JUKKA KENTALA

Smoking Prevention in Oral Health Care

Brief Intervention among Adolescents

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ACADEMIC DISSERTATION
To be presented, with the permission of
the Faculty of Medicine of the University of Tampere,
for public discussion in the small auditorium of Building K,
Medical School of the University of Tampere,
Teiskontie 35, Tampere, on May 12th, 2007, at 12 o'clock.

UNIVERSITY OF TAMPERE

ACADEMIC DISSERTATION
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www.uta.fi/taju
http://granum.uta.fi

Cover design by
Juha Siro

Printed dissertation
Acta Universitatis Tamperensis 1228
ISBN 978-951-44-6935-0 (print)
ISSN 1455-1616

Electronic dissertation
Acta Electronica Universitatis Tamperensis 616
ISBN 978-951-44-6936-7 (pdf)
ISSN 1456-954X
http://acta.uta.fi

Tampereen Yliopistopaino Oy – Juvenes Print
Tampere 2007

CONTENTS

LIST OF ORIGINAL COMMUNICATIONS

The thesis is based on the following original articles, referred into the text by their Roman numerals I to IV:

I Kentala J, Utriainen P, Pahkala K, Mattila K.
Can brief intervention through community dental care have an effect on adolescent smoking? Preventive Medicine 1999, 29:107-111. (Reprinted with permission from Elsevier Publishing.)

II Kentala J, Utriainen P, Pahkala K, Mattila KJ.
Nuorten tupakointia ehkäisevän mini-intervention toteutettavuus suun terveydenhuollossa. Suomen Hammaslääkärilehti 2005,11:1114-1123. (Smoking prevention among youth – feasibility of brief intervention in oral health care). (Reprinted with permission from the Finnish Dental Journal.)

III Kentala J, Utriainen P, Pahkala K, Mattila K.
Verification of adolescent self-reported smoking. Addictive Behaviors 2004, 29:405-411. (Reprinted with permission from Elsevier Publishing.)

IV Kentala J, Utriainen P, Pahkala K, Alanen P, Mattila K.
Cigarette smoking is associated with caries experience and periodontal treatment need: a cross-sectional approach by adolescent school grade. Submitted.

ABBREVIATIONS

CO	Carbon monoxide
CoHb	Carboxyhaemoglobin
CPITN	Community Periodontal Index of Treatment Need
DMFT	Decayed Missing and Filled Teeth
DMFS	Decayed Missing and Filled Surfaces
DT	Decayed Teeth
FRAMES	Feedback, Responsibility, Advice, Menu of strategies, Empathy and Self-efficacy
NRT	Nicotine Replacement Therapy
PMN	Polymorfonuclear Neutrophiles
ppm	Parts per million
RR	Risk Ratio
5 R`s	Relevance, Risks, Rewards, Roadblocks, and Repetition.
SPSS	Statistical Package for the Social Sciences
SSSR	Stimulated Salivary Secretion Rate
VAS	Visual Analogue Scale
VSC	Volative Sulphur Compounds
WIC	Walk-In Counselling

ABSTRACT

The aim of the present study was to investigate the brief intervention method in real-life dental settings and to determine its feasibility in adolescent smoking cessation. Also the opinions and attitudes of dental personnel in smoking-related issues were assessed; likewise the validity of the information on adolescent smoking habits obtained in dental care. We also sought to test the possible early association of tobacco smoking with oral health indices in adolescents.

The 3% reduction in adolescents` smoking achieved by the brief intervention can be regarded as a good result. In unstable smoking habit conditions the improvement was achieved with little extra input over and above normal routine dental care. Dental staff were mostly of the opinion that the prevention of smoking is an important factor within dentistry. Obvious defects were, however, observed in practical feasibility of the brief intervention method.

It seemed needless to use biochemical verification of smoking in normal dental practice, since the authority of the dental profession appeared to elicit reliable information on the habit.

The smoking habit seems to be a prominent determinant of caries occurrence and treatment need in adolescents. Calculations of the likelihood of an adolescent having nonintact teeth showed that this was 1.8-2.8 times more likely in smokers than in non-smokers. Smokers had a need for periodontal care 1.6-2.0 times more often than non-smokers. This possible association must to be taken into account when planning strategies for adolescent oral health.

Smoking counselling should be a fundamental part of the dental curriculum and prevention program in every practice. The feasibility of the brief intervention method can be improved by raising the self-motivation and formal training of dental personnel for health counselling.

LYHENNELMÄ

Tutkimussarjan tarkoituksena oli kokeilla mini-interventio –menetelmää käytännössä sekä selvittää menetelmän toteutettavuutta nuorten tupakoinnin vieroituksessa. Lisäksi selvitettiin suun terveydenhuollon henkilöstön mielipiteitä ja asenteita tupakointiin liittyvissä kysymyksissä sekä arvioitiin nuorilta tupakointitavoista suun terveydenhuollossa saatujen tietojen luotettavuutta. Halusimme myös selvittää, onko nuorten tupakoinnin ja suun terveyden indeksien välillä yhteyttä.

Mini-interventiolla saavutettua 3 %:n vähennystä nuorten tupakoinnissa voidaan pitää hyvänä tuloksena ottaen huomioon murrosikäisten tupakointitapojen vaihtuvuuden sekä sen seikan, että tulos saavutettiin vähäisellä lisäpanostuksella normaalin hammashoitotyön ohessa. Suun terveydenhuollon henkilöstö piti tupakoinnin ehkäisyä tärkeänä asiana hammashuollossa. Mini-intervention käytännön toteutuksessa havaittiin kuitenkin selviä puutteita.

Hammashuollon normaalitoiminnassa nuorten tupakointitavan varmistaminen biokemiallisin menetelmin on tarpeetonta. Hammashuollon henkilöstön auktoriteetti näyttää varmistavan nuorilta saatujen tietojen luotettavuuden.

Nuorten tupakointi näyttää olevan merkittävä tekijä karieksen ja parodontaalisairausten hoidon tarpeen kannalta. Tupakoimattomilla nuorilla oli 1.8-2.8 kertaa useammin reikiintymättömät hampaat ja tupakoivilla parodontaalihoidon tarve oli 1.6-2.0 kertainen tupakoimattomiin verrattuna. Suun terveydenhuollon strategioiden suunnittelussa tämä mahdollinen yhteys on otettava huomioon.

Tupakoinnista vieroittamisen tulee olla hammaslääkärin ammatinharjoittamiseen liittyvä perustehtävä ja osa ehkäisevää työohjelmaa kaikilla hammaslääkärin vastaanotoilla. Mini-interventio-menetelmän toteuttavuutta voidaan parantaa lisäämällä hammashuollon työntekijöiden omaa motivaatiota tupakointiin liittyvien aiheiden käsittelyssä vastaanotolla sekä kehittämällä asiaan liittyvää terveysneuvonnan koulutusta.

INTRODUCTION

Cigarette smoking is the leading preventable cause of illness and premature death in Finland and in many other industrialized countries (Peto 1994). In Finland, cigarette consumption has in the past been among the highest in the world. In the 1950s nearly 80 % of adult men but only 13% of women smoked. In the 1960s and 1970s smoking declined in men but increased in women (Martelin 1984). The figures for adult Finns have since been among the lowest in Europe (Joossens et al. 1994**,** Helakorpi et al. 1994).

The problem in Finland is teenage smoking. The number of children and young people starting to smoke has not decreased; adolescents have in fact begun smoking earlier in Finland and they also have smoked more than young people elsewhere in Europe (Rimpelä et al. 2003**,** Godeau et al. 2004). Fortunately the latest reports indicate a positive development as experimentation and regular use of tobacco appears to take place later than hitherto (Rimpelä et al. 2005). As the majority of smokers take up the habit during teenage years, the high rate of young smokers will eventually feed through into adult smoking rates. Only few studies have been conducted on adolescent cessation programs. More research is thus needed on youth smoking cessation and prevention programs available to health professionals.

Although an increasing amount of smoking-related research has been done among adults and adolescents, it is crucial to obtain reliable and validated instruments for assessing smoking behaviors. The reliability and validity of self-reports and questionnaires are often questionable in that adults tend to give socially desirable information regarding their smoking status. Estimates of the reliability of self-reports on adolescent smoking have been fairly high (Post 2005, Mayhew 2000), and this is essential for health professionals to be able to provide adequate treatment for their patients.

There are nowadays several guidelines on treating tobacco use and dependency, which are evidence-based (Fiore 2000, A Clinical Practice Guideline for Treating Tobacco Use and Dependence 2000). Also in Finland a national recommendation was drawn up at the end of

2002 by the Finnish Medical Society (Käypä hoito- suositus 2002). This used science-based methodology (systematic review) and expert clinical judgement to develop effective clinical approaches for all health professionals treating tobacco dependency. Brief clinical smoking intervention has proved an essential part in evidence-based strategies in all modern recommendations (Fiore 2000, Johnson and Bain 2000). Such interventions can be provided by any clinicians (physicians, dentists, nurses, dental hygienists etc.), all of whom see a wide range of patients. Among the various health personnel groups the dentists, hygienists and dental nurses are those most frequently in contact with the population and in particularly with teenagers using systematic school dental services. This offers an excellent opportunity to reach the adolescents and achieve a positive impact on their smoking behavior.

The general health risks of smoking have been well-documented. Tobacco, especially in the form of smoked tobacco, is also associated with various changes and diseases in the oral cavity (Winn 2001, Kassirer 1994). Most of the literature on the impact of smoking has involved adults. Recent studies, however, have shown that the use of tobacco may also involve an increased risk for adolescents (Hirsch et al. 1991). It was the possible association between adolescent oral health and smoking which awakened my interest in this specific scientific problem. The effort to prevent and intervene in adolescent smoking in the public dental setting suggested itself as one possible sensible approach in anti-smoking policy. Although this study confined the focus to cigarette smoking, it also provides information on the use of smokeless tobacco among adolescents.

REVIEW OF THE LITERATURE

SMOKING TRENDS IN FINLAND

Smoking among adults

Finland has achieved remarkable results in cutting down smoking in recent decades. Cigarette consumption was the highest in the world in the 1920s, and after the Second World War, 76 % of men and 13 % of women being still smokers (Martelin 1984). Although the enormous health hazards of smoking were convincingly demonstrated in the 1950s, the first proper attempts to reduce smoking started in the 1960s and 1970s. Faced with formidable cardiovascular and cancer disease rates, first preventive measures and policies were started (Puska et al. 1995).

Smoking prevalence continued very high at the beginning of the 1960s, when 60% of men and 15% of women smoked (Statistics Finland 2002). When the first tobacco act came into force in 1977, 35% of men and 20% of women smoked. Since then smoking has decreased further, smoking prevalence among Finnish adult men being in 2003 26% and among women 19% (Helakorpi et al. 2005). Overall smoking levels among the Finnish adult population are nowadays among the lowest in Europe.

Finnish anti-smoking policy to reduce smoking has been based on comprehensive action. The main devices have been legislation, tobacco taxation (price policy), health promotion, monitoring and research. The first legislation was passed in 1977 ("Act on measures to reduce tobacco smoking" 1976). Further improvements in legislation were attained in 1995 (worksites smoke-free) and 2000. A special health education office was established in 1978 at the National Board of Health, and in 1992 the office was transferred to the Ministry of Social Affairs and Health. The unit has been and is active regarding the national anti-smoking policy in Finland. During the past few decades voluntary health organizations and primary health care services have also undertaken variety smoking cessation activities.

Before the 1970s socioeconomic differences were not clearly reflected in adult smoking statistics, but the recent studies indicate a change in population habits, Finns of the lowest educational level smoking more often than those of the most highly educated (Patja and Vartiainen 2003).

Smoking among adolescents

While data on Finnish adults` smoking habits are nowadays based on interview surveys "Health behaviour among the Finnish adult population" made by the National Public Health Institute, data on the population aged 14-18 years are based mostly on the "Adolescent Health and Lifestyle Survey" carried out every other year since 1977.

Although adults in Finland smoke less than those in many other countries, adolescents tend to begin smoking earlier than in most parts of Europe. The proportion of smokers at 14, 16 and 18 years of age has been constantly relatively high since the 1980s (Currie et al. 2000). The percentage of 14-18-year-old girls using tobacco products increased slightly until the beginning of the 21st century, reaching more than 25% (Fig 1.). The rising trend in smoking stopped and began to fall to the level of the beginning of the 21st century. Among boys this tendency was emerged even earlier. The proportions of daily smokers among 14-16-year-olds approached the lowest ever measured figures from the year 1977. In 2005, 22% of 14-18 boys used tobacco products daily and 23% of girls correspondingly (Rimpelä et al. 2005).

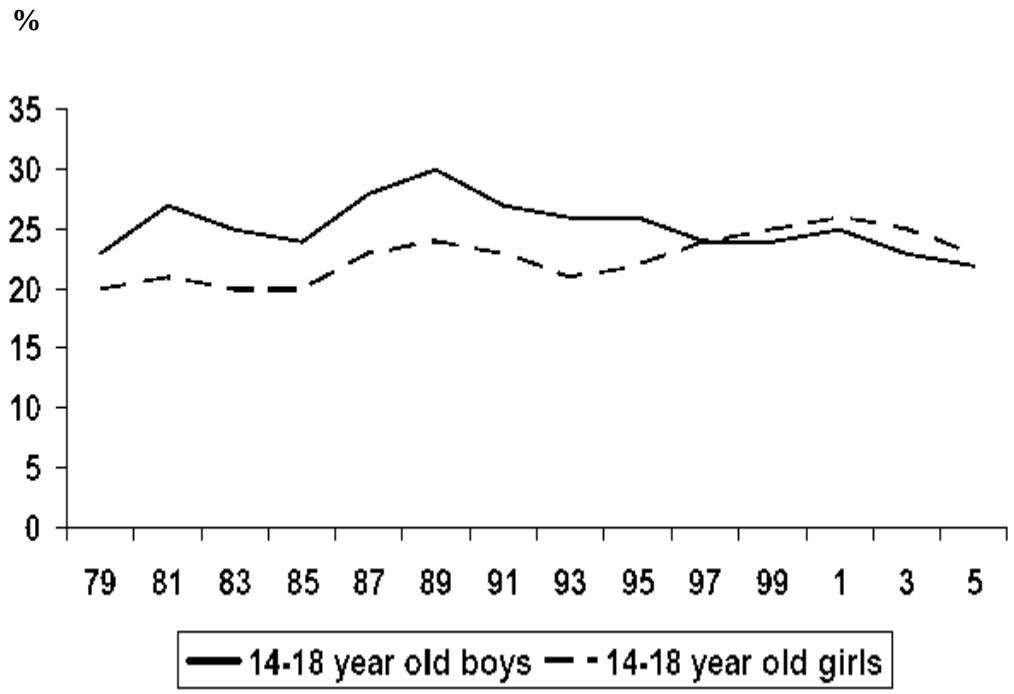


Figure 1. Proportion of daily smokers (%) among young people in Finland 1979-2005. Source: Rimpelä A, Rainio S, Pere L, Lintonen T, Rimpelä M (2005): Use of tobacco products and substance use in 1977 – 2005. Adolescent Health and Lifestyle Survey 2005. Reports of the Ministry of Social Affairs and Health, Helsinki

This early onset is so far seen as one of the major problems and causes of the discrepancy in adolescent figures still standing among the worst and adult figures among the best in Finland. This conception is supported by the fact that the prevalence for the age group 20-24 years is one of the lowest in Europe. The most recent studies (during the years 2003-2005) have shown that experiments with tobacco in Finland are now started somewhat later than before and this phenomenon will hopefully continue (Rimpelä et al. 2005).

The Government Resolution on the Health 2015 public health programme (2001) outlines the targets for Finland's national health policy for the next fifteen years. The main focus of strategy is on health promotion. There are targets for different age groups and in the case of smoking the goal is to reduce smoking by young people to less than 15% of those aged 16-18 (Fig. 2).

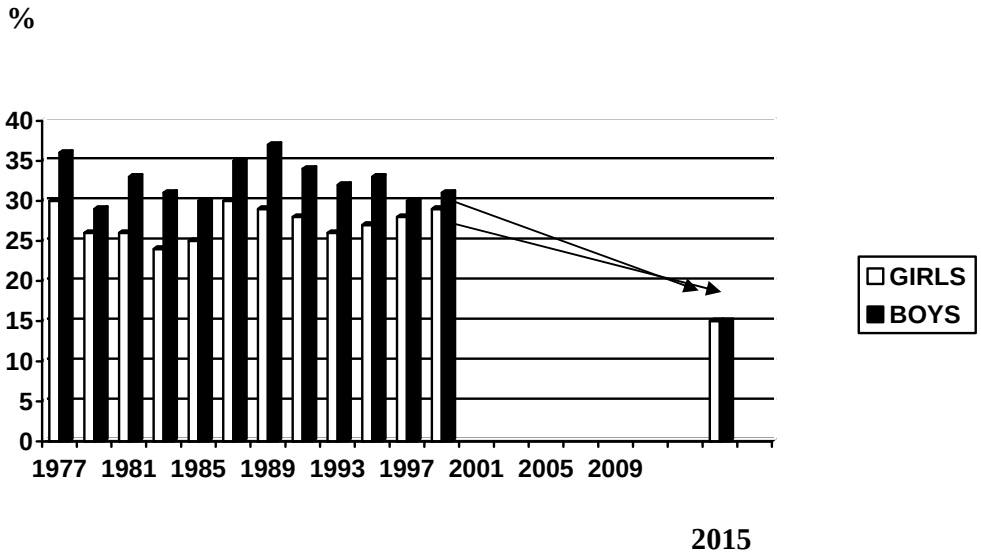


Figure 2. Proportion of daily smokers (%) among 16-18-year-old girls and boys since 1977 and target for 2015. Adapted from: Rimpelä, Vikat, Rimpelä, Lintonen, Huhtala. Young peoples` health habits in 1999. Changes in smoking and substance use. National Research and Development Centre for Welfare and Health, STAKES, Themes 18/1999, Helsinki 1999.

Factors contributing to young people`s smoking

Smoking in youth starts with the formation of attitudes and beliefs on smoking, trying, experimenting and gradually becoming addicted to smoking (Flay et al. 1983).

The literature documents a number of factors in relation to smoking among adolescents. These include for example the behavior, attitudes and expectations of parents and peers (Tyas et al. 1998). If parents, older friends and peers smoke, the adolescent is at a higher risk becoming a smoker. In the USA studies have shown that the strongest predictors of adolescent smoking discovered are parental smoking, best friends who smoke, dropping out of school, adopting early positive attitudes toward smoking, other risk-taking behavior and poor academic progress (Glynn et al. 1993).

The role of parental smoking is shown to be related to the persistence of adolescent smoking (Flay et al. 1998) and to smoking trajectories showing early onset, rapid escalation of the habit and long-term persistence (Chassin et al. 2000). As tobacco dependency shows significant heritability, parental smoking may reflect an important genetic influence (Health and Madden 1995). Psychosocial research has also elucidated the role of parental smoking in terms of social learning

theory, hypothezing that modelling and access to cigarettes at home may raise the adolescents risk of smoking (Flay et al. 1999). On the other hand, parental support has been shown to constitute a prominent protective factor against the onset of smoking (Simantov et al. 2000).

Pressure from peers is often considered to be one of the main factors underlying adolescent smoking (Engels et al. 1998)**.** Many correlational studies (Allen et al. 2003, Andrews et al. 2002, Unger et al. 2001) have shown that adolescents who smoke are more likely than non-smoking adolescents to have friends who also smoke. Adverse life conditions, stressful events in life (Anda et al. 1999) and low self-esteem are also associated with a higher risk of regular smoking (Glendinning and Inglis 1999). Adolescent assume, that smoking will help them cope with the everyday stress to facilitate easier contacts with the opposite sex and expecially among girls, to control or reduce body weight (Verduykt 2002).

Smoking has also been shown to be connected with other types of risk behavior lifestyle. Youth smokers aged 12-17 for example are three times more likely to use alcohol heavily than nonsmokers (U.S. Department of Health and Human Services 1999) and tobacco is also suspected to be major gateway to other forms of substance use (Kandel 2002). Koivusilta and associates concluded that a health-compromising lifestyle, (including smoking) in adolescence is an important mechanism from which educational health differences originate (Koivusilta et al. 1998).

Although adolescents are well aware of the adverse effects of smoking, they tend to underestimate the virulence of its consequences and their own vulnerability (Pallonen et al. 1998). Young people fail to realize that as little as 2 weeks` use of nicotine changes the brains` chemistry and addiction can set in. Adolescents are more sensitive to the rewarding effects of nicotine, which is one of the addictive components of tobacco. Adolescents who are less addicted, as measured by low frequency of cigarette use are more likely than daily users to quit (Sargent et al. 1998). Health care workers should therefore focus on keeping occasional smokers from moving on to daily smoking status, where nicotine addiction begins to play a prominent role in maintaining the behavior.

Experts have consistently stated (Glynn et al. 1991) that the highest tobacco use rates are among those youths least likely to be reached by school-based programs. School dropouts were 6.46 times more likely to smoke heavily than were control students and they reported poorer health than did their peers. Findings suggest that the relation between educational attainment and perceived health is mediated by cigarette smoking (Aloise-Young et al. 2002).

Hill (1999) brought out an interesting opposing aspect to the depate on whether tobacco control programs should be targeted principally at adults or the young. He claimed with solid arguments that teenage smoking is unlikely to decline substantially unless and until adult rates drop substantially. According to him there is no basis for defeatism about adult smoking when it is recognized that quitting among smokers is a majority behavior by the time they reach their mid-forties. In the depate there is nowadays no dispute that in the long run public health efforts to reduce smoking must be targeted both at the young and adults (Myers 1999).

VALIDITY OF SELF-REPORTED SMOKING

Problems with the validation of self-reports

Data on adolescent smoking habits are generally obtained by self-reports, in which the reliability has been fairly high, 88-100% (Barnea et al. 1987, Needle et al. 1983). Reliability can be definid as the extent to which a measurement instrument yields consistent, stable and uniform results over repeated observations or measurements under the same conditions each time. There are two ways by which reliability is usually estimated: test/retest and internal consistency.

Infrequent smokers constitute the group which causes inconsistencies in adolescent reports. Also adolescents may under- or overreport their smoking behavior, this been difficult to correct in reliability measurements (O´Malley et al. 1983, Reinisch et al. 1991). Self-administered questionnaires are a cheap method of assessing self-reported smoking status. Questionnaires are noninvasive for the test persons and the confidentiality of information reduces the refusal rate among participations. Self-reported information can be used to measure behavioral change, to evaluate the exposure risk or to study pathways to smoking cessation.

To tackle the problem of under -or overreporting two approaches have commonly been used:1) using objective measures for validating self-reports or 2) using procedures for improving validity, for example the pipeline method. Biochemical measures are most commonly used as an objective tool. In the pipeline method (Jones and Sigall 1971) subjects are convinced that the reseachers can by an objective measure independently verify their self-reported smoking habit. Validity can be

defined as the best available approximation to the truth or falsity of a given inference, proposition or conclusion.

The possibility of using reliable and validated instruments when assessing smoking behavior is essential. The validity of self-reports is often questioned by reason of the common belief that smokers tend to exaggerate their behavior in a socially acceptable direction. Early investigations have shown that up to one fourth of those claiming abstinence did not tell the truth (Haley and Hoffman 1985, U.S. Department of Health and Human Services 1990).

The availability of more accurate physiological tests has helped researchers to check the validity and reliability of self-reports. In measuring the accuracy of self-reports by biochemical measures 2x2 tables are often used (Fig. 3.). Accuracy is the degree of veracity or the proportion of true positives and true negatives in a population.

Results of biochemical test using definite cut-off points

		Yes	No
Self-reported	Yes	a	b
smoking	No	c	d

Figure 3. The 2x2 table. Measurement of accuracy.

Sensitivity and specificity are the two measures of accuracy usually applied in validitating an analysis. Sensitivity may be defined as a/a+c (the proportion of respondents with a positive level on the biochemical index measuring smoking. Specificity d/b+d can be defined as the proportion of respondents with a negative level on the biochemical measure who reported non-smoking.

Two major strategies have been adopted to improve the validation of adolescent self-reported tobacco use. In the bogus pipeline method (Murray et al. 1987) the participants are informed in advance that self-reports can or will be objectively verified by means of a biochemical test. In reality no verification takes place; specimens are collected but not analysed.

Smoking questionnaires can be developed by means of items validated in different populations. There are some ready-to-use instruments to evaluate smoking behavior: the Fagerström Test on Nicotine Dependency (Heatherton et al. 1991) and the Prochaskas model test (DiClemente et al. 1991, Prochaska and DiClemente 1983). The Fagerström test is used when testing the strength of smokers` addiction and the Prochaskas model evaluates smokers individual stage in the quitting process. The Fagerström test has some limitations in use with adolescents. Several items in the test are difficult to apply to experimenters or moderate smokers, and internal consistency is low (Etter et al. 1999, Lichtenstein et al. 1986).

The content validity of a questionnaires may be assessed by examining the relevancy of the items related to the study aim (Haynes et al. 1995). This may be done by asking smoking cessation experts to analyse the questions` relevancy in relation to smoking behavior. The internal consistency of a questionnaire may be tested by ensuring that the participants understand all the questions.

Hennrikus and colleagues (2005) compared reports of smoking status provided by adolescents aged 14 to 17 years during phone interviews and reports of smoking on a health history form completed during a dental visit. It was noted that adolescents underreported tobacco use on the health history forms. The form identified 57% of those who reported having smoked daily and only 38% of those who reported having smoked in the previous 30 days during the phone interview. The researchers propose that adolescents who smoke do not label themselves as smokers. This may be due to infrequent smoking or social pressure felt when completing the form.

Biochemical methods

Biochemical methods are widely used in when validating self-reports of smoking. Biochemical assessments are primarily for assessing the point prevalence of current tobacco use (Velicer et al. 1992). Smoking levels are often evaluated by measuring components or by-products of inhaled smoke in the urine, saliva or serum, biochemical markers being cotidine, thiocyanate, nicotine and carboxyhemoglobin.

Cotidine concentrations can be measured in the serum (Langone 1973), urine (Greenberg et al. 1984) or using saliva samples (McNeill et al. 1987, Kandel et al. 2006). Urinary cotidine is often used by reason of relatively easy collection, and concentration analysis in fluids can be done by radioimmunoassay (RIA) (Haley et al. 1983) or gas chromatography-mass spectrometry (Benowitz et al. 1983). Cotidine is also sensitive in detecting adolescent smokers, who tend to smoke at lower rates than do adults. Cotidine has a relatively long half-life (about 15-30 hours), good stability throughout the day and excellent accuracy in marking smokers. The main disadvantage in its use as a marker is its high cost.

Serum thiocyanate can be measured in smokers by the trace amounts of cyanide present in tobacco. It can also be analysed in urine or saliva. Thiocyanate has a long biologic half-life (about two weeks). The major disadvantage in its use is the fact that some leafy vegetables, nut and beer may influence thiocyanate levels (Komro et al. 1993). Luepker and associates (1981) support the use of salivary concentrations of thiocyanate as a non-invasive biochemical method of detection among adolescents. The main advantages of thiocyanate in validitation are its long half-life, its not being affected by time of day and its cheapness.

Nicotine itself can also be measured in blood, urine or saliva samples. It has a particularly short half-life (about 30 minutes), which prevents its use as an adequate marker of tobacco consumption.

Carbon monoxide (CO) displaces oxygen in the blood, forming carboxyhemoglobin (COHb). COHb can be analysed in blood or breath samples. Alveolar air CO is directly related to the level of COHb, which is related to smoking. Levels of CO are usually measured with CO analysers. The main problems in analysis are its short half-life (about 3-4 hours) and the possible effect of second-hand smoking. The advantages are its low costs, non-invasiveness and immediate feedback. Other biochemical measurements are more expensive in terms of both equipment and laboratory time, invasive and inconvenient, and may cause subject non-compliance. With adolescents the unestablished patterns of smoking and inhalation, on the other hand, may distort some individual results.

Biochemical validation is often considered to be a “gold standard”(= considered more accurate than self-reporting of smoking habit) in validation studies. However, despite their assumed objectivity biochemical measures do not in fact provide an absolute gold standard. They are also not perfect measures of accuracy for use in assessing criterion validity, this due to different weak points every biochemical validation method has (short half-life, refusals, disturbing foodstuffs in analysis).

Validating self-reported smoking status by simultaneous measurement of carbon monoxide and salivary thiocyanate, Morabia and colleagues (2001) concluded that this comparison of questionnaire data with the simultaneous measurement of salivary thiocyanate and expired carbon monoxide indicated that valid responses can be obtained for self-reported, current smoking in population-based surveys. However, they noted that the validity of questionnaires can be underestimated if the gold standard (of exposure to tobacco smoke) is either high levels of carbon monoxide or high levels of salivary thiocyanate.

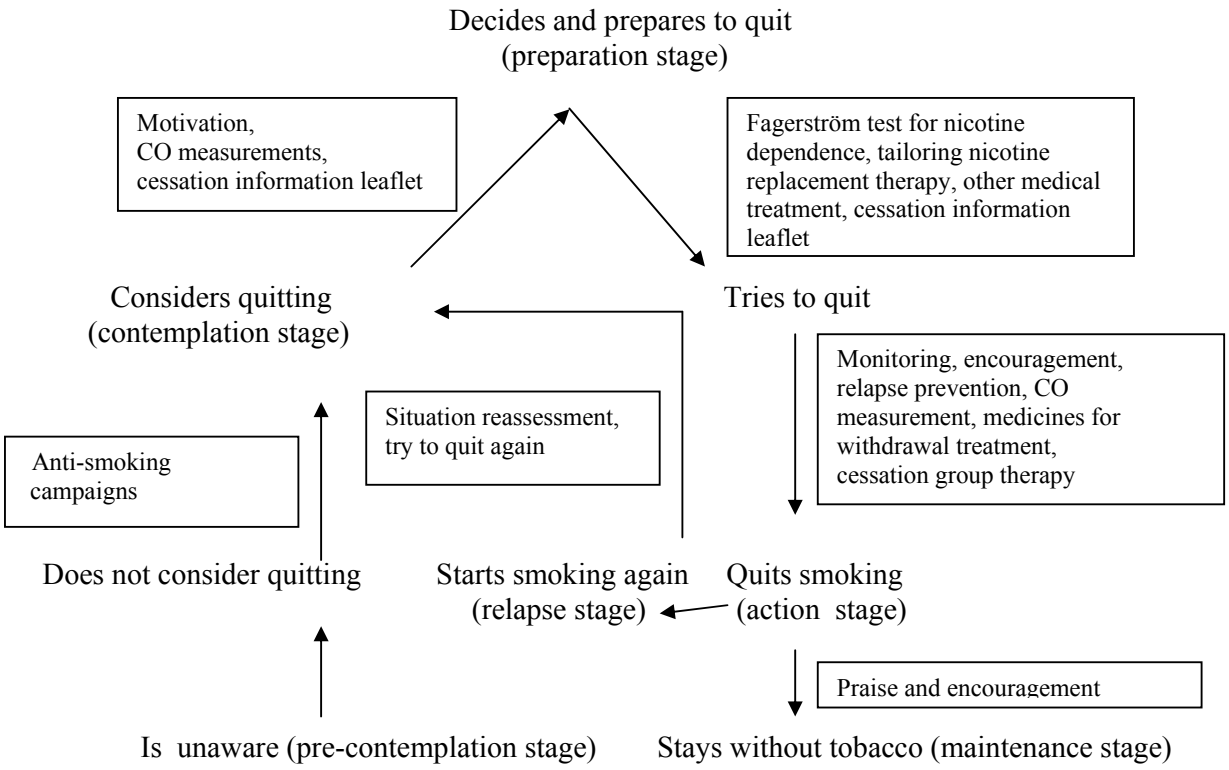
SMOKING CESSATION PROGRAMS FOR HEALTH PROFESSIONALS

Cessation methods in general

Evidence-based medicine supports the development of three main types of intervention for health care professionals: 1. brief intervention made by health professionals in their routine work 2) more intensive support by treatment specialists (in smokers` clinics) 3) pharmacological aid with the help of nicotine replacement therapy (NRT) and bupropion (First WHO European Recommendations on the Treatment of Tobacco Dependence 2001).

An effective model to assess a person's willingness to change smoking behavior is Prochaska and DiClemente's Transtheoretical Model, commonly known as the Stages of Change (Fig.4). By asking a few basic questions, this model gives clinicians insight into whether a tobacco user is ready to quit, and if so, when (Prochaska and DiClemente 1983). According to this model cessation theoretically takes place in five stages over time: precontemplation (any consideration of quitting), quitting, contemplation, preparation (decision), action (cessation) and maintenance.

Figure 4. The process of cessation in stages and the various interventions used during the process (adapted from Prochaska JO and DiClemente CC, (1983): Stages and processes of self-change in smoking: towards an interactive model of change. J Consult Clin Psychol 51:390–395).



The health care professional needs first to determine the stage the patient has reached, whereafter it is possible to offer encouragement and support with the right direction and timing.

The designers describe a series of stages people pass through in the course of changing problem behaviour such as smoking. Motivation is understood in their theory as a person's present stage or readiness to make changes. External factors may influence this stage. In counselling, health personnel must identify correctly each adolescents` current stage of readiness to change. Prochaska and DiClemente observed that smokers often need to go through the process three and even seven times before they succeed in quitting**.**

The Health Behavior Change (Rollnick et al. 1999) is another strategy available to health care professionals to help accurately assess whether a patient is ready to quit. The clinician is encouraged to explore:

1. How important quitting is to the patient
2. How confident the patient feels in the ability to succeed in quitting - self efficacy
3. How ready the patient is to quit at this time

This is also a relatively non-offensive means of helping the patients focus on what they are actually ready to do and helps the clinician decide on what intervention would be most appropriate.

A Clinical Practice Guideline for Treating Tobacco Use and Dependence (2000) – this recommendation states that health care personnel have nowadays a great opportunity to reduce tobacco use rates in that 70% of the smokers try to stop their smoking totally, 46% try to quit annually and effective and evidence-based methods are now available. This guideline suggests the use of the 5 A`s (Table 1).

Tab.1. The 5 A`s. Adapted from the PHS Clinical Practice Guidelines. Treating Tobacco Use and Dependence, 2000.

5 A`s	**Brief tobacco cessation intervention (dental hygiene/dental visit)**	
Ask	• Identify all tobacco users-new and existing patients • Health history should include frequency of tobacco use, amount, type and if they have thought about quitting • Verbally clarify the tobacco use information on the health history Establish the Stage of Change Precontemplation: Not interested in quitting Contemplation: Planning to quit in next six months Preparation: Planning on quitting in the next 30 days Action: has quit within the past month Maintenance: Has not used tobacco for at least six months • Flag the patient`s record to indicate tobacco use-sticker, symbol	
Advice	• Advice the tobacco user to quit • This could be done during the health history review, during oral cancer screening or periodontal evaluation. Sensitivity, empathy, active listening, and personalizing the message are key elements when advising a patient to quit.	
Assess	• Assess the patient`s williness to quit using the Stage of Change section of the Health History or verbal inquiry: Precontemplation: Utilize the 5R`s or discontinue intervention Contemplation: Utilize 5R`s and provide information Preparation: Provide assistance Action: Provide assistance Maintenance: Congratulate and encourage them on a great choice	
Assist	• Help the patient with a quit plan; set a quit date before the appointment is made: make a note in their chart. • Give them a resource packet (how to quit pamphlets, quit assistance in the community, quit hotline or web site, problem solving strategies). • Discuss the use of nicotine replacement therapies or bupropion SR. • Offer this information as a part of the educational component of the dental hygiene appointment. • If more assistance is needed, refer to Tobacco Dependence professional.	
Arrange	• Provide follow-up in approximately one week after the appointment-by phone or letter • Follow-up intervention at next dental appointment. If the patient is using tobacco again, encourage them and continue to provide assistance.	

"5 R's": relevance, risks, rewards, roadblocks, and repetition.

Delivering different types of health education and health promotion is one of the key roles for health care professionals. Purchasing treatment for tobacco dependence represents a cost-effective way of reducing ill health and prolonging life. Health professionals should use tobacco dependence treatment and choose evidence-based intervention methods appropriate for local circumstances.

Health professionals should be trained to advise and help smokers to stop smoking. Education should be started at under-graduate or basic level and continued at the clinical and post-graduate levels.

The Finnish Current Care Guideline in smoking, nicotine dependency and interventions for cessation (Käypä hoito–suositus 2002) recommendation presumes that the opportunity to discuss smoking should be offered to all smokers and that physicians and dentists should have obligations to take up the subject of smoking every year. The "Six A`s" (Table 2.) in the Finnish recommendation instead of the 5A`s will assist clinicians in this task. The only difference in these recommendations is that the Finns emphasize more accounting and recording of tobacco use status.

Tab.2. The "Six A's of Abstinence", recommended for use in helping patients quit smoking.

Ask about the patient's tobacco use status at least once a year.

Assess the patient's willingness to stop smoking. Talk with the patient about quitting.

Keep an **Account** of tobacco use status. Record amount and duration of smoking.

Advise the patient to quit. Commence treatment when needed.

Assist the patient in quitting. Give positive feedback and remit to other treatment when appropriate.

Arrange monitoring of progress during ensuing visits.

The Finnish guideline also states that even greater benefit comes from multiple patient encounters with a variety of health care professionals contributing to the intervention process. The key elements in successful cessation seem to be: the number of patient encounters during the intervention process (Hulscher et al. 2005), the duration of the intervention process, the type of

encounters (multiprofessional) (Kottke et al. 1988) and the mode of encounters (individualized) (Lancaster and Stead 2005).

Secken-Walker and colleagues (1994) compared the smoking cessation counselling activities of six types of health professional. Physicians, family planning counsellors, WIC counsellors were active in counselling and providing advice compared with mental health counsellors, dentists and dental hygienists. Specific activities such as setting a quit date, arranging follow-up or further help took place very seldom**.** Kottke and associates (1988) analyzed the attributes of successful smoking cessation intervention in medical settings. The meta-analysis showed that face-to-face intervention had a better effect than other modes and the use of several intervenors (both phycisian and nonphycisian counsellors better than either alone) was useful. Also the number of interventions and the long duration of the sessions predicted good success.

Physicians` interventions and the activity of other health care professionals

Most of the literature on the impact of advice by health professionals on the behavior of smokers has involved physicians. Pederson (1982) concluded that patients with severe smoking- related diseases and those with direct dangers from smoking were the groups which best toed the line with advice.

Many studies have shown that physicians rather seldom advised their patients about smoking. In a study from 1978, two-thirds of smokers reported that they had never been advised to quit by their physician (Health Maintenance Survey 1978), and 44% of smokers gave the same answer in 1987 (Anda et al. 1987). In Finland the majority of smokers (80%) had consulted a doctor during the previous year, but only one fifth of them had been advised to stop smoking (Helakorpi et al. 2005).

Slama and the colleagues (1995) studied the effectiveness of minimal intervention by general practitioners in a randomized, controlled study in France. At 12 -months follow-up smokers receiving the intervention were four times likely to remain abstinent than controls. Studies show that a three-minute-long discussion between the doctor and the patient about smoking has an even greater effect (Fiore 2000, West et al. 2000, Silagy and Stead 2001). The opportunity to discuss smoking should be offered to all smokers and this should be possible at every doctor's appointment.

Wilson and group (1988) used the criterion of at least three months of abstinence when assessing a randomized trial with trained physicians in experimental intervention. The process involved advice, setting a quit date, nicotine gum and a follow-up visit. As a result, 8.8% of patients stopped smoking.

Follow-up appointments for patients during the intervention process can facilitate progress. In general, more time spent on patient assistance spread over several visits also seems to make an intervention more effective (Lancaster and Stead 2005, Hulscher et al. 2005).

Traditionally physicians have emphasized a biomedical model in their counselling, which has been oriented towards diagnosis and treatment of diseases. This has occasionally led to a paternalistic and directive style with patients, which is less likely to lead to change in behavior (Engel 1977).

Based on a series of clinical trials, the National Cancer Institute developed a program (How to Help Your Patients to Stop Smoking) (Glynn and Manley 1988) for physicians helping their patients to stop. The manual provides the necessary smoking cessation techniques for their practice. Recommended interventions were simple and brief and the manual helped parents create a smoke-free environment for their children.

Counselling by a nurse, a health visitor or some other health care professional alone also has a positive effect (Rise and Stead 2006) in health checks and prevention activities. The Cochrane review showed, however, that the success in quitting smoking was best in hospital settings. Nurse-managed interventions have also been found useful with pregnant women and hospitalized patients (Lumley et al. 2004, Meenan et al. 1998) and with patients with tobacco related illnesses (diabetes, myocardial infarction, lung cancer) (Canga et al. 2000, Taylor et al. 1990, Silagy and Stead 2001).

Dentists in smoking cessation interventions

Dentist are ideally placed to give smoking cessation advice and assistance to their patients (Davis 2005). If a dentist advises them to do this, about 50% of the smokers report that they would do so (National Institutes of Health 1994). It would appear, that dentists try to assist smokers with smoking cessation, but only few do so as a routine part of their work. Clover and associates (1999) found high levels of smoking cessation interventions with patients. This included advising patients of the adverse effects of smoking, asking about quitting interests and advising clients to stop. However, it has been observed (Dolan et al. 1997, Wood et al. 1997) that these activities are

not systematic and the dentists do not routinely ask about smoking or document tobacco use. In the 1996 Study of Tobacco Use Cessation Efforts Among Dentists it was reported that 60% of dentists do not routinely ask about smoking and barely 24% of smokers who had seen a dentist in the past year reported that the dentist had advised them to quit (Tomar et al. 1996). Campbell and Macdonald (1994) noted that dentist could expand their role as tobacco counsellors. Over 90 % agreeded that the dentist should show leadership and set a good example. However, only 60-70% indicated activity in helping patients to quit, and 25% indicated that intervention was not appropriate. Chestnutt and Binnie (1995) examined dentists` opinions in Scotland on counselling their patients to give up smoking. The results showed that over half (55%) of the respondents thought the dentist had a role in anti-smoking activities with patients, 24% were uncertain and 21% felt the smoking issue was outside their territory. The attitudes of dentists regarding smoking cessation and prevention in child and adolescent patients was recently studied in Saudi Arabia also by a group under Wyne (Wyne et al. 2006). The majority of respondents thought it was part of their responsibility (69%), but 37% thought their counselling would not be at all effective and 38% only moderately effective. The majority (59%) were either not at all confident/somewhat confident in their ability to help adolescents with smoking cessation. Secken-Walker and colleagues (1989) made a statewide survey of dentists`smoking cessation advice in the USA. As many as 87 % of dentists reported discussion with their smoker patients.

A smoking cessation programme conducted through dental practices in the UK has been analyzed by Smith (1998). In addition to dentist counselling, nicotine patches were made available. Compliance in attending follow-up was poor; only 74 of the 154 subjects attended. Among them 11% were successful in giving up tobacco. A smokeless tobacco cessation intervention targeted at college athletes was more effective: the cessation prevalence was as high as 35% in the intervention group (Walsh et al. 1999).

Macgregor (1996) studied a group of periodontal patients receiving smoking reduction advice in combination with dental health instruction and periodontal care. Patients were given 4-6 minutes` information on the adverse effects of smoking for periodontal health. Fifty per cent of intervention subjects reported reducing to half or less than half of their initial cigarette consumption and the smoking cessation rate in the group was 13.3%. Gordon (2005) and her group estimated the impact of brief tobacco-use cessation intervention in public health dental clinics by analyzing differences in self-reported quitting after intervention activities. They found signicant differences between intervention and control groups, OR 4.85 after three and 5.25 after six months.

However, the researchers commented that the patients in public health clinics in Oregon were low-income and with a high percentage of smoking patients. A large adolescent tobacco-use prevention trial in orthodontic offices was conducted in California by Howell and colleagues (1996). Differences in the two-year tobacco incidence rates between the control group and the experimental group did not reach significance. Experimental group offices received tobacco prevention training, anti-tobacco materials and 50 cents for each anti-tobacco ”prescription” written. This outcome reflects the problem in achieving good results with adolescents.

In the latest Cochrane review by Carr and Ebbert (2006) concerning interventions for tobacco cessation the researchers assessed the effectiveness of interventions offered to cigarette smokers and smokeless tobacco users in the dental office or community setting. Interventions conducted by oral health professionals increase tobacco abstinence rates (OR 1.44) at 12 months` or longer follow up. These results were more evident in smokeless tobacco users.

Fried and Cohen (1992) explored above all dentists` attitudes regarding tobacco issues and sought to assess dentists` interest in attending skill development workshops on tobacco-use interventions. They observed that dentists own behavior (smoking) was associated in many attitudinal variables, including dentistry`s role in anti-smoking work; 82% believed cessation advice is the dentist`s responsibility but less than half saw cessation interventions as a practice builder.

The first national survey in USA from 1967 revealed that 34% of dentists smoked. In 1989 Gerbert and group reported smoking rates of only 4% among dentists. The tendency in the States has been for dentists, like physicians, declining rates and also to smoke substantially less than the general adult population on the average (Wilhelmsen and Bernow 1988). Geboy (1989) also reviewed smoking practices among dentists, attitudes towards involvement in smoking counselling and finally their counselling activities in the USA. He also demonstrated a decline in the percentage of dentists who claim they smoke.

Cohen and associates (1989) undertook a randomized controlled trial with private practice dentists. They noted that access to nicotine gum increased the amount of time spent in smoking counselling. In determining dentists` smoking cessation advice in a statewide survey in Vermont the researchers observed that 87% of the dentists discussed about smoking with their patients who smoke. Secken-Walker and group (1989) also estimated dentists to use an average of 2.4 minutes on these issues with patients. The majority of dentists who took on antismoking activities gave advice to their patients on how to change smoking behavior. The larger the proportion of smokers advised to change their smoking behavior, the greater the dentists` willingness to undergo specific training and to give their patients incentive help.

A large population study (1200 adults) in Finland revealed that only 8% of daily smokers had been advised by their dentist to quit; 14 % of daily smoking patients reported having discussed smoking with their dentists during dental visits (Telivuo et al.1996)**.** Telivuo studied earlier Finnish dentist tobacco counselling. Only 4% of dentists reported always advising and 15% often advising their patient about smoking (Telivuo et al. 1991). The majority of dentists agreed on the dentist` responsibity to take part in smoking education and their ability to advise patients to stop smoking. Murtomaa and Telivuo (1988) reported in an earlier study of dentists in private practice that there were also problems in the attitudes even to dental health education. Economic profitability was considered to be the largest hindrance to health education in practice. Also older dentists mentioned the lack of appropriate material and their individual counselling abilities as barriers of health education.

When comparing dentists with other health care professionals in relation to anti-smoking activities Block and colleagues (1999) found that even if dentists more often than others are more likely to accurately estimate their patient`s tobacco use, they seldom undertake tobacco interventions. He also reported that dentists were less likely to claim strong tobacco cessation skills or knowledge levels and more often to have barriers to interventions compared with other health care professionals. In the dentists' survey, only 17% of San Francisco Bay area dentists said they frequently discussed smoking cessation with their patients who smoke, in contrast to 58% of a similar group of Bay area internists, who said they frequently counsel smokers (Gerbert et al. 1989). Dentists attributed their lack of counselling to inadequate insurance coverage, insufficient time, lack of training, and apprehension that patients might become irritated and leave their dental practices.

A study was made by a group under Stacey (2006) to determine the attitudes and activities of dental professionals (dentists, dental nurses and dental hygienists) as well as the barriers to smoking cessation advice. The majority of dentists and hygienists asked about smoking status and all the professionals believed hygienists and dentists should offer smoking cessation advice. Lack of reward, time and training were identified as the major problems in carrying out anti-smoking activities.

Ojima and associates (2005) noted an interesting point when studying the stage progression of dental patients following brief smoking intervention. When measured by a modification of Prochaskas`s model they made changes in stage progression so that more than half of the patients who had not prepared for cessation prior to intervention and all the patients in the preparation period reported smoking cessation following brief interventions.

Brief intervention method

A brief intervention means a time-limited intervention focusing on changing patient behavior. The approach is by nature mainly motivational using counselling skills to reduce or stop tobacco consumption. A brief intervention usually takes some minutes of information and advice to one to four sessions of motivational counselling**.**

Babor (1990) desribed the features of a brief intervention appropriate to primary health care settings. Low cost, modest time and resource investment, emphasis on self-help and self-management. Early interventions may according to Werner (1995) be distinguished from prevention) in that they are targeted at specific individuals rather than the general population. The acronym FRAMES summarizes (Werner 1995) the key elements of brief intervention (feedback, responsibility, advice, menu of strategies, empathy and self-efficacy).

The brief intervention method has been widely used with success with excessive drinkers (Sommers et al. 2006, Vasilaki et al. 2006). Hence it has also been in use in Finland in primary care settings and projects of occupational health and is also a part of the Finnish Current Care Guideline in the treatment of alcohol abuse (Käypä hoito -suositus 2005)**.**

Brief intervention trials have usually been evaluated for a wide range of activity from a single session of structured advice delivered by a doctor or nurse through to a multiple sessions of motivational interviewing or counselling accompanied by several follow-ups conducted by various personnel in primary health care.

Brief interventions are recommended for use with all populations, including pregnant women and adolescents (A Clinical Practice Guideline for Treating Tobacco Use and Dependence 2000); only the use of NRT products needs consideration. It can be used with different types of patients: current smokers wishing to make an attempt to quit, current smokers unwilling to quit now and former smokers who have recently broken the habit.

IMPLEMENTATION OF SMOKING CESSATION METHODS WITH ADOLESCENTS

Over the past decades tobacco control efforts for young people have concentrated on prevention. The lack of interest in cessation has been based on several assumptions: 1) prevention is more effective 2) adolescents can stop smoking more easily in that they are not dependent on nicotine 3) adolescents have not been interested in stopping smoking 4) adult programs could be used effectively also with adolescents. It has nowadays, however, become evident that smoking cessation interventions are also needed for adolescents.

The spontaneous or unassisted quitting rates are low and do not differ from those among adult smokers. There is also clear evidence that 20 to 68 % of adolescent smokers may be classified as nicotine-dependent (Colby et al. 2000). A large Australian study of 14-16-year-olds showed that 43 % of smokers were currently thinking about smoking and 55 % had tried to stop in the past year. Even if adolescents want to stop smoking they either do not recognize adult quitting programs or they experience them as abstract.

Many adolescent intervention studies have encountered methodological problems. Poorly described interventions and methods, insufficient measures of cessation, brief follow-ups and poor retention rates. Study of teenage cessation programs has suffered from very small numbers of participants and subject characteristics (baseline smoking levels). Reports have mostly only 5-12 months follow-up periods possibly too short to give reliable results. It is easier to make an impact with adults than with adolescents in intervention studies, as the adults often have stable and high base levels of smoking.

The current state of smoking prevention and cessation programs among adolescents has in many cases developed without a study of the mechanisms of widespread realistic application and use in practice. Recently greater emphasis has been placed on real-world effectiviness studies (Holder et al. 1999). There is still the question about of the efficacy of brief intervention in a naturalistic environment and of putting research findings into practice in routine primary health care. In this area of smoking research there is a lack of scientific knowledge.

Discolorations

The most visible and immediate dental manifestation of smoking is tooth coloration. Tobacco smoking causes discoloration of the teeth, gums, dental restorations and dentures. The effect of smoking is more severe than that of the consumption of coffee and tea. Tar stains also become adsorbed into dental plaque and are difficult to remove. When they get near any restoration work they will also be adsorbed through micro-leakages between the restoration and the tooth surface. A national representative study with over 3 300 UK adults interviewed (Alkhatib et al. 2005) showed that 28 % of smokers had moderate or severe stainings in their teeth. Non-smokers reported discoloration in only 15 % of cases. Tobacco stains may be yellow, brown, dark brown or black in color. Their severity is dependent on the duration and the frequency of the smoking habit.

Melanin pigmentation of the oral mucous membranes is normally seen in colored races. In North European Caucasians, however, it is far less prevalent (about 10%) and normally with a subtle appearance. Heavy cigarette smokers show a pigmentation prevalence of about 30% (Axell and Hedin 1982), thus giving rise to the designation smoker's melanosis (Hedin 1977), which is most prevalent on the attached gingiva. Melanosis has no symptoms and the change is not premalignant.

Saliva

Some authors have described possible degenerative changes in the salivary glands and excretory ducts caused by smoking (Christen et al. 1991, U. S. Department of Health and Human Services 1986). No difference has, however, been found between smokers and nonsmokers in the long term (stimulated or unstimulated) salivary flow. In analyzing the stimulated salivary secretion rate (SSSR) Swedish researchers (Axelsson et al. 1998) found that male smokers had higher SSSR than the non-smoker group. In the short term smoking increases the flow rate of the parotid gland.

The results of studies of pH in saliva and buffer capacity between smokers and nonsmokers have been equivocal. The pH of saliva rises during smoking (Kenney et al. 1975), but over a longer time periods smokers have lower pH in paraffin-stimulated whole saliva and the pH is negatively correlated with saliva nicotine concentration (Parvinen 1984). Buffer capacity was earlier found to

be lower in smokers (Heintze 1984). This was not confirmed by a subsequent study by Olson and associates in 1985. However, the most recent study (Wikner and Söder 1994) again showed a reduced buffering capacity in smokers.

There are reports that IgA and IgA2 and J-chain concentrations are higher**,** (Gregory et al. 1990) but lysozyme and lactoferrin concentration lower with smokers (Gregory et al. 1991). Reduced binding of the secretory component to the IgA/J complex in smokeless tobacco users has also been reported (Gregory et al. 1990).

Sakki and Knuuttila (1996) noted that smoking was strongly associated with higher lactobacilli counts and the presence of yeasts. However, the relation between smoking and mutans streptococci in saliva was weak.

The concentration of thiocyanate, a product present in tobacco and in normal saliva, is increased in the saliva of smokers (Tenovuo and Mäkinen 1976). Nicotine and cotidine appear in the saliva of smokers and their concentrations are often used in detecting the habit.

Dental caries

Some studies link smoking with dental caries, most of them involving adults. Jette and colleagues (1993) observed with older subjects that tobacco smoking was a significant risk factor for coronal and root caries. Coronal and root decay in older adults was also affected by smoking (Locker and Leake 1993, Locker 1996). Other studies have also shown that smoking may be associated more with root surface caries than with coronal caries (Ravald et al. 1993, Tomar and Winn 1999). Axelsson and group (1998) studied relationships between smoking and dental status in 35-,50-,65-, and 75-year-old individuals. The number of intact tooth surfaces was lower in all age groups of smokers than non-smokers. The same tendency was observed in the number of missing surfaces, this being higher at the ages of 35, 50 and 75 with smokers. Also in a recent study with HIV-seropositive women Phelan and colleagues (2004) found an increased root caries incidence among smokers. Most cross-sectional studies have used DMF index (or some variation) in measuring caries prevalence (Hirsch et al. 1991, Thomas et al. 1994, Locker 1992). The most prominent differences

in numbers of caries experience surfaces in studies between smokers and non-smokers were found in studies using DMFTS (Zitterbart et al. 1990, Axelsson et al. 1998).

Only a few studies have been done with adolescents. Hirsch and associates (1991) showed that smoking as a habit and an increased number of cigarettes smoked had a positive correlation to the DMFT index and to the number of initially decayed proximal surfaces. Dietary and oral habits as confounding factors were not taken into account, for which reason the definite causative role of smoking cound not be ascertained. There are only few studies on the associaton between smoking and caries controlled for potential confounding factors. Diet, use of dental services, oral hygiene habits and socioeconomic status have only in some cases being taken into account when examining the association between smoking and dental caries. Bruno-Ambrosius and colleagues (2005) in a study among Swedish female teenagers noted that some bad eating habits and smoking were significantly associated with a caries increment in the eighth grade. On the other hand toothbrushing habits had no significant influence on caries progress. A few studies have noted also the cumulative and irreversible feature of DMFT index (Axelsson et al. 1998, Hirsch et al. 1991); this may be associated with age even if this is not actually a risk factor for the incidence of dental caries.

Reduction of passive smoking has proved to be an important factor for promotion of children`s dental health (Aligne et al. 2003). Elevated cotidine levels were significantly associated with decayed (odds ratio 2.1) and filled deciduous teeth (1.4). This effect was not shown with permanent teeth. The relationship persisted after adjustment for age, sex, race, family income and frequency of dental visits. Williams and associates (2000) also found that maternal smoking was a significant risk factor predicting a caries risk in 3-4.5-year-old children even when social class was taken into account. The same association was studied by a group under Shenkin (2004) with children aged 4-7 years with corresponding results adjusting for age, socioeconomic status, toothbrushing frequency as confounding factors. Environmental tobacco smoke was associated with an increased risk of caries among 4-7-year-old children. Bolin and colleagues (1997) studied a large sample of 5-and 12- year-old-children in eight EU countries for the effect of certain sociodemographic factors on dental health. They established the social class of the family and mothers`s smoking habits and in 5-year-olds the number of siblings as the main risk factors for caries.

Microbiology and immune function

The composition of the subgingival periopathogenic microflora would not appear to differ when comparing smokers and nonsmokers (Preber et al. 1992, Stoltenberg et al. 1993). Stoltenberg studied the prevalence of five bacteria commonly associated with periodontal disease: Porphyromonas gingivalis, Actinobacillus actinomycetemcomitans, Prevotella intermedia, Eikemella corrodens and Fusobacterium nucleatum. Recent studies, however, give evidence that smokers are more likely than nonsmokers to harbour specific periodontal pathogens. Zambon (1996) studied the risk of subgingival infection among smokers/former smokers and nonsmokers. Smokers had a higher risk of infection with Bacteroides forsythus (OR=1.54), A. actinomycetemcomitans (OR= 1.40) and P. gingivalis (OR=1.16) than non-smokers. Current smokers had a greater risk than former smokers.

The amount of plaque does not appear to differ between smokers and nonsmokers (Alexander 1970, Macgregor et al. 1985**,** Bergström 1981, 1990, Lie et al. 1998) although some earlier studies have found smokers to have more visible plague (Sheiham 1971, Preper et al. 1980, Preper and Bergström 1985). Differences in dental health habits may be the cause of cross-sectional differences in plaque levels between smokers and non-smokers (Preper and Kant 1973, Preper et al. 1980**,** Andrews et al. 1998). Bergström (1999) studied tobacco smoking in relation to supragingival dental calculus formation. The prevalence rates of calculus for current smokers, former smokers and nonsmokers were 86%, 66% and 65%, respectively, the differences between the groups being statistically significant. Preber and associates (1995) monitored periodontal healing and the presence of periopathogenic microflora in smokers and non-smokers. In spite of the fact that periodontal therapy succeeded in reducing the amount of periopathogens (A. actinomycetemcomitans, P. gingivalis and P. intermedia) in smokers and nonsmokers, the investigators observed a less favourable results in non-surgical therapy in the smoker group.

The greater prevalence and severity of disease might be explained by smokers having disturbances in immunoglobulin and cytokine levels and lymphocyte counts and impairment of the

function of oral neutrophils. Smokers have decreased levels of IgG, IgA and IgM but increased levels of IgE (Kenney et al. 1975, Quinn et al. 1998). Smoking increases the number but impairs the function of polymorphonuclear leukocytes (PMNs, or neutrophils), peripheral blood cells which take care of the first line defence mechanisms against micro-organisms (Noble and Penny 1975, Barbour et al. 1997).

Cigarette smoke seems to have an immunosuppressive effect on T-lymphocytes, which may reduce the antibody response to periodontal bacteria (Barbour et al. 1997). Levels of cytokines may be increased in smokers. This may affect collagen destruction and bone resorption (Boström et al. 1998a). In severe periodontitis researchers have found a synergistic interaction between smoking and a specific cytokine, IL-1. Feldman noted that cigarette smokers had significantly greater pocket depths than non-smokers or pipe/cigar smokers (Feldman et al. 1983).

Gingivitis

Earlier studies have reported more gingival inflammation and bleeding after probing in smokers compared with nonsmokers. Investigations have also demonstrated more dental plaque and calculus (Arno et al. 1958, Preber and Kant 1973, Preper and Bergström 1985).

Recent studies in which the plaque level was controlled for smokers demonstrate less gingivitis and less gingival bleeding compared with nonsmokers (Bergström 1990 and Preber 1986). Similar findings were previously reported by Danielsen and associates (1973) in a study of experimental gingivitis among smokers. This reduced gingival bleeding may reflect more the suppression of an inflammatory response than reduced gingival blood flow (Danielsen et al. 1990, Dietrich et al. 2004, Bergström and Preper 1986). The effect is strongest in heavier smokers and smallest in former smokers In one study the effect of smoking on gingival fluid flow was analyzed (McLaughlin et al. 1993). It was in fact observed that smoking caused a transient increase in gingival crevice fluid.

The cytotoxic effect of smoking on fibroblast function is one further explanation for the problems in gingival tissue. Nicotine may inhibit the growth of gingival fibroblasts and their production of collagen and fibronectin and thereby damage the structure and attachment of the gingiva (Tipton and Dabbous 1995). Tipton observed that nicotine itself inhibits the growth of fibroblasts and transient vacuolization of the fibroblast and even cell death.

Many studies have reported smokers higher susceptibility to ANUG (acute necrotizing ulcerative gingivitis) compared with nonsmokers (Pindborg 1951, Kardachi and Clarke 1974, Rowland 1999).

Research into smoking and periodontitis in the late 1940s explored only the association between smoking and alveolar bone loss (Arno et al. 1958). More recently the clear independent, direct association has been addressed (Ismail et al. 1983, Feldman et al. 1983, Grossi et al. 1995). Bergström (1989) estimated the risk ratio of adult smokers to be 2.5 compared with nonsmokers in developing periodontal diseases. Stoltenberg and colleagues (1993) analysed the risk ratio to be 5 times greater among smokers; he used probing depth > 3mm as diagnostic criterion. When different adult smoker groups were tested with periodontal treatment need assessed by CPITN, it was noted that the index was always greatest among smokers (Axelsson et al. 1998). Grossi and group (1994) found that smoking carried relative risks ranging from 2.05 for light smokers increasing to 4.05 for heavy smokers. These associations remained valid after controlling for gender, socioeconomic status, income, education and oral hygiene. Findings from case-control, cross-sectional and cohort studies report a risk ratio (RR) estimate for smokers and onset or progression of periodontitis as 1.4-to 20 times more compared with nonsmokers (Bergström 2003). Also the relationship between the number of cigarettes smoked per day (Norderyd and Hugoson 1998)/cigarette years (Grossi et al. 1995) or the duration of smoking (Tomar and Asma 2000) and periodontal status has been exposed. Schenkein and associates (1995) observed that smoking was more prevalent in patients with early-onset periodontitis and adult periodontitis than in those with juvenile periodontitis or healthy periodontium. Ylöstalo and group (2004) studied young adults in Finland with adjustment for socio-economic and behavioral factors. A dose-dependent association emerged between smoking and tooth loss, the odds for heavy smokers being 5.30. In the United States one half of periodontitis cases is thought to be attributable to cigarette smoking (Tomar and Asma 2000).

The association between smoking and periodontitis also remains after allowing control for age and oral hygiene status (Bergström and Eliasson 1987a). In a later study among Swedish dental hygienists (1991) also involving adults with good oral hygiene, Bergström observed the loss of periodontal bone to be related to smoking and the loss does not correlate with plaque infection.

When Sintonen and Tuominen (1989) explored the determinants of periodontal treatment costs it emerged that smoking was one of the four significant factors predicting high total costs in periodontal treatment. The results of the treatment are less favorable in smokers (Tonetti et al. 1995, Ah et al. 1994, Rosen et al. 1996, Boström et al. 1998b) and treatment failures are predominantly

seen in smokers in 90 per cent of refractory cases (Bergström and Blomlöf 1992, Magnusson et al. 1994). Also high levels of cigarette consumption caused less favorable results after periodontal therapy (Kaldhal et al. 1996).

Other adverse effect of smoking on oral health

Halitosis (Kleinberg and Westbay 1990), diminished taste (Gromysz-Kalkowska et al. 2002, Sulibursk a et al. 2004) and smell acuity (Frye et al. 1990) are common side-effects of smoking. Halitosis (oral malodor, feotor ex ore, bad breath) is an unpleasant problem which primarly affects the adult population (Rosenberg et al. 1996, Tonzetich 1977). Oral malodor in healthy patients arises from the mouth on the tongue dorsum (Young et al. 1993, Yaegaki et al. 1992). Anaerobic bacteria producing sulphur compounds seem to be the primary source of this odor (Tonzetich 1971). Tobacco smoke itself also contains volative sulphur compounds (VSC) (Miyazaki et al. 1995) and the cigarette odor may stay for more than a day after smoking (Rosenberg et al. 1991).

In a recent work by Bazemore and associates (2006) the most odoros compounds found in smokers` breath were 2,3,5-trimethyl pyridine, 2,5-dimethyl pyrazine and 2-ethyl-3,5-dimethyl pyridine. Pyridines and pyrazines, the most prominent classes of odoros compounds identified in the experiment, may be generated during cigar pyrrolysis by cleavage of nicotine or by the Maillard reaction.

Many studies have shown that taste and smell acuity are affected by smoking (Fortier et al. 1991, Pasquali 1997). It has been shown that cigarette smoking influences taste sensitivity in subjects to a lesser extent (Gromysz-Kalkowska et al. 2002). A goup under Yamauchi (1995) also observed that smokers in their 20s evinced a slight rise in the threshold only for bitter taste. However, smoking may have a 'normalizing' effect on olfactory identification in some patients with psychosis (Mc Lean et al. 2004).

Smoking affects wound healing for example after periodontal surgery, tooth extraction or implant surgery (Jones and Triplett 1992, Preber 1986, Meechan et al. 1988, Miller 1988). The mechanism may lie in peripheral vasoconstriction with increased plasma levels of adrenaline and noradrenaline after smoking. In periodontal surgery Scabbia and colleagues (2001) evaluated the treatment outcome following flap surgery in cigarette smokers compared with nonsmokers, and noted a

negative effect of smoking when measuring pocket depths and clinical attachment levels in their patients.

Tobacco smoke has a direct carcinogenic effect on the epithelial cells of the oral mucous membranes. There is a dose-response relationship between tobacco use and the risk of the development of oral cancer. Smokers` risk of oral cancer is 2-4 fold compared with nonsmokers. Previously the risk with cigars and pipe was estimated to be lower than with cigarettes (Wynder et al. 1977). However, it has recently been concluded that the risks of oral cancer are similar for cigar smokers and cigarette smokers (NCI Monograph 1998). Smokers who also drink heavily carry a 6-15- times greater risk than nonsmokers/non-drinkers (Wynder et al. 1977, Kato and Nomura 1994, McCoy and Wynder 1979, Blot et al. 1988, Lesch et al. 1989, Hsu et al. 1991).

Leukoplakia is one of the potentially malignant lesions of the oral mucous membrane. It occurs six times more frequently in smokers (Baric et al. 1982) and also bears a dose response relationship to smoking. Smoking cessation may result in the regression or disappearance of this premalignant change.

Smokers` palate is a reversible, non-precancerous mucosal disease in the hard palate of heavy smokers, especially among pipe and cigar smokers. Prevalence varies from 1-6% in Scandinavia depending on the criteria used (Axell 1976, Saietz 1975).

Only the plaque form of lichen planus is more common among smokers. A negative statistical relationship has been found with other forms of this oral manifestation (Neumann-Jensen et al. 1977, Axell 1976).

In a meta-analysis conducted by Little and colleagues (2004) significant associations were found between maternal smoking and non-syndromic orofacial clefts in infants. The relative risk between maternal smoking and cleft lip, with or without cleft palate, was 1.34 and between maternal smoking and cleft palate 1.22.

The conclusions from the literature review

We know now from the literature that tobacco affects the oral health of adults and small children. Does the same tendency also apply to teenagers? What we also do not know is whether adolescents give us correct answers regarding their smoking habits when they visit community dental clinics.

As only adolescent smoking is the main problem for Finnish smoking policy, can dentistry affect it with an evidence-based intervention method? Is such an intervention feasible in real life conditions as part of routine dental care?

AIMS OF THE STUDY

The purpose of this study was to to test the brief intervention method and its feasibility in smoking cessation and prevention and to investigate the possible early association of tobacco smoking with oral health indices in adolescents. The specific questions posed were:

1. Does brief intervention in dental care help an adolescent to stop or prevent smoking?

2. What are the possible problems with implementation of the brief intervention method in practice?

3. Do adolescents answer correctly when dental personnel inquire after smoking habits?

4. Is smoking associated with oral health changes already in adolescents ?

SUBJECTS AND METHODS

SUBJECTS, SAMPLING METHODS AND DATA SOURCES

The brief intervention study and the study of the effects of smoking on oral health were evaluated based on the same follow-up material. The feasibility study was carried out partly with dental staff undertaking the smoking intervention in practice and partly with all dental personnel in the province of Western Finland. The verification study was made with adolescents of the same age and region as the intervention and oral health studies. The outline of Studies I-IV is presented in Table 3.

Tab.3. Outline and summary of the number of subjects, sampling methods, data sources and statistical analysis used in Studies I-IV.

Study	n	Sampling method	Data source	Statistical analysis
I	2586	age cohort, systematic sampling	clinical examination, patient records, smoking questionnaire and interview	t-test $\chi 2$ -test logistic regression analysis (study IV)
IV	2586			
III	150	six randomly chosen classes	smoking questionnaire, interview, measurement of CO and thiocyanate(saliva)	contingency coefficient analysis, positive and negative predictive values, regression analysis
II	60	all agents (dental staff) in intervention study	questionnaire	t-test confidence intervals
	274	total dental staff in the province	questionnaire	

In *Study I* and *IV* the target group comprised all adolescents (n=2586) born in 1979 living in four towns (Kokkola, Pietarsaari, Seinäjoki and Vaasa) in Finland. The average age of the participants (n=2582) was 13.1 years at the first visit, 14.2 at the first follow-up,15.2 at the second and 15.6 at the third. Owing to the low response rate at the third follow-up visit, we rejected this for the final analyses. All adolescents in question were making regular visits to community dental clinics, which made it possible to implement an annual follow-up for the age class as a part of their routine check-up. Prior to the dental examinations all adolescents were asked to complete a smoking questionnaire (Appendix 1). A summary of the descriptive information on the baseline age cohort as obtained by the questionnaire is seen in Appendix 2.

In the brief intervention (*Study I)* the adolescents were assigned to either to a normal care group (those with an even last digit in their date of birth) or an intervention group (odd last digit). The brief intervention took the form shown in Table 4.

Tab.4. Protocol of brief anti-smoking intervention.

The dentist inquires about smoking at the beginning of the routine dental examination. Depending on the answer:
1. If the adolescent does not smoke, dental status is checked as usual and positive feedback is given regarding abstinence from smoking. After the examination the adolescent is shown a set of photographs showing discoloration to the teeth as a consequence of smoking and is invited to use a mirror to observe whether he/she has any such discolorations.
2. If the adolescent smokes, dental status is checked as usual. After the examination the adolescent is shown a set of photographs of harmful discolorations to the teeth caused by smoking and is invited to use a mirror to observe whether he / she has any such discolorations.

The intervention measures were implemented in conjunction with normal routines, taking only a couple of minutes`extra time per examination. The staff of the community dental clinics were informed of the principles of the brief intervention and the experimental arrangements and they received instructions for the project.

When evaluating the smoking intervention (*Study II*) all dental personnel who had taken part in the experiment (60) assessed the realization of the method in practice and attitudes towards this kind of preventive work in a questionnaire (Appendix 3). Those participating in the intervention measures were asked how well the different phases of the intervention had been implemented during dental visits. The four different stages of brief intervention were: asking about smoking, providing positive feedback, showing photographs and looking at teeth with a mirror. All community dental personnel (n=274) in the province of Ostrobothnia were also asked about attitudes and problems possibly accompanying with the brief intervention. Replies were received from a total of 164 dentists and 194 dental assistants representing 24 health centres out of the 34 to which these questions had been sent. The response rate was 83.5% for dentists and 70.1% for dental assistants.

The schoolchildren (n=150) in *Study III* were aged 15 (in the 9th grade) in six randomly chosen classes in the county of Vaasa. There were 48% girls and 52% boys in this group. Preferably we verified the adolescents` own reports of their smoking habit given in the above-mentioned questionnaire prior to their routine dental examinations. Further we tested the associations between the various validation systems available in dental settings. After the self-administered smoking questionnaire smoking status was ascertained by the dentist asking whether the pupil smoked or not (standardized procedure) and with measurement of CO concentration and analyses of saliva thiocyanate. Among the 150 adolescents valid results were obtained in 100% of cases in the questionnaire and dentist`s question, 87% in saliva analyses and 70% in CO measurements. The validity of the questionnaire was analyzed in terms of sensitivity and specificity and the relations between the verification methods was tested by contingency coefficient analyses.

The dental examination itself in *Study IV* involved monitoring of the usual measures of oral health indicators, i.e., D, DMF, and CPITN indices.We used the same age cohort and follow-up as in Study I. At the beginning of the routine dental examination the dentist also asked the simple question:" Do you smoke?". On the basis of this question (yes/no) the respondents were divided into two categories of smoker /non-smoker (as mentioned before).

The plan of the studies was accepted by the local ethical committee for medical reseach.

STATISTICAL PROCEDURES

Statistical comparisons between intervention and control groups were made by t-test and with dictotomous variables by χ^2 statistics in the brief intervention study (Study I).

In the feasibility study (II), where attitudes towards the theories were analyzed, we placed the values into categories:"totally agree" or "totally disagree" and "always" or "never". The statistical significance of the means of the VAS index was described with confidence intervals. The statistical significance of differences between the groups were analysed using the t-test.

In the verification study (Study III) contingency coefficient analysis was used in performing analyses between the different verification methods. When analyzing the biochemical methods (saliva thiocyanate and CO) we first transformed the values using cut-off points, 4ppm for CO and 1.5mM/l for saliva thiocyanate. We also calculated the positive and negative predictive values for different verification procedures. Regression analysis was performed to construct a model explaining smoking as reported in the questionnaire.

Prior to analyzing smoking and its association with dental health (study IV) indices we carried out categorization of the DT, DMFT and CPITN index values due to their skewed distribution. Comparisons between smokers and non-smokers were made by the χ^2 –test. Logistic regression analysis was used in calculating odds ratios and their confidence intervals in respect of having caries or periodontal treatment need. Comparisons between groups in study IV were evaluated by t-test and dichotomous variables were tested with χ^2-statistics.

Detailed descriptions of the statistical methods and necessary modifications of the variables are given in Studies I-IV.

Statistical analyses were performed using the SPSS 10.0 for Windows statistical package.

RESULTS

1. INTERVENTION ON SMOKING OF ADOLESCENTS

BRIEF INTERVENTION

The brief intervention in connection with dental examinations proved effective.

The two-year follow-up revealed that adolescent smoking increased from 5.7 % (13- year –olds) to 19.4 % by the age of 15. Girls reported smoking less often at every examination. At the end 18.1 % of the adolescents who had undergone intervention procedures smoked and 20.8 % of the control group, respectively.

A great majority of smokers in both intervention and control group tried to stop smoking during the study. However, interest in participating in a group aimed at helping them stop smoking was rather low. The adolescents felt they had sufficient information on the health risks attached to smoking.

Parental smoking emerged as an important predictive factor in adolescents` smoking. If either parent smoked at the outset, the risk of the child also smoking was four times as great as for those with non-smoking parents. The risk ratio remained at almost 3 also at the end of the study.

The study also revealed that the native language had an effect on reported smoking. Finnish-speaking adolescents were 1.7-3.0 times more likely to smoke than their Swedish-speaking classmates of the same age.

FEASIBILITY OF BRIEF INTERVENTION AND EMPLOYEES ANSWERS

Brief intervention was seen as a possibility in dentistry, but also problems were perceived in employees answers and in the feasibility of the method.

The coverage of the intervention

The coverage of the intervention was considerable.

A total of 6 335 examinations were performed on 2 586 schoolchildren in four towns, with 84 % of the initial group having two examinations and 61 % three.

Tab.5. Initial age cohort and a number of adolescents examined annually

Examination	n	Mean age (years)
Initial stage	2586	13.1
First examination	2178	14.2
Second examination	1571	15.2

All Ostrobothnia employees` attitudes concerning smoking-related theories

The basic attitude towards antismoking issues was positive.

When all employees in the municipal dental health service in the province of Ostrobothnia were asked about their attitudes towards smoking-related issues it was found: 1) the majority thought that smoking prevention is an important factor in dentistry 2) Finnish smoking legislation is not too oppressive 3) some interprofessional differences were noted in relation to theories concerning smoking. Dentists were more of the opinion that prevention of smoking is a matter for dentistry while dental assistants more often believed that it could be affected decisively by means of health education 4) the staff members who had participated in the experiment evinced a more favorable attitude to the theories put forward than did their non-participant colleagues 5) respondents` own smoking habits were clearly reflected in their attitudes towards smoking issues and health education as a whole. Smokers were also more critical towards the law on smoking than non-smokers.

All Ostrobothnia employees` attitudes concerning the brief intervention project

Brief intervention was seen as a possibility in dentistry, but problems could also be perceived in employees answers.

Eight per cent of respondents held that smoking intervention in connection with dental examinations is done in vain. Seven per cent found it annoying to have to ask their patients about smoking. Most personnel thought it was interesting to adolescents to show them dental stainings as a harmful effect of smoking. The answers brought out a concern over the inadequacy of the resources for anti-smoking intervention. Only 35 % of respondents thought that dental health resources are sufficient. Respondents` own smoking habit was again reflected in the opinions: 50 % of smokers thought intervention is futile; more than one third found it annoying to ask about smoking.

Staff members carrying out a brief intervention: attitudes concerning the intervention

Implementation in a dental setting succeeded comparatively well.

Six per cent reported that they never conducted the different stages of brief intervention. Those who took part in the experiment, however, commented that there were obvious faults in the implementation of their intervention. The various stages of the brief intervention were not carried out in the manner planned. In 75 % of cases smoking had actually always been inquired about and there was positive feedback in 51 % of cases. The series of photographs showing the harmful effects of smoking had always been shown in 57 % of cases and in only 34 % had the subjects been allowed to examine their own teeth with a mirror.

2. VALIDITY OF THE METHODS ASSESSING SMOKING OF ADOLESCENTS

The self-administered questionnaire and question on smoking by a dentist gave reliable information on adolescents smoking habits.

The sensitivity and specificity values of the self-administered questionnaire were verified slightly according to the measurement chosen to be true (the golden stardard).

When the dentist`s question about smoking was taken as golden standard, very high sensitivity (0.96) and specificity (0.95) were reached. Taking the biochemical measures (CO concentration or saliva thiocyanate) as gold standard also gave fairly high sensitivity and specificity values.

The positive predictive values for smoking asked in the questionnaire were high whatever other verification methods were used. The highest value (0.90) was obtained when using dentist`s question as the true criterion of measurement.

The most significant correlation (0.67) was also measured between the questionnaire and dentist`s question when correlations between the different verification methods used were calculated.

When performing regression analysis in constructing a model to explain smoking what was reported in the questionnaire, it was observed that the dentist`s question on smoking alone explained 95% of the reports of smoking in the questionnaires.

3. THE ASSOCIATION BETWEEN SMOKING AND ORAL HEALTH

Dental health indices between smokers and non-smokers

Dental health indices were poorer among smoker adolescents in every phase of the follow-up.

DT and DMFT indices differed statistically significantly every year. When the study commeneed (6^{th} grade) the mean DT was 1.0 and the mean DMFT 3.4 in smokers. The corresponding mean rates of non-smokers were 0.6 (DT) and 2.2 with DMFT. In the 7^{th} grade the mean DT was 1.0 and the mean DMFT 3.8 for smokers and 0.7 and 2.7 for non-smokers. At the second follow-up (8^{th} grade) the mean DT index was 1.0 for smokers and 0.6 for nonsmokers. The mean DMFT figures were 4.2 and 3.0, respectively. An adolescent having nonintact teeth was 1.8-2.8 times more likely in smokers than in nonsmokers. Also the index of periodontal treatment need (CPITN) was significantly poorer in the smokers group. Smokers needed periodontal care 1.6-2.0 times more than non-smokers.

Similar results were obtained when testing oral health indices among those who were non-smokers but who had experimented with tobacco.

Follow-up

The first examination was attended by 2582 adolescents, 1265 boys and 1 317 girls. The participation rate of the age cohort (2586) was 99 % in the beginning (6th grade), decreased to 83 % in the 7th grade and finally 60 % at the end of the follow-up.

DT, DMFT and CPITN indices

The mean DT index in the 6th grade was 0.6 (SE= 0.0) and the mean DMFT index 2.3 (0.1) at the first examination. The caries situation in the cohort worsened with ageing: the mean DT index was 0.7 (0.0) in the 7th grade and 0.7 (0.1) in the 8th grade, the DMFT index mean 2.8 (0.1) and 3.2 (0.1), respectively.

The average number of gingival healthy sextants in the first examination was 2.8 (0.1), and 19 % of those examined had no need for periodontal treatment. The mean number of gingival healthy sextants at the second examination was 2.9 (0.1) and at the third 2.9 (0.1). The need for periodontal treatment varied only slightly with increasing age. At the completion 81 % of adolescents had a need for periodontal treatment.

Smoking and signs of smoking

There were initially 5.7 % smokers in the total age cohort and only 1.6 % of them admitted having discolorations of the teeth and only 0.3 % had noticed any effects of smoking on their gingival tissues. The number of smokers grew up to 12.6 % at the first follow-up. Two per cent had observed alterations in their gingival tissues and 5.7% discolorations.

At the end of the follow-up the total group included 19.4 % smokers; 2 % of these had seen changes in their gingival tissues and 4.8 % discolorations.

DISCUSSION

Targeting anti-smoking activities

There are several solid arguments supporting the implementation of tobacco prevention and cessation programs for adolescents. Young people tend to underestimate their personal risk of dying (Romer and Jamieson 2001) and overestimate their ability to quit smoking (U. S. Department of Health and Human Services (1986). While 80% of young people were aware that smoking is addictive, 60% thought it was not particularly hard to quit. It has been shown that if smoking does not start during adolescent years, it is unlikely ever to occur (Coambs 1992). Most adult smokers have established the habit before they were 18 (World Health Organization 1999). People who start smoking in youth are more likely to continue the habit in adulthood as a result of nicotine addiction. A recently published study on the addictive effects of nicotine reveals that adolescent smokers can become addicted even before they have established a daily smoking habit (DiFranza 2000). There are likewise observations that the probability of cessation in adulthood is inversely related to age at initiation (Breslau and Peterson 1996). Chassin (1990) has pointed out that even infrequent experimental smoking in childhood increases the risk of adult smoking.

In Finland there are further, specific arguments which advocating the focusing of tobacco control programs on preventing adolescents from smoking instead of encouraging adult smokers to quit. Although there has been favorable development in smoking rates among adolescents in the recent years, the smoking rates are not until now close to the figures for 1977, when the lowest levels of adolescent smoking were obtained. As also shown in the present study, the majority of the adolescents want to quit and try to quit smoking already in youth.

Most smoking prevention programs for adolescents are targeted on the years 11-17. However, by this time attitudes towards smoking and first experiments with cigarettes may have already been established. Also in this series this phenomenon was observed. According to our hypothesis, programs need to be age-specific, based on parental authority for younger adolescents and later on social influence. The sex differences noted in our intervention study suggest that the programs could also be different for boys and girls. Interventions and other programmes must perhaps be implemented before regular patterns of smoking have been established. This means that we must even consider children at the age of 5-10 as another target for antismoking actions in dentistry.

The health care system cannot cope with the adolescent smoking problem alone. Regular and continuous reseach is also needed when planning and updating national policy. In Finland adolescents are expected to grow independent earlier than elsewhere in Europe and their psychological age can not keep up with development well enough; Finnish adolescents may need more support and guidance. Hence changes in the social environment, family support and society are needed. It is possible that one of the most effective means of preventing adolescent smoking is to try to influence parent smoking. As our results also showed, adolescents largely inherit smoking habit from their parents. This issue has not been sufficiently taken into account. By raising parents` awareness of their impact on their childrens opinions, attitudes and action in relation to smoking issues, even dental personnel have an important task.

Community dental practice may offer a fairly favorable environment for establishing smoking prevention and cessation programs as part of routine care among adolescents. First, the purpose of most visits is prophylaxis, so that adolescents set out with a prevention orientation and often there is no need for acute care. A further important factor is the amount of time a patient spends in the clinic. When most dental visits last from 30 minutes to 1 hour, medical visits are often scheduled for 15-minute intervals. There is thus theoretically more time available in dental settings for counselling than in most medical settings. In the United States a group under Campbell (1999) observed that about 50% of smokers see a dentist annually and patients routinely expect the dentist to provide cessation information.

It should be borne in mind that when making studies with adolescents whose smoking conditions are unstable it is much harder to achieve good results in interventions compared with studies in an adult population with stable and high base levels of smoking. The reduction in adolescent smoking in our project must be regarded as good in view of our circumstances with low cost action (as a part of routine work) and a long follow-up period. The value of our intervention is increased by the fact that it was achieved with little extra input relative to normal routine dental care. We sought to give a realistic picture of the feasibility of implementing such an antismoking program. To investigate the weaknesses of our program and on the other hand aiming to improve the method for the future we made another study to analyze problems in feasibility. Factors possibly reducing the effectiveness of brief intervention are still partly unknown. Clover and associates (1999) have

discussed the barriers identified in other studies. Lack of resources and patient materials, doubts about dentists` effectiveness to give advice and lack of confidence to tackle the problem were the first mentioned. Also anticipated negative patient reactions, uncertainty as to the dentist`s role, the costs, lack of time and doubts about the dentist`s skill in assisting patients to quit smoking. These findings are in line with our present observations. Most dentists are of the opinion that they have a role in smoking cessation counselling. In spite of the fact that they have a knowledge of the adverse effects of smoking they do not feel confident in discussing smoking issues with patients. Many dentists said it was appropriate to ask patients about their smoking status. In practice it has been noted, however, that dentists do not systematically ask all patients about smoking. Some still think it is not appropriate to ask about smoking and assist their patients with quitting. These dentist are unlikely to practice smoking cessation activities. Giving smoking cessation interventions legitimate basis in dentistry may help these dentist to progress in their professional development.

Training dental staff

Training for dentists and all employees in dental clinics in the conduct of smoking interventions is important. Since the various phases were carried out only partially during our intervention study, it is clear that the method and the working teams need more attention. The feasibility of the brief intervention method can be improved by raising the self-motivation of staff for health counselling. Feasibility will also be enhanced when quality standards for this kind of action are accompanied by quality assurance. Different means of implementing brief interventions need to be evaluated to find better ways to support dental practice personnel in their efforts with antismoking work. In respect of the problems encountered in our implementation of smoking cessation programs in dental settings there are certain further aspects worthy of consideration. The first is the fostering of a team approach and team spirit in implementing new program. Taking into account the whole dental personnel, the dentists, dental hygienists, dental nurses and receptionists would probably help in adopting the program. Another point is to create such conditions that smoking counselling is not only integrated into routine practice but also takes care of continuation after possible project support is withdrawn. Dentists are still more inclined to give antismoking counselling in response to existing pathology rather than as a preventive measure (Trotter and Worcester 2003)**.** This same study revealed that only 4 % of dentist had previously had any training in smoking cessation

interventions, but 63% expressed an interest in attending to training. This issue must be taken into account when teaching the present and the next generation of dentists. Current information on the health impact of smoking is not enough. Practical training of dental students for example in the form of role-playing (anti-smoking discussion between dentist and patient) could be of use before graduation. Dentists may also hesitate to advise smoking patients to quit because they perceive that such advise has little impact compared with other methods. Dentists need to understand the long process involved in quitting. Information and communication should be adjusted to the stage of change. If a patient is in the quitting process it is unhelpful to go into all the adverse health effects of smoking. At this stage the patient has a need for information of a more technical nature and on the barriers to quitting. The advice of a dentist (or physician) generally yields about 5% quit rate in a year after the advice is given (U.S. Preventive Services Task Force (1989). The significance of dentist advice lies in leading the patient along the path to quitting, not just measuring how many patients become ex-smokers within a given time unit. As Phochaska and DiClemente showed (1983) smokers generally move through the stages of not thinking about smoking, then thinking about it, making a quit attempt and so on.

Verification of self-reported smoking

Adolescents seem to be fairly honest in answering self-administered questionnaires on smoking. Post and associates (2005) confirmed this conception when analyzing Swedish adolescent smokers. By comparing the self-reported questionnaire to saliva cotidine the group noted a sensitivity of 96% and specificity of 93%. As Hennrikus and colleagues (2005) concluded, screening questions for identifying adolescent tobacco users should leave little room for interpretation. A simple standard question for example whether any smoking has occurred in the past 30 days` more likely to reveal low-rate users than more general question about tobacco use which leaves more space to the subjects to decide the criteria for tobacco use. In normal dental practice the authority of the dental profession seems to elicit reliable information of adolescent smoking and it is therefore needless to use biochemical verification in routine work.

Repeated use of the same questionnaire within the same study population may help to test the reliability of responses and to identify any ambiguity in the questions. Absolute validity in a questionnaire is impossible to reach in that a golden stardard must be chosen and with smoking

there is no definition which with 100% confidence determines whether a subject is a smoker or not. Cotidine is so far considered to be the best"gold standard" for measuring intake (Benowitz et al. 1983). In smoking studies it provides a reliable estimate for plasma cotidine whether measured in saliva or blood (Curvall et al. 1990). However, it has also now been proved that adolescents` self-reports correspond well with several other biochemical markers when confidentiality is ensured (Mayhew et al. 2000). In ideal conditions, an independent "gold standard" is available when developing a questionnaire. This standard may be too expensive or difficult to use on a large scale (as in our case cotidine), but is useful in the validation process. Smoking could be monitored by an independent observer as in the case of short term exposure to test a questionnaire. This result would not be generalizable if respondents know that they are being observed. Adolescents could change their smoking behavior as a result of surveillance, making results true but irrelevant.

Studies using biological markers all have some weaknesses. It is very difficult to standardize the time intervals between possible tobacco use, self-report and marker test. This may cause, for example, occasional users to be misclassified by the biological marker as non-users. Also daily variation in background CO always causes slight differences in the precision of this measurement (Stepney 1982); the difference is however relatively unimportant when comparing groups of smokers and nonsmokers (Irving et al. 1988). In any case this must be noted when making decisions on the classification of individuals with low thresholds. In our verification study we encountred some problems with the biochemical measurements. Thiocyanate analysis in saliva is not very sensitive in detecting very low-level smokers as in experiments or patients who smoke only a few cigarettes in a month. We had to take this into account when choosing a slightly higher cut-off points for this analysis compared with Luepker and colleagues (1981) used in their saliva analysis. As some food stuffs may also disturb chemical analysis (vegetables, fruits) we also had to exclude some adolescents from the analysis. SCN is still a useful measure in an adolescent population because it well idenfies false-negative cases (=self-reported nonsmoker with SCN value indicating smoking) documenting trustworthy heavy smoking in adolescents (Cummings and Richard 1988).

Tobacco smoking and oral health

As there is abundant scientific evidence of the effect of smoking on the oral health of children and adults, it is not suprising that a clear association was also found in our study among adolescents. It has, however, been believed that smokers` oral health changes in adults are due to

long-term use of tobacco while changes in children are due to environmental/parental smoking. The fact that changes are already manifest in adolescents implies that there must be some direct or rapid effects of smoking which affect the tissues or host response quickly. Destruction of soft tissue and alvelolar bone in periodontal diseases is thought to involve toxins and proteases produced by bacteria. Likewise these affect hyperresponsiveness and reactivity of various components of the immune system. Smoking would appear to play a role in the pathogenesis of periodontal diseases by altering immune function and tissue repair also in adolescents.

There are also several hypothesized mechanisms linking smoking and dental caries. As with periodontal diseases, smoking seems to alter the bacterial profile or the rate of formation of dental plaque (Bergström and Eliasson 1987b, Lie et al. 1998). As mentioned above some studies (Heintze 1984, Parvinen 1984) have shown the effect of smoking on the buffering capacity or pH of saliva impairing the function of saliva as a protective factor against enamel demineralization (Edgar and Higham 1996). Macgregor(1989) demonstrated in a review article that smoking increases the salivary flow rate, but does not alter the composition of plaque and a group under Christen (1991) concluded that smoking had only a minor effect on changes in the saliva in terms which might affect the caries process. It seems that the effect of smoking to salivary fuctions is not the key element in causing dental caries.

Some studies have shown that tobacco smoke may affect the morphology and morphogenesis of children`s teeth (Kieser 1996, Heikkinen 1995). The teeth of smokers erupt earlier and are morphologically deviant with a lower degree of maturation compared with those of children of non-smoking mothers. This may increase susceptibility to adolescent caries in families where the parents smoke. Establishment of the ultimate character and mechanisms of the association also with dental caries calls for more studies. In adults study of smoking and caries indices may be confused by advanced periodontal disease causing tooth loss if the missing component of DMFS is not limited to surfaces lost due to caries. In the case of adolescents this problem did not cause any disturbance in our study.

Future studies must seek to control all potential confounding factors associated with the analysis of a likely mechanism. Unfortunately, the effect of the possible accumulation of bad habits (including poor oral hygiene) in the same individuals was not included in our analysis. Koivusilta and colleagues reported (2003) a low toothbrushing frequency beeing positively associated with “street-oriented” behaviors such as smoking and alcohol use. Thus adolescents who well take care of their teeth propably may have health-enchanging behavior in other dimensions of

health as well (Wannamethee et al. 1998). Studies are also needed to determine whether adolescents` quitting smoking changes the risk of periodontal diseases or caries development in future.

New ideas to be considered

The adjunctive use of nicotine replacement products has been studied in many clinical trials and meta-analyses. These show the use of nicotine chewing pieces (Tang et al. 1994, Silagy et al. 1994 Cepeda-Benito 1993), nicotine patches (Tang et al. 1994) and bupropion (Hurt et al. 1997, Jorenby et al. 1999) to be succesful as an adjunct to smoking cessation services. In our brief intervention this was not included in the program. There might well be reason to have such nicotine replacement products available in every dental clinic. As Cohen and associates (1989) observed, for the dentist the discussion of smoking was more likely to take place if the dentist could give for example free nicotine gum to patients who smoke. It might also be easier for a smoker to start a discussion and ask for help with quitting smoking when antismoking material is visible in the dental clinic, especially since many dentists have remarked on the difficulties in initiating a discussion of cessation with patients. Our way of identifing smoking related conditions such as stainings or changes in periodontal conditions also provided the dentist with an opportunity to raise the subject.

There are many dimensions in dentistry which could be used in connection with smoking prevention. The regular contacts between adolescents and dental teams makes it easier to combine educational elements with their visits. Dental staff act as a role model to their adolescent patients and they should take care that the model corresponds to the desired ideal. The smoking habits of dental personnel must also be taken into account in this connection. The fact that dental personnel have achieved good reults in preventing caries and teaching habits of oral hygiene may help in tranposing this know-how to the prevention of smoking.

Long-term follow-up of at least two to three years is necessary for smoking prevention programs to show effect. If a trend to delayed onset exists, longer follow-up is necessary. This was one motivation in our study to use long follow-up. School based programs have had modest and limited effects. They have been particularly effective in delaying the onset, but less successful in reaching and targeting the high-risk and minority youth (Glynn 1989). It has therefore been a challenge to try to invent and test new strategies in health care settings which help to reach and affect these high-risk adolescents in smoking prevention.

In conclusion

In conclusion, since tobacco is a modifiable risk for oral and general disease, dentists and the whole dental team could play a substantial role in antismoking policy. Among the various health staff groups these are most frequently in contact with the population; the clinical manifestations caused overall or in part by tobacco are well known and sometimes easily demonstrated to patients. Smoking counselling should constitute a fundamental part of the dental curriculum and prevention program in every practice. Practioners need more formal training in smoking cessation counselling so that this could be offered in practice in a professional manner.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the present study, the following conclusions and recommendations may be made:

1. Documentation of tobacco use status is necessary. Adolescents need smoking prevention and cessation programs. The dental team needs education and training for counselling in practice.

2. Brief smoking intervention in a dental setting is important. Smoking cessation products should be available in dental clinics.

3. Adolescent intervention programs need to be targeted by age, sex and probably also by native language

4. Parental smoking is an important factor which must be taken to account when planning anti-smoking policy for adolescents

5. The real-life feasibility of smoking interventions must be controlled with quality assurance

6. Smoking interventions must first be targeted at employees in health care

7. It is needless to use biochemical verification of the smoking habit in normal dental practice; even in the case of adolescents

8. Adolescent smoking habits must be noted when predicting the risk of caries and periodontal problems.

ACKNOWLEDGEMENTS

The present thesis was carried out at the University of Tampere, Medical School, Department of General Practice and Pirkanmaa Hospital District, Centre of General Practice. The majority of the work involved in collecting the material was done in public dental services in four Finnish towns of Kokkola, Pietarsaari, Seinäjoki and Vaasa. I thank the whole staff of these health centres for their positive attitude towards my work.

My deepest gratitude goes to my supervisor Professor Kari J Mattila, M.D., Ph.D., for his patience over the years. His scientific experience and quidance helped me through the pitfalls of scientific research, teaching me how to express complicated ideas clearly. He always succeeded in providing a positive atmosphere during our discussions. I feel priviledged to have him as my supervisor.

I am also grateful to Pekka Utriainen, Ph.D., L.D.S.. His inspiring personality and everlasting enthusiasm to everything new encouraged me to start the scientific career when both working as the chief dental officers in the neighbouring towns of Seinäjoki and Vaasa. I also enjouyed our discussions on topics outside the world of science.

Sometimes even the most sincere thanks come too late. Kimmo Pahkala, M.D.,Ph.D., the fourth member of our original research team did not live to see the completion of this work. His wide experience and knowledge of the field of geriatrics and human behaviour widened my view to understand adolescent smoking as a part of wider behavioural context.

I want to express my warm thanks to Professor Pentti Alanen, D.D.S., Ph.D.. His broad perspective in public health, epidemiology and dentistry guided me in final phases of this study.

The official referees for this work, Professor Eino Honkala and Docent Marita Poskiparta provided valuable comments and advice on the manuscript, for which I am particularly grateful.

I owe warm thanks to Robert MacGilleon, M. A. for his careful revision of the English language.

I want to express special thanks to my personal friend Joonas Pulkkinen, D.D.S, Ph.D. and to my friends and ice-hockey team mates, Reijo Linnola M.D, Ph.D. and Kari Panula, D.D.S., Ph.D. for stimulating discussions, good advice and friendship.

My very special thanks go my sisters Riitta and Marja and to my brother Pekka for their warm support during these years.

Finally I owe my deepest thanks to my dear wife Kirsi and my sons Janne and Ville. This book is dedicated to you.

Financial support for this study was provided by the Ministry of Social Affairs and Health, The Yrjö Jahnsson foundation and the Finnish Cultural foundation.

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APPENDIX

Appendix 1. The smoking questionnaire.

Nämä tiedot ovat luottamuksellisia ja jäävät vain hammashoitohenkilökunnan tietoon

Rastita oikea vaihtoehto	Kyllä	Ei
1. Tupakoitko?	☐	☐

Kysymyksiä tupakoiville	Kyllä	Ei
1. Tupakoitko säännöllisesti?	☐	☐
2. Montako savuketta poltat päivässä?	kpl	
3. Montako savuketta poltat viikossa?	kpl	
4. Tupakoiko jompi kumpi vanhemmistasi?	☐	☐
5. Hyväksyvätkö vanhempasi tupakointisi?	☐	☐
6. Onko Sinulla tietoa tupakoinnin aiheuttamista terveyshaitoista?	☐	☐
7. Luuletko jatkavasi tupakointia?	☐	☐
8. Oletko yrittänyt lopettaa?	☐	☐
9. Haluaisitko lopettaa?	☐	☐
10. Tulisitko ryhmään, joka auttaisi sinua lopettamaan tupakoinnin?	☐	☐
11. Oletko kokeillut nuuskaa tai purutupakkaa?	☐	☐

Kysymyksiä niille, jotka eivät tupakoi	Kyllä	Ei
1. Oletko kokeillut tupakointia?	☐	☐
2. Aiotko kokeilla?	☐	☐
3. Tupakoiko jompikumpi vanhemmistasi?	☐	☐
4. Onko Sinulla tietoa tupakoinnin aiheuttamista terveyshaitoista?	☐	☐
5. Oletko kokeillut nuuskaa tai purutupakkaa?	☐	☐

Kiitos vastauksista

Appendix 2. Baseline descriptive information on smoking by questionnaires in the whole age cohort

	Total age cohort			
	n	25 86		
	Yes		**No**	
	n	valid %	n	valid %
Do you smoke ?	148	(6%)	2438	(94%)
Questions for smokers	(n=148)			
1. Do you smoke regularly?	62	(42%)	86	(58%)
2. How many cigarettes a day ?	mean : 6 cigarettes/day			
3. How many cigarettes a week?	mean: 26 cigarettes/week			
4. Do your parents smoke?	109	(74%)	39	(26%)
5. Do your parents accept your smoking?	39	(26%)	109	(74%)
6. Do you have information on the adverse health effects of smoking	144	(97%)	4	(3%)
7. Do you consider continuing smoking?	39	(26%)	109	(74%)
8. Have you tried to stop smoking?	95	(65%)	53	(35%)
9. Do you want to stop ?	109	(74%)	39	(26%)
10. Would you come to a group to help you with quitting?	34	(20%)	114	(80%)
11. Have you tried smokeless tobacco ?	46	(31%)	102	(69%)
Questions for nonsmokers	(n= 2428)			
1. Have you experimented with smoking?	1097	(45%)	1341	(55%)
2. Do you think you will experiment?	146	(6%)	2292	(94%)
3. Does either of your parents smoke?	999	(41%)	1439	(59%)
4. Do you have information on the adverse health effects of smoking	2316	(95%)	122	(5%)
5. Have you tried smokeless tobacco?	105	(4%)	2343	(96%)

Appendix 3. The questionnaire for evaluation of the smoking intervention.

ARVOISA VASTAANOTTAJA

Tupakointiin liittyvä valistustyö on terveysneuvonnan tärkeimpiä alueita. Vuosina 1992-95 kokeiltiin Vaasan läänin neljässä kaupungissa toimintaa, jossa mini-intervention keinoin pyrittiin ehkäisemään koululaisten tupakoinnin aloittamista ja jatkamista. Mini-interventio on kuvattu ohessa.

MINI-INTERVENTIO TUPAKOINNIN EHKÄISEMISEKSI

Normaalin hammastarkastuksen aluksi hammaslääkäri kysyy tupakoiko koululainen. Vastauksen perusteella tehdään seuraavat toimenpiteet:

1. Koululainen ei tupakoi: Hänen hammasstatuksensa tutkitaan normaalisti ja samassa yhteydessä hänelle annetaan positiivinen palaute tupakoimattomuudesta. Tarkastuksen jälkeen näytetään valokuvasarjasta esimerkki tupakoinnin aiheuttamista hampaiston värjäytymismuutoksista. Tämän jälkeen koululainen vielä peilin avulla itse toteaa, onko hänellä värjäytymiä hampaissaan.

2. Koululainen tupakoi: Hänen hammasstatuksensa tutkitaan normaalisti. Tarkastuksen jälkeen näytetään valokuvasarjasta esimerkki tupakoinnin aiheuttamista värjäytymismuutoksista. Tämän jälkeen koululainen vielä peilin avulla itse toteaa, onko hänellä värjäytymiä hampaissaan.

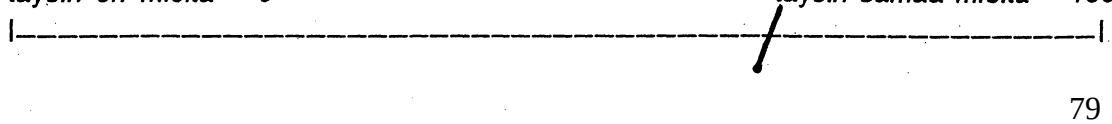
Kokeilu on nyt päättynyt ja tuloksia ollaan analysoimassa. Kokeiluun liittyen tutkimusryhmä haluaa kuulla Sinun henkilökohtaisen mielipiteesi tupakkavalistuksen toteuttamisesta hammashuollon yhteydessä. Siksi pyydämme Sinua täyttämään oheisen kyselylomakkeen ja palauttavan sen suljetussa kirjekuoressa terveyskeskuksen johtavalle hammaslääkärille, joka puolestaan toimittaa kirjekuoret lääninlääkäri Kimmo Pahkalalle. Antamasi tiedot käsitellään täysin luottamuksellisesti ja tulokset esitetään numeroina ja yhteenvetotaulukkoina, joista yksittäisiä vastaajia ei voi tunnistaa.

Osaan kysymyksistä vastataan rastittamalla, osaan vastataan vetämällä janaan poikkiviiva kohdalle, joka vastaa Sinun mielipidettäsi janan kahden ääripään mielipiteen välillä. Janan ja poikkiviivan leikkauskohta on tärkeä.

Esimerkki:

Tupakointi on huolestuttavasti lisääntynyt Suomessa?

täysin eri mieltä = 0 — täysin samaa mieltä = 100



Aluksi haluamme Sinun kertovan itsestäsi muutaman taustatiedon.

1. **Mikä on koulutuksesi?**

❒ Hammaslääkäri ❒ Hammashoitaja ❒ Muu, mikä? .....

2. **Minä vuonna olet syntynyt?** Vuonna 19.....

3. **Missä terveyskeskuksessa työskentelet?**

❒ Kokkolan ❒ Pietarsaaren ❒ Seinäjoen ❒ Vaasan
❒ Muualla

4. **Tupakoitko?**

❒ En ❒ Kyllä → Montako savuketta päivässä? .....kpl

5. **Osallistuitko etusivulla mainittuun kokeiluun?**

❒ En ❒ Kyllä → Montako mini-interventiota arvioit tehneesi kokeilussa? .....kpl

Jos et osallistunut edellä mainittuun kokeiluun niin siirry suoraan vastaamaan kysymykseen numero 11.

6. **Mikä oli koodinumerosi tutkimuksessa?** Nro .....

7. **Toteutuiko kokeilussa mini-interventio edellä kuvatulla tavalla?**

a. Kysymys koululaiselle tupakoinnista

aina = 0 ei koskaan = 100

|----------|

b. Positiivinen palaute hammastarkastuksen yhteydessä

aina = 0 ei koskaan = 100

|----------|

c. Valokuvasarjan katselu yhdessä koululaisen kanssa

aina = 0 ei koskaan = 100

|----------|

d. Oman hampaiston tutkiminen peilillä

aina = 0 ei koskaan = 100

|----------|

8. **Oliko kokeilulla arviosi mukaan vaikutuksia tupakoinnin aloittamiseen?**

ei lainkaan = 0 erittäin paljon = 100

|----------|

9. **Mitä kokemuksia Sinulla on mini-interventiosta? Mitä hyviä puolia, mitä ongelmia kohtasit?**

.....

.....

.....

.....

.....

.....

10. **Mitä mieltä olet seuraavista väittämistä?**

Suomen tupakkalaki on liian ankara.

täysin eri mieltä = 0 täysin samaa mieltä = 100

|----------|

Tupakoinnin vastustamistyö kuuluu hammashuollon tehtäviin.

täysin eri mieltä = 0 täysin samaa mieltä = 100

|----------|

Edellä kuvattu mini-interventio on turhaa touhua.

täysin eri mieltä = 0 täysin samaa mieltä = 100

|----------|

Tupakoinnin kysyminen potilaalta on kiusallista.

täysin eri mieltä = 0 täysin samaa mieltä = 100

|----------|

Tupakointiin voidaan ratkaisevasti vaikuttaa terveysneuvonnalla.

täysin eri mieltä = 0 täysin samaa mieltä = 100

|----------|

Hammashuollon resurssit riitävät kuvatun mini-intervention kaltaiseen tupakoinnin vastustamistyöhön.

täysin eri mieltä = 0 täysin samaa mieltä = 100

|----------|

Hampaiden värjäytyminen kiinnostaa koululaisia.

täysin eri mieltä = 0 täysin samaa mieltä = 100

|----------|

11. **Oletko huomannut tupakoivilla yläasteen oppilailla hampaiden tai limakalvojen värimuutoksia?**

ei lainkaan = 0 erittäin paljon = 100

|----------|

12. Vuosina 1992-95 terveyskeskusten hammashuoltohenkilöstö tarkasti 1979 syntyneet koululaiset Kokkolan, Pietarsaaren, Seinäjoen ja Vaasan terveyskeskuksissa keskimäärin kolme kertaa. Puolelle koululaisista eli koeryhmälle tehtiin tarkastusten yhteydessä etusivulla kuvattu mini-interventio tupakoinnin vähentämiseksi. Puolelle koululaisista eli vertailuryhmälle ei mini-interventiota tehty. **Miten monen prosentin arvelet näistä koululaisista tupakoineen yhdeksännen luokan tarkastuksen yhteydessä?** Älä epäröi arvata, sillä arviosi on tutkimuksen kannalta tärkeä.

Koeryhmästä tupakoi pojista .....% tytöistä .....%

Vertailuryhmästä tupakoi pojista .....% tytöistä .....%

13. Jos koko valtakunnassa siirryttäisiin hammashuollossa mini-interventioon tupakoinnin vastustamiseksi, **mitä ongelmia sen toteuttamiseen mielestäsi liittyisi?**

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Lopuksi haluamme esittää suuret kiitokset kaikille Teille kokeiluun ja tutkimuksemme onnistumiseen myötävaikuttaneille ihmisille.

Tutkimusryhmän puolesta

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Preventive Medicine **29,** 107–111 (1999)
Article ID pmed.1999.0512, available online at http://www.idealibrary.com on IDEAL®

Can Brief Intervention through Community Dental Care Have an Effect on Adolescent Smoking?[1]

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Background. **Community dental clinics are good settings for smoking intervention. The aim here was to put forward a strategy for preventing adolescent smoking by means of a brief intervention.**

Methods. **A total of 2,586 12-year-olds participated in this follow-up study. They were asked upon arrival for their annual routine dental examination to complete a smoking questionnaire and were randomly assigned to either the intervention group or the usual care control group according to the last digit of their date of birth (odd or even). The intervention comprised annually inquiring about smoking, showing photographs of the harmful effects of smoking on the teeth, allowing participants to examine their own mouth with a mirror, and finally counselling them in accordance with their answer to the question on smoking habits. The smoking status reported was not verified by other means.**

Results. **The prevalence of smoking at the end of the 2-year follow-up was 18.1%, in the intervention group and 20.8% among the controls. However, no statistically significant differences between groups were found.**

Conclusions. **These results reflect the difficulties of achieving successful results with long-term smoking cessation programs with adolescents in unstable conditions.**

Key Words: **smoking; intervention; dentistry; follow-up study.**

INTRODUCTION

Smoking is the most significant individual preventable factor that causes premature deaths in our society. Although the habit has decreased in some populations in recent decades, it remains very popular among adolescents [*1–3*]. The process leading to it begins with the formation of attitudes, after which the adolescent may start to experiment with smoking itself. An addiction to tobacco develops gradually, the process taking about 3 years [*4*]. It seems reasonable, therefore, to aim to influence adolescents as soon as possible, before they start smoking, or even at the experimental stage. It is reported that 90% of adolescents who smoke three or four cigarettes a day remain regular smokers for the rest of their lives [*5,6*].

There are many ways of combating smoking; those pursued most intensively in Finland are health education, pricing policy, legislation, control, and observation. The public health service has a number of ways of preventing smoking [*7*], implemented to date for the most part by temperance workers, public health nurses, and doctors [*8–10*]. Brief interventions have been used with success in preventing addiction to alcohol and drugs, and these offer an approach that is simple and requires few resources in terms of the time and attention of busy doctors and clinics [*11*]. Brief intervention periods stress the patient's own responsibility and impart positive, empathic attitudes that enhance the patient's self-esteem.

Smoking affects the mouth in many ways, most typically through discoloration of the teeth and gums, bad breath, mucous membrane diseases, and oral cancer [*12–14*]. A number of papers were published in the late 1980s on the opportunities for dental personnel to educate their patients in matters related to smoking [*15–17*]. The majority of dentists subscribed to the idea that they should participate and thought that a dentist could incite patients to reduce or stop smoking. In practice, however, it appears that dentists very seldom ask their patients about smoking or make any active effort to contribute to this campaign [*17,18*].

In the area of adolescent tobacco-use reduction, it has been observed that young people at "high risk" are least

[1] We gratefully acknowledge the financial support provided for this study by the Ministry of Social Affairs and Health and the Yrjö Jahnsson Foundation.

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0091-7435/99 $30.00

likely to be reached through school-based or other traditional programs. Experts have failed to provide health organizations with clear direction as to how best to reduce smoking rates [*19*].

Based on experiences in other sectors, a brief intervention model was devised for use in dentistry, discouragement of smoking being based on elucidation of the oral consequences of tobacco combined with the subject's observation of his or her own oral health. Since teenagers are often very particular about small details of their appearance our model involves a certain element of narcissism.

The aim of this study was to investigate whether a brief intervention undertaken in the context of dental health care can have an affect on adolescent smoking.

MATERIAL AND METHODS

The target group comprised all adolescents born in 1979 now living in four cities in Finland. When the experiment commenced in 1992 they were at the age at which the first experiments are usually made with smoking.

All these young people were making regular visits to a community dental health clinic, and this made it possible to implement an annual follow-up for the whole age class as a part of their routine annual check-up. The adolescents were assigned to either the normal care group (those with an even last digit in their date of birth) or the intervention group (odd last digit), who were subject to intervention annually. The average age of the participants was 13.1 years at the first visit, 14.2 at the first follow-up, 15.2 at the second, and 15.6 at the third. Because of the low response rate (21%) at the third follow-up visit, we rejected it from the final analysis. The numbers of males and of frequent smokers were greater among the withdrawals after the initial examination at the age of 13 than among those who continued. The initial age group and the number of adolescents examined annually in each group are presented in Table 1.

All adolescents were asked to complete a smoking questionnaire prior to attending their routine dental examination. The examination itself involved monitoring of the usual measures of oral health indicators, i.e., D, DMF, and CPITN indices [*20,21*]. The brief intervention took the form shown in Table 2.

TABLE 1

The Initial Age Group and the Number of Adolescents Examined Annually

Examination	Intervention group (*N*)	Control group (*N*)	Total (*N*)	Mean age (years)
Initial stage	1,348	1,238	2,586	13.1
First examination	1,149	1,029	2,178	14.2
Second examination	845	726	1,571	15.2

TABLE 2

The Protocol of the Brief Anti-smoking Intervention

The dentist inquires about smoking at the beginning of the routine dental examination. Depending on the answer:

1. If the adolescent does not smoke, dental status is checked as usual and positive feedback is given regarding abstinence from smoking. After the examination the adolescent is shown a set of photographs showing discoloration of the teeth as a consequence of smoking and is invited to use a mirror to observe whether he/she has any such discolorations.
2. If the adolescent smokes, dental status is checked as usual. After the examination the adolescent is shown a set of photographs of harmful discolorations of the teeth caused by smoking and is invited to use a mirror to observe whether he/she has any such discolorations.

The intervention measures were planned so that they could be implemented in conjunction with the normal routines, taking only a couple of minutes' extra time per examination. The staff of the community dental clinics were informed of the principles of brief intervention and the experimental arrangements, and received instructions for the project. A total of 64 dentists were involved in this study. We were not in position to control cross-over information from the subjects in the intervention group to controls.

Statistical analyses were performed using the SPSS statistical package. Comparisons between groups were evaluated with *t*-test and dichotomous variables were tested with χ^2 statistics.

RESULTS

The 2,586 adolescents examined at the beginning of the year, 1,264 girls (49%) and 1,320 boys (51%), included 148 who smoked (5.7%). Smoking increased during the follow-up years to the extent that by the end of the study 19.4% were smoking. The difference between the intervention group and the controls widened, so that by the end 18.1% of the intervention group smoked and 20.8% of the control group smoked. The differences between groups were not, however, statistically significant (Table 3). The rejected third follow-up visit gave

TABLE 3

Proportion of Smokers (%) among the Adolescents Examined

	Intervention group			Control group		
	Examined	Smokers		Examined	Smokers	
Examination	(*N*)	(*N*)	%	(*N*)	(*N*)	%
Initial stage	1,348	74	5.5	1,238	74	6.0
First examination	1,149	153	13.3	1,029	126	12.2
Second examination	845	153	18.1	726	151	20.8

TABLE 4

Number of Cigarettes Smoked per Week

Examination	Intervention group (*N*)	Intervention group Mean (SE)	Control group (*N*)	Control group Mean (SE)	Statistical significance
Initial stage	66	26 (3.5)	76	22 (3.3)	$P = 0.752$
First examination	132	30 (2.4)	108	39 (3.4)	$P = 0.012$
Second examination	134	36 (2.7)	143	36 (3.1)	$P = 0.230$

a difference of 5% between groups (17.6% intervention group versus 22.6% control group). Because of the high drop-out rate of the third follow-up visit the reliability of the result is questionable and was left out from the analysis.

There was no effect on the numbers of cigarettes smoked daily, but the number smoked weekly was lower in the intervention group. Although the smokers in the intervention group smoked more initially than did the controls, they achieved a statistically significant cut in weekly numbers of cigarettes smoked at the time of the first examination (Table 4).

The great majority of these adolescents tried to stop smoking during the years of the follow-up, as many as 73% of those in the intervention group and 63% of the controls claiming to have made efforts in the last year of the study. When, however, the smokers were asked if they would be willing to join a group aimed at helping them stop smoking, however, only 12–19% each year showed any interest in doing so. Although interest in this decreased with age, it was always greater in the intervention group than among controls (Table 5).

The adolescents were themselves well aware of the health risks attached to smoking, more than 90% each year stating that they had sufficient information on this. Experimentation with snuff or chewing tobacco was reported by 5.7% at the beginning of the follow-up, and this increased over the years to reach 11% at the last examination. Brief intervention had no influence on the use of snuff or chewing tobacco.

Assessment of the effect of sex on smoking showed that the girls reported smoking significantly less at every examination (Table 6).

TABLE 5

Number and Proportion (%) of Smokers Who Tried to Stop Smoking

Examination	Intervention group (*N*)	Intervention group %	Control group (*N*)	Control group %
Initial stage	51	67	47	57
First examination	98	68	94	75
Second examination	110	73	91	63

The influence of parental smoking emerged as an important factor predicting adolescent smoking during the follow-up. If either parent smoked at the outset, the risk of the child in question also smoking was four times as great as for those with non-smoking parents. The parents' influence decreased with time during follow-up, but the risk ratio remained at almost 3 and was statistically significant up to the end of the study (Table 7).

The native language of the adolescent had an effect on reported smoking, in that Finnish-speakers were three times more likely to smoke than the Swedish-speakers. This influence was greatest at the beginning of the study and decreased with age/follow-up, remaining albeit statistically significant throughout (Table 7).

DISCUSSION

The 3% reduction in adolescent smoking achieved by the brief intervention can be regarded as a good result. No interventions in conjunction with dental examinations involving comparable arrangements have been reported, but intervention studies by doctors report results on the order of 5–6% in 1-year follow-ups. These have mostly set out from circumstances in which the base levels of smoking were high and stable and the subjects adults. It is in fact easier to achieve good results with adults than with adolescents, for whom conditions are often unstable (i.e., they are likely to experiment with smoking). The value of our intervention is increased by the fact that the improvement was achieved with little in the way of extra input relative to the normal routine dental care. The fact that we failed to attain a statistically valid result may be partly due to problems in feasibility or the use of a single approach instead of multiple prevention and cessation strategies simultaneously. It may also be suggested that the effects of this brief intervention were dissipated shortly after implementation in consequence of the long interval between reinforcements.

A gratifying observation was that the intervention had an effect on the number of cigarettes smoked weekly and on the adolescents' interest in trying to stop smoking. On the other hand, it must be borne in mind that the chief factor in evaluating smoking prevention program is the proportion who give it up, i.e., become non-smokers, as those who only reduce their smoking return to their previous habits with time [*3*]. The result is nonetheless important as far as the situation in Finland is concerned, as it has been shown that adolescents here smoke more than those of the same age elsewhere in Europe [*22*].

An attempt was made when planning this experiment to take account of the known weaknesses of previous investigations. Thus the adolescents were monitored

TABLE 6

Smokers by Sex

Examination	Girls			Boys			Statistical significance
	Total (*N*)	Smokers (*N*)	Smokers %	Total (*N*)	Smokers (*N*)	Smokers %	
Initial stage	1,264	58	4.6	1,320	89	6.7	$P = 0.018$
First examination	1,086	110	10.1	1,092	169	15.5	$P < 0.001$
Second examination	794	139	17.5	777	165	21.2	$P < 0.001$

for 2 years to obtain an adequate time-span in which changes might occur. The uncertainty attached to reported smoking habits was partly obviated by asking about this again at each examination, and the validity of the questionnaire form was tested with a group of 150 adolescents of the same age with saliva hypothiocyanate and carbon-monoxide in their expiratory air. It was sought to ensure that the intervention and control groups were equally homogeneous and sufficiently large. On the other hand, the intervention was planned so as to avoid disturbances in the normal procedures of dental care and so as to give a realistic picture of the feasibility of implementing such a prevention method.

It is evidently not enough simply to stress health aspects when attempting to prevent smoking among adolescents; such methods have been found to increase the amount of information they have on the effects of smoking but have much less effect on their attitudes or values and usually none at all on their behavior. It was similarly shown here that the subjects knew well enough themselves what harmful health risks were attached to smoking.

There are many dimensions in dentistry which could be exploited in connection with the prevention of smoking. The regular contacts between adolescents and dental staff make it possible to combine a number of educational elements. Also dental staff, like health personnel in general, act as a role model for their patients, and they should take care that the model they give corresponds to the desired ideal. It has previously been demonstrated what dental staff can achieve in preventing caries and teaching habits of oral hygiene, and transposition of these ideas to the prevention of smoking may be assumed to yield good results. Brief intervention is a good addition to the methods of preventing smoking available within dentistry. We know that no single trick or approach by itself will achieve this, but the use of several approaches and methods in combination will have the greatest likelihood of succeeding. A good prevention program should include not only facts but also elements of social influence and positive feedback. Such programs seem to prevent, or at least postpone the onset of, smoking [*23*].

The sex differences noted suggest that smoking prevention could be different for boys and for girls. Moreover, the programs must be age-specific so as to reach adolescents at points at which they are susceptible to influence. According to our hypothesis for younger adolescents they must be based on parental authority, and later, when young people become more critical and cynical, they should be based on social influence. The fact that the influence of native language came up in this study may be a cultural proxy based on an ethnological division into different folk cultures.

The methods of preventing smoking that are suitable for use in public health care all have certain features in common: low costs, minor demands on time or other resources, and an emphasis on self-responsibility. This reported brief intervention in a dental context was an attempt to combine behavioral, cognitive social and psychological elements with these desirable principles in order to prevent smoking.

TABLE 7

Relative Risk (RR) of Smoking by Parental Smoking or if Native Language is Finnish versus Swedish

Examination	Parental smoking		Finnish as native language	
	RR	Statistical significance	RR	Statistical significance
Initial stage	3.99	$P < 0.001$	2.95	$P < 0.001$
First examination	2.98	$P < 0.001$	2.01	$P < 0.001$
Second examination	2.76	$P < 0.001$	1.68	$P = 0.003$

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Artikkeli on läpikäynyt Apollonian referee-järjestelmän

Nuorten tupakointia ehkäisevä mini-interventio

Toteutettavuus suun terveydenhuollossa

JUKKA KENTALA, PEKKA UTRIAINEN, KIMMO PAHKALA, KARI MATTILA

Nuorten tupakointi on merkittävä kansanterveydellinen ongelma. Artikkelissa selvitetään mini-intervention tyyppisen tupakoinnin vieroitus- ja ehkäisymenetelmän toteutettavuutta terveyskeskusten käytännön suun terveydenhuollossa. Taustatiedoksi kerättiin suun terveydenhuollon henkilöstön mielipiteitä ja asenteita tupakoinnista ja sen vastustamisesta. Henkilöstö suhtautui periaatteessa myönteisesti tämäntyyppiseen toimintaan ja piti sitä järkevänä osana käytännön suun terveydenhuoltoa. Toteutettavuutta mitattiin lisäksi tiedustelemalla intervention toteuttajien omia kokemuksia mini-interventiosta suun tutkimuskäyntien yhteydessä. Tutkimuksessa havaittiin selviä puutteita intervention käytännön toteutuksessa. Henkilökunnan oma tupakointi heijastui asenteissa ja toiminnassa.

Tupakointi on suurimpia kansanterveysongelmia sekä maailmanlaajuisesti että Suomessa. Terveydenhuollon henkilöstön rutiinityössä tupakoinnin vieroitus on tärkeää sekä yksilö- että väestötasolla (1). Erityisen hyvä mahdollisuus vieroitukseen on perusterveydenhuollossa, jossa väestö tavoitetaan kattavasti ja potilaskontaktit ovat säännöllisiä. Nuorilla tämä toteutuu erityisesti suun terveydenhuollossa.

Suomalaisnuoret aloittavat tupakointikokeilut yleensä jo 12—14 vuoden iässä. Nämä kokeilut johtavat usein säännölliseen tupakointiin (2). Suun terveydenhuollon henkilöstöä nuori kohtaa keskimäärin kerran vuodessa (3). Näihin käynteihin on mahdollista sisällyttää tupakointiin liittyvää terveysneuvontaa.

Suomessa kartoitettiin vuoden 1987 lopussa valtakunnallisesti hammaslääkäreiden tupakointia koskevia asenteita sekä osallistumista tupakoinninvastaiseen terveyskasvatukseen. Tuolloin Telivuo työtovereineen huomasi, että suomalaiset hammaslääkärit suhtautuivat enimmäkseen myönteisesti tupakoinnista vieroitukseen (4). Tehtävään positiivisesti suhtautuvat hammaslääkärit olivat aktiivisempia toteuttamaan vieroitustoimia omassa työssään. Vuonna 1999 selvitettiin EU:n alueella hammaslääkäreiden suhtautumista tupakoinnin vastustamistyöhön (5). Valtaosa hammaslääkäreistä piti tupakoinnin vastustamistyötä suun terveydenhuollon tehtäviin kuuluvana. Kuitenkin käytännössä vain kolmannes hammaslääkäreistä tiedusteli potilaidensa tupakointitapoja.

Pitkään kestänyt tupakointi vaikuttaa suun terveyteen ja ulkonäköön monin tavoin. Tavallisimpia muutoksia ovat hampaiden värjäytymät ja pahanhajuinen hengitys, joista on merkittävää sosiaalista haittaa. Myös tupakoinnin yhteys suusyöpään sekä vaikutukset hampaisiin ja hampaiden kiinnityskudoksiin tunnetaan (6, 7). Näkyvät muutokset suussa saattavat olla tehokas keino motivoida murrosikäisiä nuoria lopettamaan tupakointi. Tässä iässä nuoret ovat hyvin tarkkoja ulkonäköönsä liittyvissä asioissa.

Tupakoinnin vieroitusmenetelmistä on olemassa useita näyttöön perustuvia ohjeistoja. Mini-interventio on tällä hetkellä eräs yleisimmin käytetyistä. Kansainvälisten suositusten mukaan sen tulisi aina sisältyä terveydenhuollon keinovalikoimaan (8, 9). Mini-interventio on yksi Suomalaisen Lääkäriseura Duodecimin laatimien Käypä hoito -suositusten sisältämä menetelmä (10). EU:n "Tupakka ja suun terveys" -ryhmän ohjeeseen (11) on kirjattu, että tupakointiin tulisi puuttua vähintään lyhyen neuvonnan keinoin. Tupakointiin kohdistuvan mini-intervention toteutettavuus sekä sen ongelmat ja esteet käytännön kliinisessä työssä tulisi tuntea ennen kuin menetelmä otetaan laajempaan käyttöön suun terveydenhuollossa.

Mini-interventio toteutettiin neljässä Länsi-Suomen läänin kaupungissa yhteistyössä terveyskeskushammaslääkäreiden ja hoitajien kanssa. Mini-interventiossa esiteltiin tupakoinnin haittoja suun terveydelle ja verrattiin näitä koululaisen havaintoihin oman suunsa terveydestä. Kokeilun tulokset olivat rohkaisevia. Yhden koululaisikäluokan kahden vuoden seurannan jälkeen mini-interventioryhmästä tupakoi 18,1 % ja kontrolliryhmästä 20,8 % (12). Vastaavia suun terveydenhuollon tutkimuk-

Taulukko 1. Ennen hammaslääkärin tarkastusta koululaisille jaetun kyselylomakkeen sisältämät kysymykset. Vastausvaihtoehdot olivat kyllä tai ei muissa kuin määrää mittaavissa kysymyksissä.

Tupakoitko?

Kysymykset tupakoiville:

- Tupakoitko säännöllisesti?
- Montako savuketta poltat päivässä?
- Montako savuketta poltat viikossa?
- Tupakoiko jompikumpi vanhemmistasi?
- Hyväksyvätkö vanhempasi tupakointisi?
- Onko Sinulla tietoa tupakoinnin aiheuttamista terveysvaaroista?
- Luuletko jatkavasi tupakointia?
- Oletko yrittänyt lopettaa?
- Haluaisitko lopettaa?
- Tulisitko ryhmään, joka auttaisi Sinua lopettamaan tupakoinnin?
- Oletko kokeillut nuuskaa tai purutupakkaa?

Kysymykset niille, jotka eivät tupakoi

- Oletko kokeillut tupakointia?
- Aiotko kokeilla?
- Tupakoiko jompikumpi vanhemmistasi?
- Onko Sinulla tietoa tupakoinnin aiheuttamista terveysvaaroista?
- Oletko kokeillut nuuskaa tai purutupakkaa?

sia ei ole aiemmin tehty. Lääkäreiden toteuttamissa, tosin vain puoli vuotta kestäneissä seurantatutkimuksissa, mini-interventioissa on päästy vastaaviin tuloksiin (13).

Tämän raportin tarkoituksena on tarkastella tupakoinnin aloittamisen ehkäisyyn ja tupakoinnista vieroittamiseen tarkoitetun mini-intervention toteutettavuutta suun terveydenhuollossa. Tavoitteena oli myös kartoittaa suun terveydenhuollon henkilöstön mielipiteitä menetelmästä ja sen käytännön toteutuksesta.

Aineisto ja menetelmät

Mini-intervention toteututettavuutta tutkittiin:

- arvioimalla mini-intervention kattavuutta, kun se toteutettiin osana terveyskeskusten järjestelmällisiä suun tarkastuksia
- lähettämällä postikysely kaikkien Etelä- ja Keski-Pohjanmaan terveyskeskusten suun terveydenhuollon henkilöstölle. Kyselyllä tutkittiin mielipiteitä tupakoinnin vastustamistyöstä sekä mini-interventiomenetelmästä. Mini-intervention toteuttajilta pyydettiin lisäksi oma arvio menetelmän käytännön toteutuksesta.

Mini-intervention koejärjestelyt

Tupakoinnin ehkäisyyn ja lopettamiseen pyrkivä mini-interventio toteutettiin neljässä Pohjanmaan kaupungissa: Vaasassa, Seinäjoella, Pietarsaaressa ja Kokkolassa. Ensimmäisessä tarkastuksessa nuoret olivat keskimäärin 13-vuotiaita koululaisia. Parittomina päivinä syntyneet nuoret arvottiin koeryhmään, jolle määräaikaistarkastuksen yhteydessä tehtiin mini-interventio. Parillisina päivinä syntyneet muodostivat vertailuryhmän. Tutkimuksen alussa 2 586 nuorta käsittänyttä kohorttia seurattiin kahden vuoden ajan. Seuranta oli mahdollista, koska he kuuluivat järjestelmällisen suun terveydenhuollon piiriin. Ennen määräaikaistarkastusta he täyttivät odotushuoneessa tupakointitapoja ja -tietämystä selvittävän kyselylomakkeen (**taulukko 1**). Hampaiston tarkastanut henkilö ei nähnyt vastauksia ennen tarkastusta, koska lomake liitettiin tarkastuslomakkeeseen vasta käynnin jälkeen. Tupakointia koskeva kysymys validoitiin mittaamalla samanikäisiltä nuorilta syljen tiosyanaattipitoisuus sekä uloshengitysilman häkä (14).

Tarkastuksessa kirjattiin D, DMF ja CPITN-indeksit. Vertailuryhmän tarkastus kirjattiin siniselle, koeryhmän punaiselle lomakkeelle, jotta mini-intervention kohdistuminen oikealle ryhmälle varmistui. Vertailuryhmälle ei tehty tupakoinnin vieroitukseen liittyviä toimia. Koeryhmään kuuluville koululaisille tehtiin mini-interventio (**taulukko 2**).

Mini-interventiossa suun määräaikaistarkastuksen tekijä kysyi koeryhmän koululaiselta, tupakoiko tämä. Sen jälkeen tehtiin tavanomainen suun kliininen tutkimus. Tutkimuksen jälkeen näytettiin neljän värikuvan sarja tupakoinnin aiheuttamista suumuutoksista sekä peilin kautta nuoren oma hampaisto. Tupakoimattomalle annettiin positiivinen palaute hänen tupakoimattomuudestaan ja tupakoivaa rohkaistiin lopettamaan. Mini-intervention toteuttamiseen kului aikaa 2—3 minuuttia tarkastuskäynnistä.

Ennen ikäkohortin ensimmäistä tarkastusta ja seurannan alkua järjestettiin seurantaan osallistuvien neljän terveyskeskuksen suun terveydenhoitohenkilökunnalle valmennustilaisuus, johon osallistui yhteensä 60 henkilöä. Mini-intervention periaatteet, kirjalliset ohjeet ja käytännön toteutus käytiin läpi intervention tulevien toteuttajien kanssa. Ohjeistuksessa painotettiin, että interventio on kokeiluaikana osa nuorten normaalia tarkastusrutiinia. Muilta osin määräaikaistarkastusten toimintatapoja ei haluttu muuttaa. Ikäluokasta seurannassa pysyneiden nuorten määrä selvitettiin vuosittain mini-intervention kattavuuden arvioimiseksi.

Postikyselyn toteutus

Etelä- ja Keski-Pohjanmaan kaikkien terveyskeskusten suun terveydenhoitohenkilökunnalle lähetettiin mini-interventiokokeilun jälkeen postikysely, jossa pyydettiin mielipiteitä ja arvioita menetelmän käytännön toteutettavuudesta sekä menetelmän ongelmista. Mini-intervention menetelmä kuvailtiin seikkaperäisesti kyselylomakkeen etusivulla.

Kaikilta vastauslomakkeen palauttaneilta saatiin arviot mini-interventioon ja tupakointiin liittyvistä väittämistä janamittarin (visual analoque

Taulukko 2. Tupakoinnin ehkäisyyn pyrkivän mini-intervention sisältö.

1) Kysytään: Tupakoitko?
2) Normaali hampaiston ja suun pehmytosien tarkastus.
3) Nuorelle näytetään neljä värivalokuvaa tupakan haitallisista vaikutuksista suun alueella.
4) Nuorelle näytetään peilillä hänen omat hampaansa ja ikenensä kiinnittäen huomiota mahdollisiin tupakan aiheuttamiin muutoksiin.
5) Suun löydöksiin perustuen nuorelle annetaan positiivinen palaute tupakoimattomuudesta tai tupakoivia rohkaistaan lopettamaan.

scale eli VAS) avulla. Janamittariin vedettiin poikkiviiva kohtaan, joka vastasi arvioijan mielipidettä janan kahden ääripään välillä, jotka olivat "täysin eri mieltä" (0) ja "täysin samaa mieltä" (100). Poikkiviivan etäisyys janan 0-päästä muutettiin graafisen levyn avulla tietokoneelle indeksiluvuksi, kun koko janan mitta-asteikko oli nollasta sataan (15). Henkilökunnalta tiedusteltiin myös avoimella kysymyksellä, mitkä ovat mahdollisia mini-interventiokokeilun koko Suomeen laajentamisen esteitä tai ongelmia.

Kokeilun toteuttajia pyydettiin lisäksi arvioimaan intervention eri osien (tupakoinnista kysyminen, valokuvasarjan katselu, oman hampaiston tarkastelu peilistä sekä positiivisen palautteen antaminen) toteutumista janamittarilla. Janamittarin ääripäitä kuvasivat luonnehdinnat "aina" (0) ja "ei koskaan" (100). Näin saatiin edellä esitetyllä tavalla janaindeksi, jonka numeerinen arvo oli välillä nollasta sataan. Yhdellä avoimella kysymyksellä kartoitettiin interventiosta saatuja kokemuksia.

Alueella oli 34 terveyskeskusta, joista 24:stä saatiin yhteensä 274 vastausta. Näistä 135 oli hammaslääkäreiltä. Vastanneiden terveyskeskusten virkatilanteesta laskettuna hammaslääkäreiden vastausprosentti oli 83,5 ja muun hammashuollon henkilöstön (hammashoitajat ja hammashuoltajat) 70,1. Mini-interventiota oli vastanneista hammaslääkäreistä tehnyt 36 ja muusta henkilökunnasta 23 työntekijää.

Vastaukset analysoitiin frekvenssijakautumina siten, että janaindeksin yläkvartiilin arvot sijoitettiin luokkiin "täysin samaa mieltä" tai "ei koskaan". Alakvartiilin arvot sijoitettiin luokkiin "täysin eri mieltä" tai "aina". Janaindeksien keskiarvojen tilastollista merkitsevyyttä kuvattiin p-arvon sekä luottamusvälien avulla. Ryhmien väliset erot testattiin t-testillä käyttäen analyysissa SPSS-tilasto-ohjelmaa. Tutkimus tehtiin yhteistyössä Länsi-Suomen lääninhallituksen kanssa, ja sille oli Vaasan terveyskeskuksen eettisen toimikunnan lupa.

Tulokset

Mini-intervention kattavuus

Kaikissa kokeilukaupungeissa intervention perusjoukko tavoitettiin kattavasti. Seurantavuosien aikana tehtiin neljässä kaupungissa 2 586 koululaiselle yhteensä 6 335 tarkastusta. Perusjoukosta 84 %:lle tehtiin kaksi tarkastusta ja 61 %:lle kolme.

Suun terveydenhuollon henkilöstön mielipiteet tupakoinnin vastustamistyöstä

Keski- ja Etelä-Pohjanmaan suun terveydenhuoltohenkilökunnasta 11 % oli sitä mieltä, että Suomen tupakkalaki on liian ankara. Täysin eri mieltä oli 64 %. Väittämän "Tupakoinnin vastustamistyö kuuluu hammashuollon tehtäviin" kanssa oli täysin samaa mieltä 33 % ja täysin eri mieltä 15 %. Väittämään "Tupakointiin voidaan ratkaisevasti vaikuttaa terveysneuvonnalla" olivat prosentit vastaavasti 31 ja 12. Vastaajan peruskoulutuksella (hammaslääkäri tai muu henkilöstö eli hammashoitaja/hammashuoltaja) ei näyttänyt olevan tilastollisesti merkitsevää yhteyttä tupakointiin liittyviin yleisiin väittämiin annettuihin vastauksiin.

Joitakin ammattiryhmien välisiä eroja kuitenkin havaittiin. Hammaslääkärit olivat muita ammattiryhmiä useammin sitä mieltä, että tupakointiin puuttuminen on suun terveydenhuol-

Taulukko 3. Suun terveydenhuoltohenkilöstön mielipiteet tupakointia käsitteleviin väittämiin ammattiryhmän, interventioon osallistumisen ja oman tupakoinnin suhteen. Tuloksena on esitetty janaindeksin keskiarvo (95 %:n luottamusväli), kun "täysin samaa mieltä" sai arvon 100 ja "täysin eri mieltä" arvon 0.

		Koulutus		
	Hammaslääkärit n = 135		Muu henkilöstö n=124	p
Suomen tupakkalaki on liian ankara	26 (21—31)		28 (23—34)	0,531
Tupakointiin voidaan ratkaisevasti vaikuttaa terveysneuvonnalla	57 (52—61)		66 (61—70)	0,005
Tupakoinnin vastustustyö kuuluu hammashuollon tehtäviin	62 (57—67)		55 (50—60)	0,035
		Interventio		
	Osallistui n = 59		Ei osallistunut n=192	p
Suomen tupakkalaki on liian ankara	24 (17—32)		28 (24—32)	0,395
Tupakointiin voidaan ratkaisevasti vaikuttaa terveysneuvonnalla	62 (56—69)		60 (57—64)	0,603
Tupakoinnin vastustustyö kuuluu hammashuollon tehtäviin	62 (55—69)		58 (54—62)	0,379
		Oma tupakointi		
	Ei tupakoi n = 235		Tupakoi n = 23	p
Suomen tupakkalaki on liian ankara	26 (22—29)		41 (27—55)	0,017
Tupakointiin voidaan ratkaisevasti vaikuttaa terveysneuvonnalla	62 (59—65)		52 (42—63)	0,070
Tupakoinnin vastustustyö kuuluu hammashuollon tehtäviin	59 (55—63)		53 (42—64)	0,317

lon tehtävä. Hammashuoltajat ja hammashoitajat uskoivat sen sijaan hammaslääkäreitä enemmän yleisen terveysneuvonnan tehoon (**taulukko 3**).

Interventiokokeiluun osallistuminen oli yhteydessä ilmoitettuihin mielipiteisiin. Ne jotka olivat osallistuneet kokeiluun ja tehneet mini-interventioita, suhtautuivat selvästi muita myönteisemmin esitettyihin väittämiin. Vastaajan oma tupakointi heijastui selvästi asenteisiin koko tupakkaterveysneuvontaa kohtaan. Tupakoivien suhtautuminen tupakkalakiin oli kriittisempi kuin tupakoimattomilla.

Suun terveydenhuollon henkilöstön mielipiteet mini-interventiosta

Kahdeksan prosenttia vastaajista ilmoitti, että tupakointiin kohdistuva mini-interventio on täysin turhaa ja seitsemän prosenttia ilmoitti, että tupakoinnin tiedusteleminen potilaalta on kiusallista. Hampaiden värjäytyminen tupakoinnin seurauksena ja siihen vetoaminen kiinnosti vastaajien mielestä koululaisia. Vain neljä prosenttia oli täysin toista mieltä. Suun terveydenhuollon resurssien riittävyyttä tämänkaltaiseen tupakoinnin vastustamistyöhön epäiltiin. Resurssien riittävyydestä oli täysin samaa mieltä 35 % ja täysin eri mieltä 22 %. Ammattiryhmien välillä ei havaittu eroja suhtautumisessa mini-interventioon (**taulukko 4**). Interventiokokeilussa mukana olleiden mielestä tupakoinnista tiedusteleminen oli merkitsevästi helpompaa kuin kokeiluun osallistumattomien mielestä.

Vastaajan oma tupakointi heijastui selvästi myös mielipiteessä mini-interventiosta. Tupakoitsijoista yli puolet oli sitä mieltä, että mini-interventio on hyödytöntä, ja yli kolmasosan mielestä tupakoinnin kysyminen nuorelta on kiusallista (**taulukko 4**).

Kun avoimella kysymyksellä tiedusteltiin mahdollisia esteitä tai ongelmia mini-interventiokokeilun laajentamisessa koko Suomeen, tuli vastauksista esiin huoli ajan ja henkilökunnan puutteesta. Jotkut vastaajista näkivät ongelmana koulutuksen puutteen ja motivaation vähäisyyden.

”Terveyskasvatus ehkä tulisi rutiininomaiseksi, jolloin vaikuttavuus kärsii. Aikapulaa kokee monet hammashuollon työntekijöistä.”

”Riittääkö aika kyseiseen hommaan kaikilla? Tupakoivilla asenne hammashoitoon voi kärsiä, jos he kokevat valistuksen painostukseksi ja epämiellyttävänä.”

”Att själv orka motivera, år efter år. Och att kunna informera på ett sätt som går hem.”

”Toimenpiteen vaatima aika on pois muusta hammashoidosta. Pikkutarkka esteettisten seikkojen korostaminen synnyttäisi myös tarpeettomia oikomishoito tms. -paineita.”

Taulukko 4. Suun terveydenhuoltohenkilöstön mielipiteet mini-interventiota käsitteleviin väittämiin ammattiryhmän, interventioon osallistumisen ja oman tupakoinnin mukaan. Tuloksena esitetty janaindeksin keskiarvo (95 %:n luottamusväli), kun ”täysin samaa mieltä” sai arvon 100 ja ”täysin eri mieltä” arvon 0.

		Koulutus		
	Hammaslääkärit n = 135		Muu henkilöstö n = 124	p
Mini-interventio on turhaa touhua	32 (27—37)		31 (27—36)	0,849
Tupakoinnin kysyminen potilaalta on kiusallista	23 (19—29)		27 (23—32)	0,201
Hampaiden värjäytyminen kiinnostaa koululaisia	73 (69—76)		73 (69—77)	0,956
Hammashuollon resurssit eivät riitä tupakoinnin vastustamistyöhön	45 (40—50)		45 (40—61)	0,983
		Interventio		
	Osallistui n = 59		Ei osallistunut n = 193	p
Mini-interventio on turhaa touhua	36 (28—44)		31 (27—34)	0,215
Tupakoinnin kysyminen potilaalta on kiusallista	19 (14—25)		27 (23—31)	0,030
Hampaiden värjäytyminen kiinnostaa koululaisia	72 (69—79)		72 (69—75)	0,851
Hammashuollon resurssit eivät riitä tupakoinnin vastustamistyöhön	49 (40—57)		44 (39—48)	0,299
		Oma tupakointi		
	Ei tupakoi n = 235		Tupakoi n = 23	p
Mini-interventio on turhaa touhua	30 (27—33)		50 (36—65)	0,007
Tupakoinnin kysyminen potilaalta on kiusallista	24 (21—27)		38 (24—51)	0,051
Hampaiden värjäytyminen kiinnostaa koululaisia	73 (70—76)		69 (60—78)	0,378
Hammashuollon resurssit eivät riitä tupakoinnin vastustamistyöhön	45 (41—49)		44 (30—57)	0,828

Mini-interventiota tehneiden arvio menetelmän toteutuksesta

Mini-interventioon osallistuneet suun terveydenhuoltohenkilökuntaan kuuluvat ilmoittivat, että he olivat toteuttaneet mini-intervention vaiheet puutteellisesti; vaiheet eivät aina toteutuneet suunnitellulla tavalla (**taulukko 5**). Vastaajista 75 % oli sitä mieltä, että kysymys koululaisen tupakoinnista toteutui aina ja kahdeksan prosenttia oli sitä mieltä, että ei koskaan. Vastaajista 51 % ilmoittivat antaneensa aina positiivisen palautteen tupakoimattomuudesta. Valokuvasarjan tupakoinnin haitoista näytti 57 % aina. Vastaajien mukaan vain 34 % koululaisista tutki peilillä oman hampaistonsa aina tarkastuksen yhteydessä. Vain harvat (6 %) ilmoittivat, että he eivät toteuttaneet mini-intervention eri osia lainkaan.

Ammattiryhmällä (hammaslääkäri / muu henkilöstö) näytti olevan merkitystä mini-intervention vaiheiden toteutumisessa. Muu henkilökunta arvioi mini-intervention toteutuneen kaikilta osiltaan paremmin kuin hammaslääkärit arvioivat (**taulukko 5**). Erot eivät kuitenkaan olleet tilastollisesti merkitseviä. Tupakoijia oli suorittajissa niin vähän (kuusi), että arviota toteutuksesta ei tehty tupakoinnin suhteen.

Kaupunkien välillä havaittiin eroja vaiheiden toteutumisessa. Toteuttajien oman arvion perusteella intervention vaiheet toteutettiin tunnollisimmin Vaasassa, jossa vain koululaisten hampaiden näyttäminen peilin kautta toteutui muita kaupunkeja huonommin.

Tiedusteltaessa suorittajien kokemuksia mini-interventiosta avoimella kysymyksellä vastauksista tuli esiin menetelmän käyttökelpoisuus nopeana ja helppona tupakan vieroituskeinona. Negatiivisina piirteinä vastauksista nousivat epäily nuorten vastausten totuudenmukaisuudesta sekä ajankäyttöön liittyvät ongelmat:

"Nopea ja helppo tehdä. Jos yksikin jättää tupakoinnin kokeilun vuoksi, on se ollut järkevää."

"Kuvasarja oli tehokas nuorille. Samojen kuvien toisto vuosittain ehkä vähensi nuoren kiinnostusta asiaan."

"Vei aikaa, nuoret eivät ehkä vastanneet totuudenmukaisesti kysymyksiin."

Pohdinta

Säännölliset suun tarkastukset ja potilaskontaktit mahdollistavat myös muun kuin hampaisiin kohdistuvan terveysneuvonnan. Suomessa on otettu käyttöön lasten ja nuorten yksilölliset tarkastusvälit jo vuosia sitten. Kutsujärjestelmän toimiessa suunnitellusti tarkastusväli määräytyy arvioidun hammassairauksien riskin mukaan. Riskiyksilöt tarkastetaan muita useammin, ja kontaktien yhteydessä pystytään antamaan myös muuta terveysneuvontaa. Yksilöllisen tarkastusvälin idea ei ole vielä toteutunut täysin tyydyttävästi terveyskeskuksissa (3). Toisaalta osaa ikäluokasta ei tarkasteta, mikä saattaa heikentää suun terveydenhuollon mahdollisuuksia osallistua yleiseen ja kattavaan terveyskasvatukseen. Tämä ei ole ongelma, jos tarkastukset kuitenkin tavoittavat suurimmassa terveysvaarassa olevat riittävän usein. Tutkimuksessamme kaikkia mini-interventioon osallistuneita ei tarkastettu vuosittain, ja osa tutkitun ikäkohortin hävikistä johtui oppilaiden muuttamisesta toiselle paikkakunnalle tutkimusvuosien aikana.

Suun terveydenhuollon kaikissa ammattiryhmissä ollaan melko valmiita tekemään tupakointiin liittyvää terveyskasvatusta. Toteutusta voidaan parantaa valitsemalla tehtävään hyvin motivoituneet ja koulutetut henkilöt. Myönteisesti terveysneuvontaan asennoituvilla on motivaatiota tämäntyyppiseen toimintaan osana normaalia suun terveydenhuoltoa. Terveydenhuoltohenkilöstön oma tupakointi heijastuu selvästi asenteisiin ja toimintaan, joten henkilökunnalle tulisi ensimmäiseksi tarjota ja järjestää mahdollisuus tupakasta vieroitukseen.

Tutkimus antoi realistisen kuvan mini-intervention toteutuksen ongelmista. Menetelmään liittyviä ongelmia ei juuri ollut, mutta käytännön toteutuksessa havaitut motivaatiovaikeudet täytyy ottaa huomioon mietittäessä laajempia kokeiluja. Hyvin harva oli toteuttanut intervention kokonaisuudessaan, mikä heijastaa puutteellista sitoutumista tehtävään.

Intervention toteuttajien koulutusta tulee parantaa laadullisesti ja määrällisesti. Kontrolloiduissa tutkimuksissa, joissa intervention tekijöille on annettu runsaasti koulutusta, he ovat luottaneet paremmin kykyihinsä ja ovat olleet halukkaampia neuvomaan potilaitaan (16, 17). Selvityksissä on tosin havaittu, että koulutuksen lisääminen ei välttämättä paranna intervention tehoa, mutta neuvonnan määrää se lisää (18).

Vaikka lääkärin/hammaslääkärin tekemän lyhyen neuvonnan teho on ollut tutkimuksissa vain muutaman prosentin luokkaa, on sen kansanterveydellinen ja kansantaloudellinen merkitys väestötasolla erittäin huomattava. Tupakoinnin ehkäisyn velvoitteen kirjaaminen kaikkien terveydenhuoltojärjestelmässä toimivien asiaksi mm. Käypä hoito -suosituksessa edistää tärkeän asian muuntumista luontevaksi arkipäivän toiminnaksi. Toteutuksen ongelmis-

Taulukko 5. Mini-interventiota toteuttaneen suun terveydenhuoltohenkilöstön vastaukset kysymykseen: Toteutuiko kokeilussa mini-interventio ohjeissa kuvatulla tavalla? Tuloksena esitetty janaindeksin keskiarvot (95 %:n luottamusväli) ammattiryhmittäin jaoteltuna, kun "aina" sai arvon 0 ja "ei koskaan" arvon 100.

	Mini-intervention suorittaja		
	Hammaslääkäri n = 36	Muu henkilöstö n=23	p
Tupakoinnin kysyminen	20 (10–30)	14 (4—25)	0,402
Valokuvasarjan katselu	31 (19—42)	20 (9—30)	0,339
Oman hampaiston tutkiminen peilillä	51 (39—63)	41 (26—56)	0,445
Positiivisen palautteen antaminen	33 (23—42)	24 (13—34)	0,398

ta huolimatta menetelmää voi suositella kaikille vastaanotoille. Ottamalla huomioon tutkimuksessa havaitut ongelmat ja rajoitukset sekä kehittämällä menetelmää voidaan saada merkittäviä väestötason tuloksia.

Puutteellinen koulutus tai riittämätön laadun varmistusjärjestelmä selittänee kaupunkien väliset erot toteutuksessa. Terveyskeskuksen johdon tulisi ottaa vastuu ja sitoutua uskottavasti tavoitteisiin. Terveyskeskuksissa vallitseva hallinto- ja työkulttuuri vaikuttavat lopulta siihen, kuinka hyvin yhteisesti sovituista periaatteista ja hoitotavoista pidetään kiinni.

Avoimissa kysymyksissä tuli esiin ajankäytön ongelma. Työtahti terveyskeskuksissa on uuden lainsäädännön tuomien lisävelvoitteiden myötä kiihtynyt, ja vaatimukset työn tuottavuuden osalta terveyskeskusten suun terveydenhuollossa ovat kasvaneet (19). Hammaslääkärin kokonaistyöajasta mini-interventioon käytetty ajallinen uhraus on kuitenkin pieni.

Mini-interventiolla on suun terveydenhuollossa perinteiseen tupakoinnin vieroituksessa käytettävään terveysneuvontaan verrattuna huomattavia etuja. Se saavuttaa määräaikaistarkastuksissa nuoret hyvin, se on halpa menetelmä eikä tarvitse erillistä käyntiä. Lisäksi tiedetään, että suun terveyden riskipotilaat ovat myös tupakoinnin riskiyksilöitä. Ennaltaehkäisyyn ja hoitoon tulisi näillä potilasryhmillä kohdentaa enemmän voimavaroja.

Tiivistelmä

Tutkimuksen tarkoituksena oli seurata mini-intervention toteutusta nuorten tupakoinnin ehkäisyssä ja vieroituksessa normaalin järjestelmällisen suun terveydenhuollon osana. Mini-interventio kohdistui yhteen kokonaiseen ikäkohorttiin seurannan kestäessä kaksi vuotta. Toteutettavuutta mitattiin tiedustelemalla intervention suorittajilta mini-intervention eri vaiheiden todellista toteutumista hammashoitokäyntien yhteydessä. Mini-interventioon kuului neljä vaihetta: tupakoinnista kysyminen, positiivisen palautteen anto, valokuvien näyttäminen sekä nuorten omien hampaiden näyttäminen peilin kautta. Taustatiedoiksi kerättiin Pohjanmaalla suun terveydenhuoltohenkilöstön mielipiteitä ja asenteita tupakoinnista ja tupakointiin kohdistuvasta terveyskasvatuksesta.

Henkilöstö suhtautui periaatteessa positiivisesti tämäntyyppiseen toimintaan ja piti sitä järkevänä osana suun käytännön terveydenhoitoa. Ammattiryhmien välillä havaittiin joitakin eroja suhtautumisessa tupakointiin liittyviin väittämiin. Samoin henkilökunnan oma tupakointi heijastui suhtautumisessa projektiin sekä tupakointiin liittyviin väittämiin. Tutkimuksessa havaittiin selviä puutteita käytännön toteutuksessa. Kaikki mini-intervention vaiheet toteutuivat vain osassa käynneistä.

Menetelmän toteutettavuutta voitaneen parantaa kehittämällä henkilöstön omaa motivaatiota ja sitoutumista terveysneuvontaan, muokkaamalla mini-interventiomenetelmää sekä asettamalla toiminnalle laatukriteerit, joita seurataan terveyskeskuksen laadunvarmennusjärjestelmässä.

Smoking prevention among youth – feasibility of mini-intervention in oral health care

The aim of this study was to evaluate the real-life feasibility of a brief intervention method for use in dentistry, especially for use in prevention of smoking. The brief intervention was focused on one age cohort with a follow-up period of two years. Those who took part in the intervention measures were asked how well the different phases of the intervention had been implemented during their dental visits. The four stages of the brief intervention were: asking about smoking, providing positive feedback, showing photographs and looking at teeth with a mirror.

All employees of the municipal dental health service in the province of Ostrobothnia were also asked about their attitudes towards smoking-related issues and the kind of health education that should be given. The dental staff was mostly of the opinion that prevention of smoking is an important factor within dentistry. Certain interprofessional differences were noted in relation to theories concerning smoking, and it could be seen that the respondents' individual smoking habits were clearly reflected in their attitudes towards the project and towards smoking issues. Obvious defects were observed in the practical feasibility of the brief intervention method. This was probably due to insufficient implementation of the method by the administration and personnel.

The various phases of the brief intervention were carried out only partially during dental visits. The feasibility of the method can be improved by raising the self-motivation of the staff for health counselling. Feasibility will also be enhanced when quality standards for this kind of action are accompanied by quality assurance.

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Hyväksytty julkaistavaksi 18.9.2005

Pergamon

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ADDICTIVE BEHAVIORS

Addictive Behaviors 29 (2004) 405–411

Short communication

Verification of adolescent self-reported smoking

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Abstract

Smoking and the validity of information obtained on it is often questioned in view of the widespread belief that adolescents tend to under- or overreport the habit. The aim here was to verify smoking habits as reported in a questionnaire given in conjunction with dental examinations by asking participants directly whether they smoked or not and performing biochemical measurements of thiocyanate in the saliva and carbon monoxide in the expired air. The series consisted of 150 pupils in the ninth grade (age 15 years). The reports in the questionnaires seemed to provide a reliable estimate of adolescent smoking, the sensitivity of the method being 81–96%, specificity 77–95%. Biochemical verification or control of smoking proved needless in normal dental practice. Accepting information offered by the patient provides a good starting point for health education and work motivating and supporting of self-directed breaking of the habit.

Keywords: Smoking; Validation; Biochemical methods; Dentistry

1. Introduction

Prevention programmes on smoking and its effects are frequently evaluated on the basis of reports given by subjects themselves. This means in effect that the validity of information obtained is often questioned in the widespread belief that smokers tend to underestimate the amount that they smoke (Haley & Hoffman, 1985; DHHS Publication, 1990) or deny

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doi:10.1016/j.addbeh.2003.08.012

smoking at all (Luepker, Pallonen, Murray, & Pirie, 1989; Murray, O'Connell, Schmidt, & Perry, 1987).

Biochemical methods are frequently used to substantiate such reports, for example, by the measurement of cotidine in blood, urine or saliva samples, analysis of thiocyanate in saliva, or blood samples or monitoring of CO levels samples of expired air (Etzel, 1990; Jarvis, Tunstall-Pedoe, Feyeabend, Vesey, & Saloojee, 1987; Ruth & Neaton, 1991; Schwartz, 1987). Carbon monoxide displaces oxygen in the blood to form carboxyhaemoglobin (COHb), the level of which may be measured in blood or more easily in the breath, especially using modern CO analyzers (Ecolyzer, Nikomed EC-50). The alveolar carbon monoxide level is directly related to COHb, which is in turn related to smoking. The disadvantages of the method are the short half-life (3–4 h) and the fact that the analysis is sensitive to environmental influences, for example, second-hand smoking because of working conditions or traffic pollution, while its advantages lie in its low costs, the ease of performing the test, and the immediate feedback provided for the patient.

Measurement of thiocyanate is based on the presence of trace amounts of cyanide in tobacco. The analysis can be performed on urine or saliva samples, and it has the advantage of a long half-life (about two weeks), whereas the disadvantage is the possibility of error because fruits, nuts, and certain other foodstuffs may raise the thiocyanate level even in nonsmokers.

Nicotine and its derivate cotidine can be measured in blood, urine, or saliva samples. The weakness of nicotine is its short half-life (only about 30 min), so that cotidine, with a longer half-life, is a better marker of smoking. On the other hand, the measurement of cotidine is expensive, which argues against its extensive use.

Estimates of the reliability of self-reports on adolescent smoking have generally been quite high, 88–100% (Barnea, Rahav, & Teichman, 1987; Needle, McCubbin, Lorence, & Hochhauser, 1983; O'Malley, Bachman, & Johnson, 1983), and hence no correction is usually made for under- or overreporting.

It is highly valuable for a dentist to obtain reliable information on adolescent smoking by reason of the obvious and well-documented connection between smoking status and oral health (Gupta, Murt, Bhonsle, Mehta, & Pindborg, 1995; Johnson & Bain, 2000; McCann, 1989; Offenbacher & Weathers, 1985). Smoking prevention efforts in connection with dental examinations have in fact proved effective (Kentala, Utriainen, Pahkala, & Mattila, 1999).

The aim of this study was to verify adolescents' own reports on their smoking given in a questionnaire administered prior to their routine dental examinations and to test the associations between the various validation systems available.

2. Method

2.1. Participants

The series consisted of 150 young people in the ninth grade (6 randomly chosen classes) in the county of Vaasa, Finland. The pupils were aged of 15; 48% were girls.

2.2. Procedure

They were asked to complete a self-administered questionnaire on smoking before attending their annual dental examination. Smoking status was then ascertained by the dentist by asking whether the pupil smoked or not (standardized procedure). Prior to this question, they were informed of the verification procedures and their consent was received. Thereafter, samples were taken for the measurement of CO concentration (EC-50 Micro) and/or saliva thiocyanate. The validity of the questionnaire was assessed in terms of sensitivity and specificity. Initially, the dentist's question was taken as the 'gold standard.' Thereafter, the carbon monoxide reading and the saliva thiocyanate values were taken as the criterion. The cut-off point for CO was 4 ppm and that for saliva thiocyanate 1.5 mM/l. The cut-off points were determined according to the literature, taking to account the age of the pupils (Barnea et al., 1987; O'Malley et al., 1983; Pechacek et al., 1984). The equipment for measuring CO and thiocyanate was calibrated and the laboratory measurements were performed in an accredited laboratory. Twelve pupils had just eaten prior to attendance; they and eight other were excluded from the salivary analysis because of problems in salivary samples or laboratory processes. We had access to CO measuring equipment in only 105 of cases.

Statistical analyses were performed using the SPSS statistical program. Contingency coefficient analyses was used to test the relations between the verification methods. The results of the saliva thiocyanate and CO measurements were transformed to dichotomous form employing the abovementioned cut-off points. Regression analyses was performed to construct a model to explain smoking as reported in the questionnaire.

The study was approved by an ethical committee in Vaasa Health Centre.

3. Results

According to questionnaire responses, there were 32% smokers among the subjects (Table 1). The proportion was lowest measured by saliva and highest by the CO method.

The sensitivity and specificity values of the self-administered questionnaire verified somewhat when using different gold standards. When choosing the dentist's question about smoking as gold standard, very high sensitivity (0.96) and specificity (0.95) were reached. Taking biochemical measures as gold standard, a sensitivity of 0.83 and a specificity of 0.89 with CO and 0.81 and 0.77 with saliva thiocyanate was measured, respectively.

Table 1
Frequencies of smoking as measured by the different tests

Test	Valid (*n*)	Smokers (*n*)	%
Questionnaire	150	48	32
Dentist's question	150	51	34
CO measurement	105	33	31
Saliva	130	55	42

Table 2
The positive and negative predictive values of different verification procedures

Questionnaire	Positive predictive value	Negative predictive value
If golden standard is		
Dentist's question	0.90	0.98
CO measurement	0.76	0.93
Saliva	0.64	0.89
Dentist's question		
If golden standard is		
Questionnaire	0.96	0.95
CO measurement	0.82	0.92
Saliva	0.65	0.89
CO measurement		
If golden standard is		
Questionnaire	0.83	0.92
Dentist's question	0.82	0.92
Saliva	0.54	0.50
Saliva		
If golden standard is		
Questionnaire	0.81	0.77
Dentist's question	0.83	0.81
CO measurement	0.66	0.72

The positive predictive values for smoking in the questionnaire were 0.90 (dentist's question as standard), 0.76 (CO measurement as standard), and finally 0.64 when saliva thiocyanate analysis was taken as the true criterion of measurement (Table 2).

The most significant correlation between the verification methods was observed between the questionnaire and the dentist's question, while a clear correlation was also found between the CO concentration and the questionnaire. The two biochemical measures did not correlate so well however (Table 3). All correlations were statistically significant ($P < .001$).

Regression analyses showed that the dentist's question about smoking alone explained 95% of the reports of smoking in the questionnaires (Table 4). The combination of biochemical measurements in the same model gave only an explanation degree of only

Table 3
Correlations between the verification methods (contingency coefficients)

	Questionnaire	Dentist's question	CO measurement
Dentist's question	.667		
CO measurement	.577	.592	
Saliva thiocyanate	.486	.527	.339

Table 4
Regression models

Variable	Percentage of smoking explained by variable (%)	*B*	S.E.	Wald	*df*	Significance
Dentist's question (DQ)	95	6.09	0.86	50.86	1	<.001
CO measurement	88	3.73	0.62	36.70	1	<.001
Saliva thiocyanate	78	2.68	0.47	32.90	1	<.001
CO and saliva	84	3.45	0.71	23.95	1	<.001
Question + Saliva + CO	95	11.91	57.00	0.04	1	ns

Smoking as reported in the questionnaire as dependent variable.

84% and the combination of dentist's question and the biochemical measurements gave 95%.

4. Discussion

Finnish adolescents stand poorly in European comparisons: Smoking rates for 15- to 16-year-old boys and girls are among the highest. The self-reported frequency of smoking in the study population was also in relation to the Finland's results in cross-national surveys and national health behaviour analysis (King, Wold, Tudor-Smith, & Harel, 1996).

When comparing the biochemical test results with adolescent's reports on their smoking, it is possible to point to two major sources of disagreement: (1) error because of the biochemical measurements or their analysis and (2) occasional false reporting by the subjects. The error in a measurement or technique is often distributed symmetrically around the true mean, whereas human error is probably biased towards a socially desirable response (Murray, Connett, Lauger, & Voeker, 1993). We used the pipeline method in this study. The subjects were convinced that their self-reported tobacco use can be independently verified by a dentist by an objective measure of tobacco use.

What were the reasons for the present differences in sensitivity and specificity between the verification methods, and how can we obtain objective measurements of adolescent smoking? The carbon monoxide concentration was not taken alone as a gold standard because saliva thiocyanate is known not to give sufficiently reliable results in children, the level of false-positive findings being too high (Gillies, Wilcox, Coates, Kristmundsdottir, & Reid, 1982). Although the reliability of the method improves with age (Luepker et al., 1980), the proportion of false-positive cases in our material was still 7%. The problem with using carbon monoxide is its short half-life, so that the method describes only short-term smoking behaviour and gives an excessively high proportion of false negative findings.

There are difficulties in verifying smoking when young people are merely experimenting or smoking irregularly (Needle et al., 1983; Reinisch, Bell, & Ellickson, 1991), as sensitivity of the biochemical measurements is insufficient to yield reliable results. Validity can be improved by changing the cut-off values, and also by using the two methods in combination,

this will reduce the number of false-positive results. We also tested other, higher cut-off points, but the positive predictive value fell.

Whatever method is used to validate abstinence, one should bear in mind that taking blood samples is intrusive as far as a young person is concerned, the taking of a saliva or breath sample being least intrusive. Cotidine has been shown to be even more sensitive in detecting adolescent smokers, but in practice, breath samples have proved to be a simpler and much cheaper means of validating abstinence from smoking in follow-up studies (Murray et al., 1993).

It is needless to use biochemical verification methods in normal dental practice because the authority of the dental profession would seem to elicit reliable information on smoking. On the other hand, biochemical verification in the dental office may be useful for motivational and scientific purposes. Smoking is nowadays considered to be among the most important risk factors for many oral diseases, for example, periodontal disease. Hence, reliable anamnestic information on smoking habits is vital to the dentist in carrying out adequate dental work and health education with the patient.

Asking about smoking instead of otherwise controlling the habit is a clear sign of trust in the patient. It gives a good and stable basis for our efforts to motivate and support the patients in abandoning smoking.

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