ages of 63 to 67. One week later, the dental hygienist (OJ) responsible for implementing the intervention called the individuals and, if they agreed to participate an appointment was booked. All interventions took place at the Public Dental Clinic in Stenungsund. The intervention consisted of two main parts, of ten minutes each. In the first part, a dialogue form (Hägglom et al., 2012) was used to explore the individual's current toothbrushing and toothpaste habits and their knowledge of F toothpaste, this in order to adjust the following information to the individual. The second part consisted of an observation of the individual's actual toothpaste and toothbrushing behaviour performed in front of a washbasin and mirror, followed up by individually based practical instruction in the most effective way to use F toothpaste. This included feedback about the amount of toothpaste, brushing time and the use of water during and after brushing. The participants were informed about the follow-up questionnaire, which they would receive about four months later.

### *The questionnaire*

The questionnaire used in this study was based on the questionnaire in Study II, including 17 of the 26 original multiple choice questions. The questions included background data such as age and gender, three questions about knowledge of F in toothpaste, two questions concerning attitudes to toothbrushing and F toothpaste, eight questions about dental hygiene habits and finally, three questions about F toothpaste behaviour.

### **Statistical analysis**

Statistical analyses were performed in Studies II and IV. In both studies a statistician performed a power calculation to estimate the sample sizes. In Study II, 150 respondents from each age group and each municipality were needed to detect improvements of 20% in knowledge and behaviour when the results were to be compared between Studies II and IV. In Study IV, 61 individuals in each group were calculated to have 95% power to detect a difference of 30% between the groups when the answers to the questionnaire were compared (unpaired samples). A sample size of 31 individuals was calculated to have 95% power to detect improvements of 30% in the intervention group before and after the intervention when the answers to the questionnaire were analyzed (paired sample).

In Study II, the descriptive analysis of the questionnaire was shown in frequency tables and the frequency distribution was statistically analysed using chi-square test. The association between the dependent variable “good toothpaste behaviour” and a number of explanatory variables was statistically analysed, using the bivariate Fisher exact test. At a later stage, a multiple logistic regression analysis was used to find associations between the constructed variable (dependent) and the explanatory variables. In Study IV, the frequency distribution of the answers was presented in contingency tables. The differences between the answers of both groups on the first and second occasions, and the differences between the intervention group and the control group on the second occasion, were analysed by Fisher’s exact test. Fisher’s exact test was also used to explore the association of the constructed variable “good toothpaste behaviour” with other factors. All data analysis in Studies II and IV was performed by a professional statistician. The level of statistical significance was set at p value of 0.05.

## Results

### Study I

The theme that emerged at the final stage of the analysis process, underlying the core findings in the data and providing a deeper understanding of the studied phenomenon was: “toothbrushing with fluoride toothpaste was a priority, despite the lack of knowledge about how to use toothpaste effectively and its positive effects on oral health”.

In the manifest analysis three categories were identified: (i) *knowledge*, (ii) *attitudes* and (iii) *behaviour*, and three categories were also identified in the latent analysis: (i) *empowerment*, (ii) *driving force* and (iii) *guidance*. The results showed that the informants in all age groups revealed a lack of knowledge regarding toothbrushing, the use of F toothpaste and the role of F in caries process. The attitudes of the informants were positive as they thought that both oral hygiene and oral health were important. However, they all expressed the opinion that toothbrushing was more important than F toothpaste in preventing caries, and that the main reason for brushing was to remove bacteria/plaque. The reason for using toothpaste and the effects of the F toothpaste were unclear. A pleasant feeling and social norms were important reasons for performing oral hygiene routines, as well as health promotion and avoiding disease and these were expressed as being the driving forces behind their actions. Confirmation and positive feedback from OHPs were said to be important for self-esteem and in empowering self-efficacy in order to perform oral hygiene. No informant stated that they had been taught, either by parents or OHPs, how to use F toothpaste efficiently. However, they expressed great feelings of trust towards the OHPs and they mistrusted advertisements. Despite this negative attitude towards advertisements, several informants were influenced by them and revealed that they had tested products because of advertising.

### Study II

A total of 2023 individuals (63%) answered the questionnaire. The highest answer frequency, 75% and 66%, were found among the oldest age groups and more women (54%) than men answered. All 15 to 16-year-olds had finished compulsory school and 61% of the 31 to 35-year-olds, 40% of the 61 to 65-year-olds and 30% of the 75 to 80-year-olds had post-upper secondary school education.

Knowledge about F in toothpaste were good as the majority stated that F “strengthened the teeth”, although more teenagers did not know the effects of F in toothpaste. Few respondents choose toothpaste for caries prevention and the majority thought that toothbrushing and toothpaste were

equally important in preventing caries. The great majority stated that they had not received instructions on how to use F toothpaste from parents, OHPs or others. Almost all respondents had a positive attitude towards toothbrushing and using toothpaste as they thought it “very” or “rather” important. The taste of the toothpaste was the most important factor when choosing toothpaste among the adults and elderly, while teenagers chose the toothpaste that they found at home. To have “healthy teeth” and “no cavities” was rated as most important by most respondents. A majority of the respondents rated their oral health as good, especially among the elderly.

The majority stated that they brushed their teeth twice a day, the highest frequency being among the 31 to 35-year-olds (91%) and the lowest among the 76 to 80-year-olds (66%). The older the respondents were, the greater the risk that they stated brushing only once a day, brushing before breakfast and after dinner and not always using toothpaste when brushing. More than 50% of the respondents stated that they brushed their teeth for less than two minutes. Almost all respondents stated that they used one centimetre of toothpaste or less on their regular brush, while the majority of those who used an electric toothbrush stated that they put toothpaste only once on the brush. The majority dipped their toothbrush into water during brushing. The result showed that the two older age groups used more water during and after brushing compared to 31 to 35-year-olds and teenagers.

Only 10.8% of the respondents proved to have good toothpaste behaviour. The odds of having good toothpaste behaviour, were increased by being female, 31 to 35 years old, having knowledge about the benefits of F, considering the use of F toothpaste important and rating one’s own oral health as good. When the variables above, which showed associations with good toothpaste behaviour in bivariate analysis, were tested in the multiple logistic regression analysis, the following variables showed positive associations. They were identical with those above, and included: being female, 31 to 35 years old, knowing that F strengthens the teeth, considering brushing with toothpaste important and considering one’s oral health to be good. For a summary of the analysis and more detailed results, see Table 2.

**Table 2.** Summary of a multiple logistic regression analysis of factors with hypothetical potential to predict good toothpaste behaviour.

	OR	(95 % CI)	p-value
Gender (being female)	1.75	(1.26-2.43)	0.0009
Age group 15-16 vs. 76-80 years	1.85	(1.07-3.18)	NS
Age group 31-35 vs. 76-80 years	2.26	(1.31-3.91)	0.027
Age group 61-65 vs. 76-80 years	1.67	(0.99-2.81)	NS
Education, elementary school vs college	1.28	(0.80-2.06)	NS
Know that F strengthens the teeth	1.61	(1.02-2.53)	0.039
Have had toothpaste instruction	0.98	(0.70-1.37)	NS
Consider brushing with toothpaste important	1.85	(1.05-3.26)	0.032
Consider own oral health to be good	1.63	(1.19-2.24)	0.002
Consider toothpaste equally important as toothbrushing to avoid cavities	1.57	(1.04-2.38)	NS

Abbreviations: OR= odds ratio. CI= confidence interval.

### Study III

The categories identified in the manifest and latent analyses were: (i) *strategies and intentions*, (ii) *providing oral hygiene information and instruction* and (iii) *barriers to optimal oral healthcare education*.

OHPs expressed the opinion that health promotion and having the patients' best interests at heart were the primarily driving force when treating patients, but some also stated that they were motivated by self-interest such as personal success at work. The main focus of oral hygiene information and instruction was on good plaque control, i.e. toothbrushing techniques, and very little on how to use F toothpaste. This was the case even when the purpose of toothbrushing was to prevent caries. Barriers to optimal oral healthcare education were primarily the OHPs lack of time and the cost for the patients. The opinion was that nowadays dentists had no time for preventive work for adults. Some expressed the view that dental hygienists and dental nurses both had more time and knowledge when it came to preventive work. The cost to the patients was also a concern and some OHPs considered that preventive work should be a part of the whole treatment since patients often did not want to pay extra for information and instruction.

The opinion was raised that some patients were impossible to motivate and for this group the success of the health promotion and caries prevention was doomed. However, the primary and most frequently declared reason for omitting optimal oral health education was the belief that patients had already had the instruction, had heard the information and they knew what to do. The OHPs took this fact for granted.

## Study IV

Of the 168 individuals in the intervention group, it was possible to reach 143 with the invitation to attend the intervention. Seventy-four declined participation and thus 69 received the intervention. The follow-up questionnaire was answered by all except one. In the control group 151 (89%) answered the questionnaire (Fig 1). There were no differences between the participants and the drop outs in regard to gender or education, either in the intervention or control groups.

Knowledge concerning F in toothpaste, "*F strengthens the teeth*", had increased in both the intervention and control groups, and no significant differences were found between the two groups. The respondents answered to a greater extent that F toothpaste was the most important in preventing caries and no differences were found between the intervention and the control groups. However, the majority of respondents still believed that toothbrushing and the use of toothpaste were equally important in preventing caries.

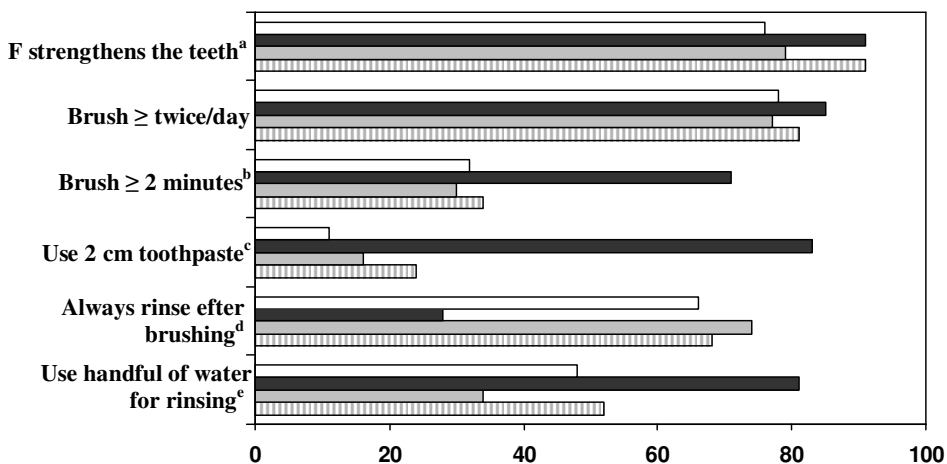
On the first occasion, the majority of the respondents stated that they had not received toothpaste instruction. On the second occasion, most of the respondents in the intervention group answered that they had received instruction while the majority of the controls still had not. Almost all respondents thought that toothbrushing and brushing with F toothpaste were "very" or "quite" important". No changes in attitudes could be seen between the first and the second occasions, or between the intervention and the control groups.

The majority of all respondents stated already on the first occasion that they brushed their teeth twice a day. There was an increase of individuals in both groups who made this statement, but no differences were found between the groups. More than 50% of the respondents on the first occasion stated that they brushed for less than two minutes and this had not increased in the control group on the second occasion. However, in the intervention group there was a clear increase among those who stated that they brushed for two minutes, and this created a difference between the intervention and the control groups.

Most respondents on the first occasions stated that they used one centimetre of toothpaste on the brush or put toothpaste just once on the electric toothbrush. This did not change in the control group, while those who received the intervention increased the amount of toothpaste. Most of them used two centimetres of toothpaste on the regular brush and put toothpaste twice on the electric toothbrush. On the first occasion, all respondents used a great deal of water during and after brushing, and this had not changed in the control group on the second occasion. There was a great decrease in using water during

and after brushing in the intervention group after the intervention, leading to a significant difference between the groups on the second occasion.

On the second occasion good toothpaste behaviour was achieved by 28% in the intervention group and 8% of the respondents in the control group. Higher education level was the only background factor that correlated significantly with good toothpaste behaviour. In figure 2 the results of some questions in Studies II and IV are shown.



**Figure 2.** Answers to some questions in the questionnaire (Study II and IV).

- Intervention group on the first occasion
- Intervention group on the second occasion
- Control group on the first occasion
- Control group on the second occasion

<sup>a</sup> Intervention group on the first occasion vs. the second occasion:  $p < 0.05$   
Control group on the first occasion vs. the second occasion:  $p < 0.01$   
<sup>b</sup> Intervention group on the first occasion vs. the second occasion:  $p < 0.0001$   
Intervention group on the second occasion vs. control group on the second occasion:  $p < 0.0001$   
<sup>c</sup> Intervention group on the first occasion vs. the second occasion:  $p < 0.0001$   
Intervention group on the second occasion vs. control group on the second occasion:  $p < 0.0001$   
<sup>d</sup> Intervention group on the first occasion vs. the second occasion:  $p < 0.001$   
Intervention group on the second occasion vs. control group on the second occasion:  $p < 0.0001$   
<sup>e</sup> Intervention group on the first occasion vs. the second occasion:  $p < 0.01$   
Intervention group on the second occasion vs. control group on the second occasion:  $p < 0.002$



## Discussion

### Methodological considerations

Research can be performed in many ways depending on the purpose. The aims, the research questions and the research problem will indicate which method or strategy to choose (Holme and Solvang, 1997; Denzin and Lincoln, 2000). In this thesis, both qualitative and quantitative research methods were used in order to better elucidate the studied phenomenon. There are some fundamental differences between these two research methods, presented below in Table 3.

**Table 3.** Differences between qualitative and quantitative methods.

<b>Quantitative research method</b>	<b>Qualitative research method</b>
Deductive – testing of theory	Inductive – generating theory
Natural science model – positivism	Interpretative or post-positivist
Objectivism	Constructivist
Explains cause and effect	“The meaning behind the numbers”
Reality and truth	(Lincoln & Guba 2000)
Answers the question how many	Answers the questions how, what, why
Numbers, breadth	Words, depth
Correlations, measurements, causal relations	Interpretations, meaning contexts, experiences
Researcher’s perspective	Participants’ perspective
Structured	Unstructured
Controlled experiment, laboratories	Natural settings, “every day life”
Trustworthiness	Trustworthiness
Validity, reliability, generalizability	Credibility, dependability, transferability

The two research methods complement each other and contribute to a greater degree to the development of new knowledge about health and are necessary for the advance of health science (Denzin and Lincoln, 2000; Hallberg, 2002). Therefore, through combining these two methods we wanted to achieve both a broader and a deeper knowledge of the studied phenomenon. Triangulation means using multiple methods and data sources (both qualitative and quantitative) to facilitate validation of data through cross-verification from two or more studies (Denzin and Lincoln, 2000; Hallberg, 2002; Rothbauer, 2008). However, “triangulation is not a tool or strategy of validation, but

an alternative to validation” according to Flick (1998, for review, see Denzin and Lincoln, 2000). In this thesis, triangulation was used in order to confirm and verify the results, and to increase the credibility and validity of the findings and the way they were interpreted in the four studies.

According to Huston and Rowan (1998), qualitative research seeks to understand and interpret personal experiences and explain social phenomena, especially those related to health. By using qualitative methods it may be possible to understand people’s oral health behaviour from individuals’ own frames of reference. Allowing respondents to describe their own thoughts and assessments using conventional qualitative methods, for example questionnaires, might miss some of the important factors affecting their behaviour. In Studies I and III, a qualitative method, interviews, was used to explore and to identify knowledge of, attitudes to and behaviour regarding the use of F toothpaste in different age groups in a Swedish population, as well as OHPs’ perspectives regarding their strategies when teaching their patients toothbrushing with F toothpaste. As Denzin and Lincoln stated (2000) “the interview is a conversation, the art of asking questions and listening.” The method of collecting and analyzing data was chosen to capture the variations and the differences among peoples’ lived experiences and their responses. Both the in-depth individual interviews and the group interviews generated a large amount of data (261 and 89 pages, respectively). However, this amount of text does not produce saturation unless further data does not bring new and vital aspects to the studied phenomenon. Saturation was reached in these two studies when the last interviews did not bring new and important insights to the studied phenomenon.

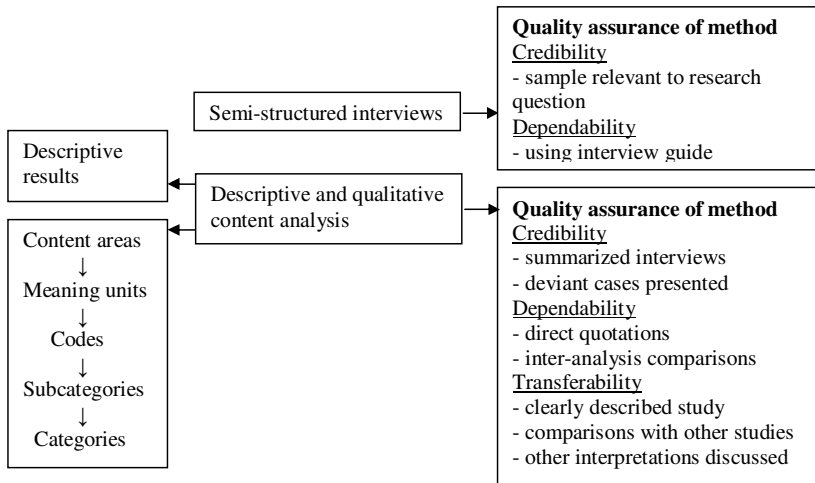
Interviews were used to gain a deeper understanding of the studied phenomena. In Study I, individual in-depth interviews were used with the focus on the individuals’ own accounts of actions, feelings and thoughts. Individual interviews gave the respondent more time to talk about the subject undisturbed, as the purpose was to find out as many aspects of the phenomenon as possible (Cohen and Manion, 1980). The interview guide with open-ended questions was used to keep the focus on the subject under study during the interview and to guide the conversation. The interview guide however unfolds during the interview and is under constant revision from interview to interview. The first qualitative study provided important knowledge on the studied phenomenon and became the basis for constructing the questionnaire in Study II.

In Study III, focus groups were used to elicit discussion among the participants, producing new perspectives. Focus groups allow the researcher to observe the interaction among the participants and this may result in richer data than individual interviews (Denzin and Lincoln, 2000). On the other hand, a possible disadvantage is that individual experience will not fully be explored. In this study, the groups were homogenous to some extent as they all had the same dental professional background.

However, they were also heterogeneous because participants were of different genders and had different educational backgrounds, professional roles, and years in their professions. Both individual and group interviews have their advantages and disadvantages which could affect the validity and reliability (Murdoch et al. 2010). Both interview methods demand a respectful and humble attitude from the interviewer and give the respondents a chance to express their thoughts and feelings, which may be a positive experience for them (Denzin and Lincoln, 2000; Kvale and Brinkmann, 2011).

In this thesis a qualitative research method, content analysis, was selected. Content analysis is a process whereby the content of written, spoken and visual information is described and systematically analyzed (Huston and Rowan, 1998). Content analysis is a social scientific methodology for making sense of recorded human communication, particularly written text (Baxter, 2009) and it emphasises differences between, and similarities within, codes and categories (Graneheim and Lundman, 2004). Qualitative content analysis focuses on interpreting and describing both the manifest (visible, obvious) and the latent (deep, hidden) meaning or content of the text (Graneheim and Lundman, 2004; Baxter, 2009). The strengths of qualitative content analysis are summarized by Baxter (2009) as being more valid, more adaptable to research situation and findings, more useful for answering “why” questions and more engaging with those studied, than other methods. The limitations of this method are that it is less reliable, transparent, generalizable, unobtrusive and inexpensive (Baxter, 2009). It has been stated that while grounded theory is concerned with the discovery of data-induced hypotheses, classical content analysis focuses on theory development and theory testing (Denzin and Lincoln, 2000; Baxter, 2009).

The quality of a qualitative study, trustworthiness, consists of credibility, dependability and transferability (Rowan and Huston, 1997; Fig. 3). Credibility describes how well data address the purpose of the study. In Study I the respondents were strategically chosen from three age groups representing different stages in life and with different experiences. In Study III the respondents (OHPs) had all had personal experience of giving information to patients about how to prevent oral diseases. Dependability, or how data changes over time, was achieved by using an interview guide and vignettes to help the informants relate to the same issue. Transferability means the extent to which research findings can be transferred to a different context, and this was achieved by carefully describing the research process (Graneheim and Lundman, 2004). Quotations from the interviews are presented in the text and this is done to facilitate the readers’ evaluation of the trustworthiness of the results (Lincoln and Guba, 1990). Quotations also provide valuable evidence for the credibility of the analysis, generating a direct link between the abstract content of the results and the actual data (Morgan, 2010).



**Figure 3.** Summary of factors influencing the quality of qualitative methods and analysis process.

In Studies II and IV a quantitative research method, a questionnaire, was used to gather data concerning knowledge, attitudes and behaviour with regard to the use of F toothpaste. The strength of Study II is the randomised selection of participants and the large number of respondents to the questionnaires. Other possible strengths are that participants came from different age groups representing different stages in life, had different educational backgrounds and lived in different geographical locations. All these factors may have contributed to the representativeness of the results (Holme and Solvang, 1997; Graneheim and Lundman, 2004). Thus, those individuals who participated may be seen as representative of their age group.

Social science research relies often on self-reports of behaviour rather than on direct observation mostly for practical reasons, but the validity of self-reports and questionnaires have been questioned (Fishbein and Ajzen, 2010). The validity of the questionnaire in Study II was improved, since the questions were based on the interviews in Study I. The questionnaire was also tested on a small group of ten people from different age groups before the final revision. The ability to accurately recall and report behaviour, especially habits performed without much cognitive effort, can influence the reliability of answers (Fishbein and Ajzen, 2010; Fiske et al., 2010). This observation was supported by the fact that in answers in the first interview study, people had difficulties describing the amount of toothpaste they used on the brush or their brushing time. At the same time, questionnaires allow respondents to take time and think about their behaviour before answering. Responding to the questionnaire may also lead participants to consider behaviour-relevant issues that they had not

considered prior to responding to the questionnaire (Fishbein and Ajzen, 2010). According to Fishbein and Ajzen (2010) the possibility of self-presentation biases is of concern primarily when dealing with behaviours that are socially desirable or undesirable. To reduce or eliminate these biases they suggest assuring people of the confidentiality and anonymity of their responses, and this was done in all four studies presented.

In Study IV an oral health intervention was performed. A shortcoming of the study was that in the intervention group the drop-out rate was relatively high since only 48% of the individuals who were invited to take part chose to do so. However, the number of participants was still within the necessary limit for the power calculation to be performed. In addition, they were assigned at random into the intervention and there were no differences between participants and drop-outs concerning age, gender, education levels and initial toothpaste behaviour. The intervention was planned to be both theoretical and practical, thus exposing the participants to facts and information but also giving them the opportunity to test skills and new behaviour. For evaluating the effects of the interventions the same questionnaire was used as in Study II. The strength of the study was that the intervention group was compared with an external control group not exposed to the intervention by using the same questionnaire in both groups (Fishbein and Ajzen, 2010). In addition, the individuals who took part in the intervention were their own controls, since their answers 18 months before the intervention were compared with the answers four months after the intervention. The follow-up questionnaire was sent to the participants four months after the intervention. One may ask if this time frame was long enough to evaluate the intervention and examine its effects on behaviour, knowledge and attitudes. Studies have shown that oral health education can increase an individual's knowledge and change attitudes, thus improving oral health behaviour. However, maintaining changes in behaviour during a longer period of time seems to be difficult (Kay and Locker, 1998; Hugoson et al., 2003; Hugoson et al., 2005a).

## Knowledge and importance of F toothpaste among people and OHPs

Study I generated the first answers to the research question, what people know about F toothpaste and its effect on caries. The study showed that, although toothbrushing with F toothpaste was a priority and behaviour was good or acceptable, there was a lack of knowledge about how to use F toothpaste effectively and its positive effects on oral health. These findings are in line with a Swedish study showing that knowledge about the effects of F was unclear among participants (Wikén and van Dijken 2010).

In Study II the majority of the respondents showed good knowledge of the strengthening effect of F in toothpaste, a result in accordance with other Swedish studies (Hugoson et al., 2005; Hedman et al., 2006). However, in the three older age groups toothbrushing was perceived as being more important than using F toothpaste in avoiding caries, while the majority in all age groups considered both toothbrush and F toothpaste equally important. In Study I the informants were even more convinced that toothbrushing was more important than the use of F toothpaste, and believed that the main reason for brushing was to reduce the number of bacteria. As oral hygiene routines are usually performed with the purpose of preventing both caries and periodontal diseases, the above statement is probably a logical conclusion. The respondents' strong conviction/belief that toothbrushing was more important than toothpaste, proved difficult to change even when a dental hygienist gave correct information about the difference between use of toothbrush and use of F toothpaste, as seen in Study IV. This may illustrate an individualistic perspective, where knowledge is regarded as a set of innate ideas/beliefs an individual holds (Chalmers, 2003) and they are thus more difficult to change. In Study III toothbrushing technique dominated the information and instruction given by OHPs, with the main purpose being good plaque control and a "clean mouth" even if the patient had caries. The OHPs views may reflect earlier knowledge from studies which led to the recognition of dental caries as a plaque-mediated oral disease and the belief that the acid production in plaque is crucial for caries development because the enamel solubility is pH-dependent (Leach, 1959; Loesche, 1979; Larsen and Jensen, 1989; ten Cate 2013).

It is thought that knowledge of the effects of F toothpaste on caries prevention is widely known among OHPs but less known among the population (Petersen and Lennon, 2004). However, in Study III OHPs expressed uncertainty regarding knowledge of effective F toothpaste technique and even doubted the advantages of F, and this created an obstacle for informing and instructing patients. Even if they described toothbrushing with F toothpaste as important in their daily work with patients, the focus was on plaque removal and toothbrushing technique. Furthermore, some OHPs were of the opinion that caries-free patients, or patients with no active caries lesions, did not need knowledge about F toothpaste. It may be concluded that because OHPs focus on toothbrushing and plaque removal even when patients suffer from dental caries, patients consider toothbrushing and reducing bacteria more important than F toothpaste.

Although in Study I the informants showed limited knowledge about F in toothpaste, they had extensive knowledge of whitening toothpastes containing abrasives and their negative effects. In Study III, OHPs stated that they informed patients about F in toothpaste and also informed or warned patients against using toothpaste containing abrasives, like whitening toothpastes. This may reflect the knowledge respondents had about abrasives in toothpastes and their negative attitudes to using them. Further results in Study III showed that OHPs took for granted that patients already had a good

knowledge about F toothpaste and the most effective way of using it, and they also expected patients to get this knowledge from other sources. People's knowledge is affected not just by factual knowledge coming from reliable sources, but it is also highly affected by the internet and advertising, both of which can be misleading, giving wrongful information or even promoting inappropriate self-care (Logan, 1997; Glanz et al., 2008). As previous studies show in Sweden, the OHPs are the main source of knowledge regarding oral health (Hugoson et al., 1995; Hedman et al., 2009).

Informants in Study I described difficulties in learning new and changing behaviour established in childhood, even when they received new information about more effective methods of oral self-care. Learning facts is seen as the first step in changing behaviour (Anderson et al., 2001). According to Bloom's Taxonomy revised by Anderson (2001), people go through different stages, i.e. six cognitive levels of learning. They are: 1) remembering relevant knowledge, 2) understanding the message, 3) applying, 4) analyzing, 5) evaluating and 6) creating. This implies that people are at different stages of learning and their individual levels must be taken into account by the educator in order for anything to be learned. According to Prochaska and DiClemente (1983) people are also at different levels of motivation and readiness to change. This fact emphasises the difficult position OHPs are when trying to teach their patients in order to change behaviour for the better and attain treatment compliance. OHPs work might be facilitated by a better knowledge and understanding of pedagogy, as concluded in a recent thesis by Stenman (2012).

Health education has been described as having many aims, including "closing the gap between what is known about desired health practice and what is practiced", but the main concern seems to be health behaviour (Hallberg, 2002; Glanz et al., 2008; Nutbeam et al., 2010). The intervention archived the goal of closing this "gap" between desired oral health practice (i.e. good toothpaste behaviour) and actual practice (i.e. the effective use of F toothpaste when brushing among older adults). The aim of the intervention was to improve oral health behaviour among the older adults by teaching them to use F toothpaste effectively for caries prevention. The results of Study IV have proved this to be it possible.

## Attitudes among people and OHPs

Conscious attitudes are often measured through self-reports involving bipolar scales like pleasant/unpleasant and expressions of favour or disfavour toward a subject, object or event (Fishbein and Ajzen, 2010; Fiske et al., 2010). The informants in Study I considered oral health and oral hygiene habits as important, which is in accordance with other Swedish studies (Hedman et al., 2006; Stenman et al., 2009). Attitudes were positive towards toothbrushing and the use of F toothpaste in both Studies I and II, as people in all age groups regarded it as important. In Study I, informants used toothpaste

mainly because of the fresh sensation it gave, “taste, clean, good breath” or, “it feels good and nice” and the reason for performing oral hygiene was that it produced a pleasant feeling. In Study II, among the three older age groups the most important factor when choosing toothpaste was the taste. This result is in accordance with a study by Saxer et al. (1998) showing that people, who rated the taste of toothpaste as high, brushed their teeth longer. As attitudes were already positive to using F toothpaste, further improvements could not be achieved in this area through the intervention in Study IV, a result in line with other studies (Brown, 1994; Bunkiene and Aleksejuniene, 2009). Understanding attitudes and knowing how they are formed seems to be relevant for understanding and predicting an individual’s health behaviour (Fishbein and Ajzen, 2010). The theory of planned behaviour identifies positive attitudes as one factor positively influencing behaviour and guiding the individual’s intentions to perform certain behaviours (Ajzen, 2011). Health education can be effective in altering attitudes and beliefs and increasing knowledge. However, even if improvements in knowledge and attitudes are achieved, they are not always directly related to changes in behaviour (Kay and Locker, 1998).

Subconscious attitudes are more difficult to measure, as a person may not be aware of, or want to show, them depending on the situation and whether it is socially desirable (Fishbein and Ajzen, 2010; Fiske et al., 2010). The in-depth interviews in Study I revealed subconscious attitudes among respondents. Negative attitudes and doubts regarding toothpaste advertisements and commercial companies were expressed by the respondents. However, they showed an ambivalent attitude as they described testing and using advertised products, in this case whitening toothpaste with abrasives. On the other hand, respondents stated that they had great confidence in OHPs and their advice regarding the choice of F toothpaste, as they were regarded as “neutral” in relation to brands and companies. Interestingly, in Study III most interviewed OHP’s were negative about giving advice or recommending specific brands of toothpastes, except in case of special problems such as sensitive teeth. For the OHPs it was important not to favour any specific toothpaste and to be neutral in relation to brands and companies.

## Peoples’ expectations and OHPs strategies

Respondents in Studies I and II stated that OHPs did not inform or instruct them in how to use F toothpaste. The results of Study III showed that OHPs gave information and instruction about the optimal use of F toothpaste to all children and the children’s parents, but not to other adults, as it was taken for granted that adults already had good knowledge, and good behaviour. This triangulation of the findings supports the patients’ statements about not receiving information and instruction on the use of F toothpaste from OHPs. The question is why OHPs do not inform all adult patients about F in toothpaste and instruct them in the most effective way of using it, an issue which must be further investigated. As the information on the importance of F and use of F toothpaste is considered the most



cost-effective tool for preventing caries (Twetman et al., 2003; Marthaler, 2004) oral health professionals must be encouraged to better inform and instruct patients of all ages.

OHPs stressed the fact that lack of time and cost for the patients were the main reasons for not providing optimal oral health information and instruction. These factors seem to negatively influence the OHPs attitudes and behaviour towards the patient and in turn negatively influence treatment outcomes. OHPs seem to be driven by good intentions towards their patients, having their best interest at heart, but they do not act according to this strategy. They described the interaction with the patient as affecting their intentions and behaviour. These interactions negatively affected the OHPs beliefs and intentions, resulting in non-professional behaviour and the loss of self-confidence, and thus influenced treatment. Similar observations have been described in other studies showing the importance of interaction and communication between patients and nurses, patients and doctors and also between patients and dental professionals (Berg and Danielsson, 2007; Hedman et al., 2009; Pennbrandt, 2009; Stenman, 2012). Learning to know your patients must be a priority before any action is taken to inform and instruct them, and this seems to be a priority among OHPs in Study III, as they described listening to their patients' attitudes, trying to earn their confidence, learning about their abilities and wishes, and trying to satisfy their needs.

OHPs expressed trying to balance different strategies such as population preventive strategies, individual-based prevention and even patients' interests and wish for information. According to OHPs, patients were responsible for their own oral health and behaviour, but at the same time they felt responsible for both their patients' oral health information and the outcome. This ambivalent attitude towards health promotion was also reported in the study by Hedman et al (2009). Attitudes can be conflicted or ambivalent, positive or negative depending on different time and place (Fishbein and Ajzen, 2010; Fiske et al., 2010). The OHPs stressed the importance of creating patient participation, which was attained by giving feedback to increase motivation and encouragement, in order to improve the patient's self-esteem. This in accordance with the Swedish Dental Act, which emphasises patient participation as it increases opportunities for individual empowerment. Informants (patients) in Study I mentioned the perspective of empowerment, to which confirmation and positive feedback from OHPs were considered important. Informants also talked about their own performance as being either satisfactory or disappointing and some expressed shame and sorrow over their poor oral health and bad habits. Few mentioned that oral health was their own responsibility, but no one stated it was anyone else's. Self-efficacy, the belief in one's ability to successfully perform a behaviour and exercise control over one's health habits, was mentioned in statements where individuals expressed being talented and capable. According to Bandura (2004) perceived self-efficacy is the most important prerequisite for behaviour performance and change, and unless people believe that they can produce the desired effects they have little motivation to act. People with high self-efficacy are more

determined and can succeed with minimal guidance while people with low self-efficacy believe that their health is beyond their control and give up trying more quickly. Thus the promotion of self-efficacy and improved sense of self-efficacy is important in successfully changing behaviour (Nutbeam et al., 2010).

## Fluoride toothpaste behaviour

Behaviours are seen either as extremely complex when determined by a large number of factors, or less complex where the processes underlying them are essentially the same (Fishbein and Ajzen, 2010; Fiske et al., 2010). Human behaviour follows reasonably or spontaneously from information or beliefs, which in turn originate from experiences, education, media and social interactions (Fishbein and Ajzen, 2010). Both Study I and II showed that F toothpaste behaviour was not optimal among different age groups in Sweden, as knowledge was lacking regarding important factors for an effective way to use F toothpaste. The respondents used mostly 1 cm toothpaste on the brush, brushed for less than two minutes and used much water both during and after brushing. As presented earlier several studies in Sweden and around the world show similar results - F toothpaste is not used properly and proper knowledge of the benefits of F is lacking among populations (Saxer et al. 1989; Twetman et al. 2003; Petersen and Lennon, 2004; Hugoson et al., 2005; Liu et al., 2007; Wikén and van Dijken, 2010; Zero et al., 2010). According to the WHO (2004) only 20% of the global population knows about the caries preventive effect of F in toothpaste. In Study I, respondents declared parents to be the main and prime source of oral health knowledge and habits. It is known that oral health habits adapted in childhood have a great affect on oral health habits later in life (Stecksén-Blicks et al., 2004; Alm et al., 2008).

### *Frequency of toothbrushing*

There is strong evidence in research supporting the recommendation to use F toothpaste twice a day (Marinho et al., 2003; Twetman et al., 2003; Marthaler, 2004; Petersen and Lennon, 2004). Studies I and II showed that different age groups in Sweden have embraced the habit of toothbrushing with F toothpaste twice a day. These results are in accordance with other Swedish studies (Hugoson et al., 2005; Wikén and van Dijken, 2010; Särner et al., 2012). However, both studies showed that more teenagers and elderly only brushed their teeth once a day and the elderly did not always use toothpaste when brushing. This result is in accordance with other studies showing that toothbrushing is not performed twice a day (Klock et al., 1989; Koivusilta et al., 2003; Tseevenjav et al., 2011). Low brushing frequency has been associated with an increased risk of developing caries (Marinho et al., 2003; Twetman et al., 2003) and an increased risk of not having regular dental care (Östberg et al., 2010). For those who brushed once a day, especially those who brushed irregularly in the evening, this was associated with high caries risk prevalence (Julihn et al., 2006). The OHPs in Study III did give advice to patients on brushing twice a day in order to have a “clean mouth”, however no one

mentioned to adults the recommendations to use F toothpaste twice a day, only to children and their parents.

### *Fluoride concentration in toothpaste*

The F concentration in toothpaste is one of the most important factors for the effectiveness of F toothpaste and there is strong evidence that higher F concentrations in toothpaste have a better caries preventive effect (Baysan et al., 2001; Davies, 2003; Marthaler, 2004; Twetman, 2009; Nordström and Birkhed, 2010; Walsh et al., 2010; tenCate, 2013). No informants in Study I mentioned being aware of the F concentration in toothpaste and therefore this was not discussed. Unfortunately, no questions were included in Study II concerning knowledge of F concentrations in toothpaste. However, some informants in Study I mentioned that one should use toothpaste because “there’s fluoride in it” and in Study II most respondents were aware of whether their toothpaste contained F or not. In the study by Wikén and van Dijken (2010) half of the participants used toothpaste containing 1,450 ppm F, while the others used toothpaste with lower F concentration. However, this study also showed that only one respondent was aware of the F concentration in the toothpaste. OHPs in Study III stated that their information included advice on F concentrations, and this was considered to be important.

### *Amount of toothpaste*

The amount of toothpaste used varied among the informants in Study I, as some describing using “a long strip” and others only “a little glob”, but not everyone was aware of the amount of toothpaste used. In Study II most respondents used 1 cm toothpaste on the brush and the majority of those using electric toothbrush put toothpaste on the brush just once. The youngest age group stated they used larger amounts of toothpaste. The significance of the amount of toothpaste on the brush has been disputed (Ashley et al., 1999; Zero et al., 2010). However, studies support the view that a larger amount of toothpaste increases the F content in saliva and thus creating a longer caries preventive effect (DenBeste and Ko, 1996; Zero et al., 2010). Zero’s study showed that increasing the amount from 0.5 to 1.5 g more than doubled the F content in saliva after brushing. In Study II only one quarter of respondents stated they used 2 cm of toothpaste, which corresponds to 1-1.5g. In Study III the OHPs stated they gave advice to children and teenagers about the amount of toothpaste, either “to squeeze a small string” or “to cover the whole brush”. The OHPs had different opinions as to whether they did or did not give advice about the amount of toothpaste to patients using an electric toothbrush.

### *Brushing time*

In both Studies I and II brushing time varied among respondents. In Study I not everyone was aware of brushing times, some stating they brushed for “30 seconds or maybe a minute” and others for “five minutes at least”. Just half of the respondents in Study II reported brushing for two minutes or longer.

This result is in line with a study by Saxer et al (1998) but not in accordance with the Swedish study by Wikén and van Dijken (2010). Zero et al. (2010) has evaluated brushing time from 30 seconds to 3 minutes, and concluded that longer brushing times reduced the retention of toothpaste in the brush thus leading to higher and prolonged F levels in the mouth. An earlier study by Watson et al. (2005) showed that more F was absorbed after 120 sec than after just 30 sec in plaque grown in situ, exposed in vivo to 1,000 ppm F. In addition, caries activity has been found to be significantly correlated to brushing time (Wikén and van Dijken, 2010). The OHPs in Study III gave advice on brushing time, recommending patients to brush for two minutes. However, this advice did not take into consideration the fact that F toothpaste should be in the mouth for 2 minutes, as they considered this advice relevant only for plaque removal.

### *Use of water during and after brushing*

In Study I several informants described rinsing the toothpaste with water methodically and without much cognitive effort. There were also those who knew better and did not rinse it off. A new perspective unfolded during Study I, as patients described the behaviour of using water during brushing and dipping the brush several times under running water. Study II gave a clearer picture of this behaviour. The majority in all four age groups stated that they dipped the brush under running water during brushing. As far as we know, the behaviour of using water during brushing, including dipping the brush under water several times has not been investigated before. However, a logical conclusion must be that extensive use of water during brushing must have a negative effect on the retention of F toothpaste in the brush, and dilutes the levels of F concentration in the oral cavity and saliva. More research is needed to explore this aspect of behaviour, and more consideration given when giving advice to patients on good toothpaste technique.

Post-brushing behaviour has been described in earlier studies (Richards et al., 1992; Sjögren and Birkhed, 1993) and there seems to be an agreement among researchers that extensive use of water has a negative effect on F retention in the oral cavity and thus a negative effect on F toothpaste efficacy (Sjögren and Birkhed, 1994; Davies et al., 2003; Zero et al., 2010; Walsh et al., 2010; Pitts et al., 2012). Study II showed that mostly elderly people use a great deal of water after brushing, a half glass of water or more, and they also used more water during brushing. Some OHPs in Study III were of the opinion that they informed patients, especially children, about not rinsing after brushing, but not everyone was sure that the advice was given to adults.

### *Other behavioural aspects of using F toothpaste*

Findings in Study I showed that both teenagers and adults seem to be driven by the same motives when performing oral hygiene such as having fresh breath, using toothpaste for a fresh feeling, complying with social norms and for avoiding tooth decay. The theory of planned behaviour identifies

social norms as one of the key factors that influence behaviour, and as such may be target for intervention (Ajzen, 2011). Hallberg (2002) also emphasises the fact that to change a habit we must understand the prevalent values of society and not only of individuals.

At the World Health Assembly (2007) it was declared that the promotion of oral health among older people should be a priority. Both Studies I and II showed that the elderly had the most unfavourable toothpaste behaviour. The intervention in study IV aimed at 63 to 67-year-olds had a positive effect on changing participants' behaviour in using F toothpaste more efficiently. The study also showed that higher education levels correlated to the adoption of good toothpaste behaviour. This is in accordance with other studies showing that toothbrushing behaviour may be affected by education level, socio-economic status, life-style factors and self-esteem (Flinck et al., 1999; Tseveenjav et al., 2010). Furthermore, according to the concept of health literacy, individuals with high levels of general literacy (i.e. higher education, cognitive and social skills) can better understand and use information and thus adopt healthier behaviours and better self-care (Nutbeam et al., 2010; Mårtensson and Hensing, 2012).

It has been stated that old habits are hard to break and new habits are hard to form (Fiske et al., 2010). However, it is also acknowledged that through repetition it is possible to learn new habits and that repeated performance can make a behaviour become routine (Fishbein and Ajzen, 2010). It was possible to improve the habit of using F toothpaste more efficiently, through the intervention in Study IV, using practice and repetition. Furthermore, results showed that supervised instruction in combination with simple, clear advice, (i.e. brush 2 times per day, for 2 minutes, using 2 centimetres of F toothpaste) was easily remembered by the participants. The social cognitive theory by Bandura (1986, for review, see Nutbeam et al., 2010), proposes the use of both observational (observe the behaviour) and participatory (supervised practice and repetition) learning as they are powerful tools that lead to the development of the knowledge and skills necessary for behavioural change. This may suggest that an intervention which combines these perspectives may have a positive effect in changing oral health behaviour and improving oral health habits. Supervised toothbrushing has earlier been evaluated as being effective in reducing caries (Twetman et al., 2003) and this intervention included supervised practice in using F toothpaste efficiently.

Levels of knowledge were improved in Study IV. However, both the intervention and the control group showed improvement, which may suggest that patients seek knowledge from other sources or that even that the questionnaire itself may have triggered interest in searching for knowledge. Despite improved knowledge in the control group no improved behaviour could be seen, resulting in the conclusion that improved knowledge does not always lead to improved behaviour. There are different views on the effects of knowledge on behaviour, many theoreticians agreeing on the fact that greater

knowledge allows individuals to make better decisions (Bandura, 2004; Glanz et al., 2008; Nutbeam et al. 2010). For example, the better knowledge one has about an illness, the better one is able to choose appropriate treatment or adopt appropriate health-protective behaviour. Fishbein and Ajzen (2010) do not agree with this assumption. On the contrary, they argue that knowledge is not directly related to behaviour, being only one factor that influences decisions to perform a behaviour, and that accurate knowledge is not sufficient to predict and explain behaviour. However, they agree that it is possible to change behaviour by providing individuals with behaviour-relevant information, in the case of Study IV the most effective F toothpaste behaviour.

According to Bloom's Taxonomy (Anderson et al., 2001), learning facts is the first step in changing behaviour, but individuals must also go through the stages of understanding, application, analysis and evaluation before they can create their own strategies. The control group did not show changes in behaviour as they probably reached only step one (learned facts, new knowledge) or possibly reached stage two (understand the message). However, those participating in the intervention seem to have passed several steps if not all six (remembering, understanding, applying, analyzing, evaluating and creating).

The studies give a complicated picture of why people use F toothpaste: they use it because it is a natural thing to do, a well ingrained habit; because of the fresh feeling and good taste it gives and because it is thought to have a cleansing effect. How and why oral hygiene is performed is determined by a range of factors such as: habits, knowledge, practical aspects, information and advertising, as well as pleasant feelings, social norms, health promotion and the wish to avoid disease.

Key variables underlying behaviour are assumed to exist as for a person to perform a specific behaviour, as presented earlier (Fishbein and Ajzen, 2010). In these studies, the following statements were seen to be true for the use of F toothpaste when brushing: 1) a strong positive intention to perform the behaviour, as was seen in Study I expressed through driving force; 2) no respondents mentioned not having the necessary skills to perform the behaviour; 3) respondents had mostly a positive attitude toward performing the behaviour; 4) respondents mentioned perceiving social pressure to perform the behaviour; 5) some also mentioned performing the behaviour as it was consistent with their self-image; 6) emotional reactions to performing the behaviour were more positive - pleasant feelings- than negative and 7) some respondents perceived having the capability to perform the behaviour i.e. self-efficacy.

## Conclusion

Triangulation achieved both a deeper and broader knowledge and understanding of the studied phenomenon as agreement between different sources confirmed the validity and the credibility of the results. The conclusions from the four studies are:

- Knowledge of how to use F toothpaste effectively and its positive effects on oral health lacked among different age groups in the studied population (Study I and II).
- Positive attitude was expressed towards the use of F toothpaste when brushing among different age groups in the population as well as OHPs (Study I, II and III).
- Different age groups in the population have adopted the frequency of toothbrushing and the use of F toothpaste twice a day, but lacked effective F toothpaste technique (Study I and II).
- When teaching patients the OHPs expressed more focus on toothbrushing technique and plaque control than on effective F toothpaste technique, and they took for granted that adults already had good knowledge of and appropriate toothpaste behaviour (Study III).
- Older adults and the elderly showed the most unfavourable toothpaste behaviour (Study II).
- Increased knowledge alone did not influence toothpaste behaviour of the older adults, but an individually-based oral health intervention improved behaviour regarding effective use of F toothpaste (Study IV).

## Clinical relevance and future considerations

The early establishment of good oral hygiene habits and the regular use of F toothpaste are important in achieving good oral health. As the establishment of these habits come early in life, while knowledge and the reasons for the habit come much later in life, it is not surprising that the population is not sure of the benefits of F toothpaste. Knowledge of F toothpaste should not be taken for granted, neither among the patients nor among OHPs. Many studies show that it is hard to improve knowledge, to change attitudes and behaviour or habits in patients, and this seems to be true also for the OHPs. There is great evidence of the effects of F toothpaste on caries prevention. F toothpaste improves dental health regardless of a person's age, gender, education and socio-economic background. Therefore, promotion of the effective use of F toothpaste twice a day remains the most important tool in preventing dental caries and OHPs should encourage and motivate patients towards adopting better F toothpaste practice.

There are several public policies that state that dental health care should work with oral health promotion. The WHO states that the goal of health promotion is to create conditions for people to take responsibility for their own health. This requires that OHPs teach people how to perform oral health preventive behaviour. These studies have identified areas for improvement in dental health, within oral health promotion. There seems to be a great need to continuously promote and teach individuals and populations about the benefits of F. When planning the content of oral health education and promotion among all age groups, the importance of good and practical easy daily advice on the optimal use of F toothpaste needs to be included. Respondents stated that they respected the recommendations given by dental professionals – this must be considered in all actions taken in prevention. OHPs have the capacity to bring about change in individuals' oral health behaviour. Seeing the individual on a regular basis gives OHPs the opportunity to influence and promote changes in attitude, knowledge and behaviour for the better, resulting in better oral health and health in general. For reducing the "burden of caries", health behaviour change may be our greatest hope. Furthermore, OHPs need to be continuously updated in the use of the best oral health promotion methods, as they are cost effective.

Media campaigns and the power of toothpaste advertising were described both by respondents and OHPs. Unfortunately, advertisement focuses more on such effects of toothpaste as helping with the problem of sensitive teeth, and whitening teeth than they do on the important primary preventive role of F toothpaste – mainly its caries preventive effect. Health promotion programs and interventions could use social marketing techniques and media campaigns as part of a mass communication strategy to raise awareness and influence public knowledge, attitudes and opinions regarding the main benefit of using F toothpaste efficiently.



## Konklusion (Swedish)

- Kunskap om effektiv användning av fluortandkräm och vikten av fluor i kariesprocessen var bristande i de olika åldersgrupperna som studerades (Studie I och II).
- Attityden var positiv till användning av fluortandkräm vid tandborstning eftersom den ansågs vara viktig både i de olika åldersgrupperna i befolkningen och bland tandvårdspersonal (Studie I, II och III).
- Olika åldersgrupper i befolkningen har tagit till sig vanan med tandborstning med fluortandkräm två gånger per dag, men hade ofta en bristfällig tandkrämsteknik (Studie I och II).
- Tandvårdspersonalens munhälsoinformation och instruktion innehöll huvudsakligen tandborstningsteknik och plackkontroll, medan lite handlade om fluortandkräm, och ännu mindre om tandkrämsteknik, även om patienten hade karies. Vidare tog tandvårdspersonalen för givet att patienterna redan hade god kunskap och bra beteende vad det gäller fluortandkräm (Studie III).
- Äldre vuxna och de äldre hade de största bristerna vad det gäller användning av fluortandkräm (Studie I).
- Enbart ökad kunskap om fluortandkrämens kariesförebyggande effekt hade ingen effekt på tandkrämsbeteendet, men en individbaserad hälsofrämjande intervention om effektiv tandkrämsteknik kunde förbättra tandkrämsbeteendet hos de äldre vuxna (Studie IV).



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*“När man är 20 har man löst världsgåtan, vid 30 börjar man tänka över den och vid 40 finner man den olöslig.” August Strindberg*

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**1. Ange din ålder och om du är man/kvinna.**

Ålder: \_\_\_\_\_ år.

Man

Kvinna

**2. Ange din utbildning.**

Grundskola

Folkskola

Yrkesutbildning

Gymnasium

Kortare eftergymnasial utbildning (3 år eller mindre)

Längre eftergymnasial utbildning (mer än 3 år)

**3. Hur många gånger borstar du tänderna per dag?**

Aldrig

Mindre än 1 gång

1 gång

2 gånger

3 gånger eller fler

**4. Tycker du att det är viktigt att borsta tänderna?**

Ja, mycket viktigt

Ja, ganska viktigt

Ej viktigt

Vet ej

**5. När borstar du tänderna?** (Kryssa för ett eller flera alternativ)

- Före frukost
- Efter frukost
- Borstar inte på morgonen
- Före kvällsmaten
- Efter kvällsmaten
- Innan jag lägger mig
- Borstar inte på kvällen

**6. Händer det att du inte borstar tänderna på morgonen eller kvällen?**

- Ja
- Nej

Om ja, när? \_\_\_\_\_

**7. Dricker eller äter du något efter att du har borstat tänderna på kvällen?**

- Ja, ibland
- Nej, nästan aldrig

Om ja, vad? \_\_\_\_\_

**8. Har du annat intag efter tandborstningen som t ex sugtabletter eller mediciner.**

- Ja
- Nej

Om ja, vad? \_\_\_\_\_

**9. Borstar du alltid tänderna med tandkräm?**

- Ja, i stort sett
- Nej, inte varje gång

**10. Använder du tandkräm med eller utan fluor?**

- Med fluor
- Utan fluor
- Vet ej

**11. Tycker du att det är viktigt att borsta tänderna med tandkräm?**

- Ja, mycket viktigt
- Ja, ganska viktigt
- Nej, inte viktigt
- Vet ej

**12. Hur ofta händer det att du inte borstar tänderna med tandkräm?**

- En gång per dag
- Mer än 2 ggr i veckan
- En gång i veckan
- Någon gång i månaden
- Aldrig

**13. Vilken betydelse har fluor i tandkräm?** (Kryssa för ett eller flera alternativ)

- Gör tänderna vitare
- Stärker tänderna
- Gör tänderna renare
- Gör att man känner sig fräsch i munnen
- Vet ej

**14. Vilken tandkräm använder du för tillfället?**

Namn på tandkrämen: \_\_\_\_\_

- Vet ej

**15. Vad avgör vilken tandkräm du använder?** (Kryssa för ett eller flera alternativ)

- Priset
- Smaken
- Reklam
- Använder den som finns hemma
- Vet ej

**16. Borstar du alltid med samma tandkräm?**

- Ja, i stort sett
- Nej

Om Ja, vad heter tandkrämen? \_\_\_\_\_

**17. Använder du vanlig tandborste eller eltandborste?**

- Vanlig tandborste
- Eltandborste
- Både och

**18. Vilket tror du att det är viktigaste mot hål i tänderna?**

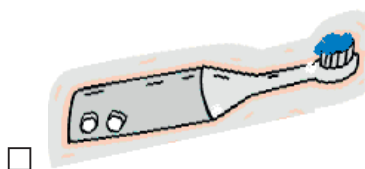
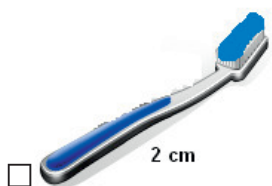
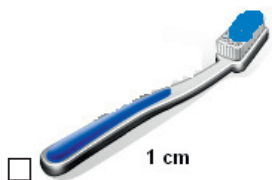
- Rengöring med tandborsten
- Fluoret i tandkrämen
- Tandborste och tandkräm lika viktigt

**19. Hur gör du rent mellan tänderna?** (Kryssa för ett eller flera alternativ)

- Tandborste
- Tandtråd
- Tandstickor
- Mellanrumsborste
- Annat



**20. Hur mycket tandkräm lägger du på din tandborste?** (Kryssa för det alternativ som gäller för dig)



Läger tandkräm 2 gånger på min el tandborste.

**21. Hur länge borstar du tänderna?**

- Mindre än en halv minut
- En halv minut
- 1 min
- Mindre än 2 min
- 2 min
- Mer än 2 min

**22. Hur många gånger doppar du tandborsten under rinnande vatten när du borstar tänderna? (Ringa in rätt siffra nedan)**

**0    1    2    3    4    5    6    7    8    9    10**

**23. Sköljer du munnen med vatten efter tandborstningen?**

- Nej, aldrig
- Ja, någon enstaka gång
- Ja, ofta
- Ja, alltid
- Har inte tänkt på det

**24. Om du sköljer munnen efter tandborstningen, hur mycket vatten använder du?** (Kryssa för det alternativ som gäller för dig)

En handfull



Två handfull



Ett halvt glas vatten



Ett helt glas vatten



**25. Sköljer du munnen med någon lösning (munvatten) efter tandborstningen?**

Ja

Nej

Vid ja, ange med vilken lösning:

Dentan

Listerine

Flux

SB12

Vet ej

**26. Har någon visat eller instruerat dig hur du ska använda tandkräm när du borstar tänderna?**

Nej

Ja

Om ja, vem? \_\_\_\_\_

**27. Hur upplever du din egen munhälsa?** (Markera med ett kryss på skalan nedan.

Bra

Dålig

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**28. Vad är viktigast för dig?**

Friska tänder

Vita tänder

Inga "hål"

Annat, svar: \_\_\_\_\_

**Tack för att du tog dig tid och besvarade alla frågorna i enkäten!**