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**Oral health behaviour, conditions and care
among dentate elderly patients in Lithuania:
preventive aspects**

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Academic dissertation

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*In the ancient is wisdom, and in length of days, prudence.
(Job 12: 12)*

*To Valerija and Alfonsas, my grandparents,
bright lights among the elderly*

LIST OF ORIGINAL PUBLICATIONS

- I.** S. Vyšniauskaitė, N. Kammona and M.M. Vehkalahti.
Number of teeth in relation to oral health behavior in dentate elderly patients in Lithuania
Gerodontology 2005; 22: 44-51.
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First-time dental care and the most recent dental treatment in relation to utilization of dental services among dentate elderly patients in Lithuania.
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ABSTRACT

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The present cross-sectional study aimed to assess oral health behaviour, dental and periodontal conditions, dental care, and their relationships among elderly dentate patients in Lithuania.

The target population in the study were dentate patients aged 60 and older attending public dental services in Kedainiai, Lithuania. The data collection took place between the autumn of 1999 and the winter of 2001. Data were collected by means of a self-administered questionnaire for all (n=174) and a clinical examination targeting about half of the subjects (n=100). The questionnaire inquired about oral health behaviour, the life-first and also the most recent dental treatments, sources on and self-assessed knowledge of oral self-care, a self-reported number of teeth, and socio-demographic information. The clinical examination included basic dental and periodontal conditions.

A total of 82 women and 92 men completed the questionnaire; their mean age was 69.2 and their average number of teeth was 16.2 (CI 95% 15.4-17.1). In all, 25% had 21 or more teeth and 32% indicated wearing removable dentures. The oral health behaviour, the participants reported, was poor: 30% reported twice daily toothbrushing, 57% responded that they always use fluoride toothpaste, 19% indicated daily interdental cleaning, nearly all said they take sugar in their coffee and tea, and 30% indicated going for check-ups. As the main source of information on oral self-care, the subjects indicated health professionals (82%), followed by social contacts (72%), broadcasted media (58%), and printed media (42%). A total of 34% assessed their knowledge of oral self-care as good, and their self-assessed knowledge correlated (r=0.52) with professional guidance they had received about oral self-care. In their most recent treatment, conservative (39%) and non-conservative (34%) treatments dominated, and preventive ones were the least reported (7%). Regarding guidance in oral self-care, 54% reported having received such about toothbrushing, 32% about interdental cleaning, and 33% had been given visual information. Clinical examinations revealed the presence of plaque, calculus, bleeding on probing and deepened pockets in all of the subjects; 70% of the subjects were diagnosed with pockets of 6mm and deeper, 94% with caries, and 73% with overhangs of restorations. Those subjects assessing their knowledge of oral self-care as good and reporting a higher intensity of guidance in oral self-care as received, indicated practicing the recommended oral self-care more frequently. Twice daily toothbrushing was associated with good self-assessed knowledge of oral self-care (OR 4.1, p<0.001) and a university education (OR 5.6, p<0.001). Those subjects with better oral health behaviour had a greater number of teeth. Having 21 or more teeth was associated with good self-assessed knowledge of oral self-care (OR 4.1, p=0.03). Better periodontal conditions were associated with a higher frequency of toothbrushing. The presence of periodontal pockets of 6mm and deeper was associated with the level of self-assessed knowledge of oral self-care being below good (OR=3.0, p=0.04) and the level of dental cleanliness being poor (OR=2.7, p=0.02).

To conclude, oral health behaviour and conditions call for improvement in elderly subjects in Lithuania. To improve the oral health of their elderly dentate patients, dentists should apply all the available tools of chair-side prevention and active guidance. The latter would be an effective means of updating the knowledge of oral self-care and supporting recommended oral health behaviour. A preventive approach should be strongly emphasized in countries with limited resources for oral health care, such as Lithuania.

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ABBREVIATIONS

ADA	American Dental Association
ANOVA	Analysis of variances
AAPD	American Academy of Paediatric Dentistry
CI	Confidence interval
CHX	Chlorhexidine
CPITN	Community Periodontal Index of Treatment Needs
DMFT	Decayed, missing or filled teeth
FDI	Federation Dentaire International (World Dental Federation)
FPD	Fixed partial dentures (also known as fixed dental prosthesis)
OR	Odds ratio
RCT	Randomized controlled trial
RPD	Removable partial dentures
SD	Standard deviation
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

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1. INTRODUCTION

The elderly population is growing fast, especially in most industrialized countries (Petersen & Yamamoto 2005, SHARE 2005). Lithuania holds the worldwide pattern of industrialized countries with seniors being a rapidly increasing segment of the population (Statistics Lithuania). The vast majority of the elderly are independent up to a very old age, and a minority are frail and functionally dependent.

Rates of edentulousness range from 6% to 78% worldwide (Petersen et al. 2005), but in industrialized countries an ever growing number of elderly retain an increasing number of their teeth. For functioning dentition, a minimum of 20 teeth has been suggested since the 1980s (Käyser & Witter 1985, Käyser 1981). It has been adopted as a goal by the WHO (1982) that more than 50% of those aged 65 and older possess at least 20 functioning teeth. Such a goal has been achieved in Sweden (Österberg & Carlsson 2007), Norway (Holst 2008, Henriksen 2004), and nearly in the UK (Kelly et al. 2000).

To guide the public in the maintenance of oral health, authorities in a number of countries issue recommendations. A large proportion of elderly subjects in industrialized countries follow such recommendations regarding twice daily toothbrushing, interdental cleaning, and going habitually for check-ups.

The dental profession faces a challenge to care for the increasing number of elderly. They are one of the priority groups emphasized by WHO (Petersen & Yamamoto 2005, Petersen 2003), that predominantly retain their own teeth, or their own teeth and dentures combined. The elderly prefer dental treatment that allows them to preserve their own teeth and, furthermore, keeps their teeth looking nice (Niessen 2000). Fillings and prosthetic therapy dominate in the treatment of the cumulative consequences of dental and periodontal diseases in the elderly.

In industrialized countries, chair-side prevention has been well incorporated into overall dental treatment, as both elderly subjects and their dentists report. Users of dental services should be aware of oral self-care, risks, and self-efficacy (Widström 2004). However, active preventive measures encouraging personal responsibility and active participation of elderly subjects in their oral self-care seem to be rare.

Knowledge of oral health-related aspects is rather uncommon in the new EU countries that had similar oral health systems in the past, but which are now undergoing development, such as in the three Baltic countries. In these countries, the bulk of population based data cover subjects only up to 64 years of age (Grabauskas et al. 2007, Pudule et al. 2007, Kasmel et al. 1999). Among those subjects aged 55-64 oral self-care habits are at a low level compared to the elderly in industrialized countries. As previously reported in Lithuania, oral self-care, the use of oral health care services among the elderly are below international recommendations, and the use of sugar is abundant (Abaravicius et al. 2008, Petersen et al. 2000, Aleksejunienė et al. 2000). The scarce data on those aged 65 and older reveal the majority of them having decayed teeth and periodontal pockets of 6mm and deeper (Skudutyte et al. 2001, Skudutyte et al. 2000, Aleksejunienė et al. 2000).

The present study aimed to assess oral health behaviour, dental and periodontal conditions, dental care, and their relationships, focusing on preventive aspects among elderly dentate patients in Lithuania.

2. LITERATURE REVIEW

2.1. Oral health behaviour in the elderly

Oral health behaviour refers to the subjects' oral self-care habits, such as toothbrushing, use of fluoride toothpaste, interdental cleaning, restriction of sugar use, and habitual dental attendance. The establishment of teeth cleaning behaviour in children is influenced by their parents' attitude towards toothbrushing for their children and their own oral hygiene habits (Okada et al. 2002). Favourable oral hygiene habits are easier to establish in childhood, and, when learnt early, are more change-resistant later in life (Kiyak 1996). Furthermore, dental care utilization patterns are learnt as early socialization (Ahacic & Thorslund 2008) and tend to continue into old age (Bomberg & Earnst 1986). Consequently, few of today's elderly in Lithuania and apparently in many other countries have established the recommended oral health behaviour as children.

Toothbrushing is a basic oral self-care method allowing effective control of plaque levels for prevention of caries and maintaining healthy periodontal conditions (Attin & Hornecker 2005, Sheiham 1970). Toothbrushing in the evening is emphasized to eliminate food remnants and to allow fluoride to be present for a prolonged period of time in the mouth when levels of saliva decrease (Attin & Hornecker 2005). Toothbrushing after a meal helps to prevent impaction of food during the daytime, and has been an acceptable habit to practice for the adult population in Japan (Kawamura & Iwamoto 1999). Consequently, toothbrushing in the evening and after a meal may be advised for elderly subjects, even though current recommendations focus on the frequency of toothbrushing.

The recommended frequency is brushing teeth on a twice daily basis (ADA 2007a, 2000, Loe 2000). In industrialized countries, from 40% to 97% of elderly subjects report following this recommendation compared to 21% in Lithuania (Table 2.1).

Table 2.1. Percentages of independent dentate elderly, reporting at least twice daily toothbrushing and daily interdental cleaning, according to population-based studies.

Country & year of study Publication	Age	n	Toothbrushing 2+/day (%)	Daily interdental cleaning (%)
Nordic countries				
Finland 2000 <i>Suominen-Taipale et al. 2008</i>	65+	964	40 (men) 69 (women)	n.a.
Denmark 2000 <i>Christensen et al. 2003</i>	65+	428	54	50 (toothpicks) 16 (floss)
Other industrialized countries				
UK 1998 <i>Kelly et al. 2000</i>	65+	669	67	16 (floss, 65-74yr) 12 (floss, 75+yr)
USA <i>Davidson et al. 1997</i>	65-74	1445	59-97	25-72 (floss)
Developing-economy countries				
China <i>Zhu et al. 2005</i>	65-74	3742	23	n.a.
Lithuania 1997-1998 <i>Petersen et al. 2000</i>	65-74	259	21	26 (toothpicks) 6 (floss)

Toothbrushing twice daily has become considerably more common among adult and elderly subjects in industrialized European countries during recent decades. In Finland, the change has been particularly noticeable among elderly women aged 65 and older: twice daily brushing has increased from 45% in 1980 to 69% in 2000 (Suominen-Taipale et al. 2008). Among adults in the UK the increase has been from 78% to 98% among women and from 64% to 74% among men between 1978 and 1998 (Kelly et al. 2000). In Lithuania, among those aged 55-64 twice daily brushing has increased from 30% to 39% among women but no improvement among men was seen (15% vs. 15%) in 1998-2006 (Grabauskas et al. 2007, 1999). No corresponding data are available for elderly subjects.

Toothpaste is the most common vehicle of daily fluoride application. The majority of elderly subjects use fluoride toothpaste: 76% in Finland and 63% in Lithuania (Suominen-Taipale et al. 2008, Petersen et al. 2000).

Interdental cleaning performed by means of dental floss, toothpicks, and interdental brushes, has been recommended daily (ADA 2000). Table 2.1 shows daily use of interdental devices, revealing the use of toothpicks among 50% of elderly Danes and dental floss among up to 72% of elderly Americans.

The detrimental effect of sucrose on dental health relates both to the frequency and quantity of consumption, with highly refined sugars being the most harmful in terms of developing caries (Moynihan 2005, Gustafsson et al. 1954). A general recommendation is restriction of sugary products to no more than four times per day, or less than 40g per day of "simple sugars" (Mobley 2003, WHO 2003). Use of sugar in coffee or tea is the most common way of its consumption between meals. In Finland, 53% of elderly women and 61% of elderly men report daily use of sugar in their coffee or tea (Suominen-Taipale et al. 2008). In the Baltic countries, 71% to 89% of those aged 55-64 take sugar in coffee or tea (Grabauskas et al. 2007, Pudule et al. 2007, Kasmel et al. 1999).

The interval of time since one's most recent dental visit is a common indicator to describe dental attendance (Nuttall 1997), and annual visits have been suggested as an acceptable indicator of appropriate use of dental care (Vargas et al. 2001). In recent decades use of dental services on a yearly basis has obviously increased among elderly subjects in industrialized countries. In Australia such an increase has been from 54% to 68% between 1987-88 and 2004-2006 (Spencer & Harford 2007), among the USA elderly from 15% in 1950 to 55% in 2003 (Brown 2008), and in Finland from 30% in 1980 to almost 60% in 2000 (Suominen-Taipale et al. 2008). In Lithuania, the corresponding changes from 1998 to 2006 among those aged 55 to 64 show an increase from 58% to 67% for women, but for men, a decrease from 54% to 42% (Grabauskas et al. 2007, 1999).

Presently, the differences in the use of dental services remain remarkable between industrialized countries and those with developing economies. Of the dentate 65-74-year-olds in the population study in the UK, 74% report having seen a dentist within one year (Kelly et al. 2000) and 85% in the regional study in Southern Sweden report having gone to a dentist within the previous year (Bagewitz et al. 2002). In comparison, only 23% of those aged 65-74 in China (Zhu et al. 2005), and 42-44% in Lithuania see a dentist annually (Petersen et al. 2000, Aleksejuniene et al. 2000).

Going for dental check-ups is an indicator of the individual's habitual dental attendance, being a recommended habit with the only variation between countries being its frequency. According to population studies, 68% of the elderly subjects in the UK and 50% in Finland employ such a habit (Suominen-Taipale et al. 2008, Kelly et al. 2000). In Denmark, 66% of those aged 65-74 report that going to see a dentist within five years is considered regular attendance for them (Petersen et al. 2004). In the Osaka region of Japan, 33% of elderly subjects report going for check-ups (Ikebe et al. 2002), but only 1% do so in China (Zhu et al. 2005).

2.2. Dentition status in the elderly

Oral health status in the elderly reflects cumulative outcomes of oral health behaviour, diseases and their treatments during one's life span. Nowadays it is increasingly common that the elderly retain most of their teeth presenting a challenge for oral self- and professional care to maintain their dentitions for a whole lifetime.

Presence of teeth

The presence of teeth is a basic measurement of oral health among adults and the elderly (Whelton & O'Mullane 2007, Consensus workshop 2004). The average number of teeth and having 20 or more teeth are common indicators of an individual's dentition. WHO and FDI have set the goal for the oral health of those aged 65 and older to achieve so that there are at least 50% with 20 and more teeth by the year 2000 (WHO 1982). Among elderly subjects edentulousness varies considerably worldwide reaching as high as 78% in Bosnia and Herzegovina. In Lithuanian elderly edentulousness appears to be low (14%) among those aged 65-74 (Petersen & Yamamoto 2005).

The number of teeth in adult and elderly subjects of industrialized countries is on a steady increase, being an average of two teeth per 10 years (Suominen-Taipale et al. 2008, Österberg & Carlsson 2007, Kelly et al. 2000). The average number of teeth among the elderly in industrialized countries varies between 12.6 and 21.0 (Table 2.2). Corresponding information for developing countries is rather scarce. In China, 65-74-year-olds possess on average 18.4 teeth (Wang et al. 2002). Lithuanian data on elderly present a median of 15 teeth (Aleksėjuniene et al. 2000).

Having 20 or more functioning teeth describes functional dentition, without the need for prosthetic rehabilitation (Meeuwissen et al. 1995, Leake et al. 1994, Witter et al. 1994, Käyser 1990, Käyser & Witter 1985, Käyser 1981), if such dentition also satisfies the patients' esthetics. Among elderly subjects, having 21 and more teeth and no RPD indicate overall satisfaction with their dentition and problem-free eating (Steele et al. 1997a).

Despite the goal of at least 20 functional teeth, set by WHO, its database offers no corresponding information. According to research articles, in industrial countries 29% to 65% of the elderly have such a dentition (Table 2.2). Information for lower-economy countries and those with developing oral health systems is not available.

Table 2.2. Mean number of teeth (NoT) and percentages of those having 20 and more teeth (20+T) among independent dentate elderly in population-based studies.

Country & year of study Publication	Age	n	Mean NoT	20+T %	Study description
Nordic countries					
Finland 2000 <i>Suominen-Taipale et al. 2008</i>	65+	812	15.3	39	clinical data
Norway 2002 <i>Holst 2008</i>	60+	783	n.a.	52	interviews and questionnaires (16% edentate)
Sweden 2001 <i>Österberg & Carlsson 2007¶</i>	70	484	21.0	65	clinical data (7% edentate)
Denmark 2000-2001 <i>Kristrup & Petersen 2006</i>	65-74	290	20.0	n.a.	clinical data
Norway 1996-1997 <i>Henriksen 2004</i>	67+	394	17.2	49	clinical data
Denmark 2000 <i>Petersen et al. 2004</i>	65+	2976	n.a.	31	interview (36% edentate)
Other industrialized countries					
USA 1999-2004 <i>Dye et al. 2007</i>	65-74	3539	18.9	n.a.	clinical data
UK 1998 <i>Kelly et al. 2000</i>	65-74	456	18.2	46¶¶	clinical data
Switzerland <i>Schürch jr. & Lang 2004</i>	60-64	365	17.6	n.a.	clinical data
Germany 1997-2001 <i>Mack et al. 2003¶</i>	60-64	1397	12.6	29	clinical data
Japan 1992 <i>Fukuda et al. 1997¶</i>	50+	1248	20.3	n.a.	clinical data

¶ regional study

¶¶ reported 21+ teeth

Dental caries

Despite the general trend of decline in the occurrence of caries among adults in industrialized countries, such a decline is least pronounced in elderly subjects (Brown 2008, Suominen-Taipale et al. 2008, Kelly et al. 2000). The presence of caries is still a public health concern, particularly in less developed countries and in underprivileged groups, such as the elderly (Petersen & Yamamoto 2005). Dental caries is a major threat for tooth loss in the elderly, accounting for up to 60% of extractions (Saunders & Meyerowitz 2005, Fure 2003). For the elderly, the incidence of caries seems to be high: a Swedish follow-up study reports that 95% of them develop caries over a 10-year period, being more prevalent with increasing age (Fure 2004, 2003). An incidence study from Australia reports 67% of the elderly having developed coronal caries and 59% root caries within five years (Thomson et al. 2002). In Japan, 36% of the elderly have developed root caries within the space of two years (Takano et al. 2003). Root caries occurs in 12%-40% of elderly subjects, according to population and regional studies (Dye et al. 2007, Imazato et al. 2006, Shah & Sundaram 2004, Mack et al. 2004, Kelly et al. 2000).

Caries is a multifactorial disease with important risk factors in the elderly being fermentable carbohydrates, plaque, especially in the presence of restorations and prosthesis, decreased dexterity and saliva secretion, and the use of medications (Curzon & Preston 2004). Modification of these factors alleviates the burden of the disease. Good oral hygiene by means of toothbrushing and fluoride allows converting root caries from being active to inactive (Nyvad & Fejerskov 1986). Consequently, those brushing their teeth more frequently (Imazato et al.

2006, Steele et al. 2001, DePaola et al. 1989, Vehkalahti & Paunio 1988) or avoiding frequent intake of sugar (Steele et al. 2001, Vehkalahti & Paunio 1988) have less root caries.

A description of caries indicating decayed (D), missing (M), or filled (F) teeth (DMFT) reflects the cumulative nature of the disease. According to the WHO data bank, the mean DMFT for those aged 65 and older varies between 15.8 in Thailand to 25.5 in the Czech Republic, and 22.3 in Lithuania (WHO Area Profile Programme). However, this index may be less informative due to the general decline of caries in populations, and less accurate to describe dental conditions in adult and elderly populations (Brown 2008, Chattopadhyay et al. 2008, Whelton & O'Mullane 2007). An accepted way of defining the occurrence of caries in adults and the elderly is as the presence of clearly cavitated teeth with softened dentine (WHO 1997). Population-based data on the occurrence of untreated caries (decayed teeth DT>0) among independent elderly are shown in Table 2.3.

Table 2.3. Percentages of independent dentate elderly with untreated dental caries (DT>0), according to population-based studies.

Country & year of study Publication	Age	n	% DT>0
Nordic countries			
Finland 2000 <i>Suominen-Taipale et al. 2008</i>	65+	964	51 (men) 30 (women)
Norway 1996-1997 <i>Henriksen 2004</i>	67+	394	30
Other industrialized countries			
UK 1998 <i>Kelly et al. 2000</i>	65+	484	48
USA 1999-2004 <i>Dye et al. 2007</i>	65-74	3539	17
Germany, Pomerania <i>Mack et al. 2004¶</i>	60-69	611	15 (men) 10 (women)
Developing countries			
India, Delhi <i>Shah & Sundaram 2004¶</i>	60+	1052	64

¶ regional study

Periodontal conditions

Periodontitis is regarded as a chronic inflammatory disease with the destruction of tissues surrounding the teeth. Although a number of systemic, local, behavioural, and social risk factors modify the disease, the presence of dental plaque on the one hand is crucial in initiating inflammatory mechanisms of periodontitis and the host's response on the other (Kornman et al. 1997, Offenbacher 1996). The response in the elderly is often immune-compromised (Fransson et al. 1999, 1996, Holm-Pedersen et al. 1980, 1975), but, on the contrary, McArthur (1998) has stated no defects in the immune system of the elderly for periodontal pathogens.

Periodontal diseases with their chronic inflammatory nature develop gradually, predisposed by the presence of plaque and calculus, as gingivitis (Corbet 2007). Gingivitis is a mild expression of periodontal disease which has been experimentally proven in humans in the 1970's (Löe et al. 1965). Compared to young adults, gingivitis in the elderly may be more severe, develop faster with plaque accumulating at higher rates and the differences in the microbial composition tending toward more severe inflammation (Holm-Pedersen et al. 1975).

Of adults in industrialized countries, 20-90% suffer from gingivitis (Albandar & Rams 2002). Periodontitis affects 13-35% of adults, 5-8% having severe forms of the disease (Sheiham & Netuveli 2002, Albandar et al. 1999, Hugosson et al. 1998). In the elderly, periodontal disease is widespread (Yoneyama et al. 1988) affecting as many as 70% (Petersen & Yamamoto 2005).

A common measurement of periodontal findings is the WHO Community Periodontal Index of Treatment Needs (CPITN) with measurements by sextants (Ainamo et al. 1982). The scoring is as follows: 0 healthy periodontal conditions, 1 gingival bleeding, 2 gingival bleeding and calculus, 3 shallow periodontal pockets 4 to 5 mm, and 4 deep periodontal pockets 6 mm and deeper. A number of population-based studies report findings, such as percentages of those having at least one tooth affected by deepened pockets of 4-5mm or 6mm and more. Measuring periodontal findings varies from two to six sites per tooth as half-mouth or full-mouth recordings. According to the WHO, the variation in the occurrence of deepened pocketing among the elderly is wide: 2% to 40% CPITN score 3 as the maximum and 5% to 53% have the score of 4 (WHO Periodontal Country Profile). Table 2.4. shows data from population studies on the elderly describing the occurrence of deepened pockets as 4mm and deeper, and 6mm and deeper.

Table 2.4. Periodontal pocketing in independent dentate elderly (%), according to population-based studies.

Country & year of study Publication	Age	n	Subjects (%) with deepened pockets	
			4mm+	6mm+
Nordic countries				
Finland 2000 <i>Suominen-Taipale et al. 2008</i>	65+	964	70	31
Denmark 2000-2001 <i>Kristrup & Petersen 2006</i>	65-74	290	62 4-5mm only	20
Other industrialized countries				
USA 1999-2004 <i>Dye et al. 2007</i>	65-74	3539	18 4-5mm only	6.5
Germany 1997-2001 <i>Mack et al. 2004 ¶</i>	60-69	611	71 women 85 men	24 women 44 men
UK 1998 <i>Kelly et al. 2000</i>	65+	384	67	15
France 1995 <i>Bourgeois et al. 1999</i>	65-74	483	29 4-5mm only	3
Countries with developing economies				
Lithuania 1997 <i>Skudutyte et al. 2001</i>	65-74	268	20 4-5mm only	75
Bulgaria 1999 <i>Yolov 2002</i>	60+	497	45 4-5mm only	18

¶ regional study

Factors predisposing periodontal conditions

Population-based studies report high levels of dental plaque in adults, with the highest in the elderly. Occurrence of visible dental plaque varies between 60% to 78% among those aged 65 and older in Finland and the UK (Suominen-Taipale et al. 2008, Kelly et al. 2000). In the elderly, a large area with gingival recession can be considered as a risk factor for abundant plaque collection. Calculus indirectly affects periodontal conditions acting as a dental plaque retentive factor (Albandar 2002, Sheiham & Netuveli 2002). It is commonly present in the elderly: 78% of elderly subjects have calculus in the UK, and nearly 90% in the USA (Kelly et

al. 2000, Fox et al. 1994). Overhangs of restorations are a risk factor for plaque accumulation, and are most common among the elderly due to the burden of their life-long restorative treatment. Half of the elderly aged 75 and older in the Helsinki Aging Study have been diagnosed with interproximal overhangs (Soikkonen et al. 1998). Their presence correlates with radiographical infrabony pockets, furcation lesions (Soikkonen 1999), and alveolar bone height in adults (Albadar et al. 1987).

2.3. Sources of information and knowledge of oral self-care

Sources of information

Dentists in particular and dental teams in general are the main authorities for the public to gain knowledge of oral health-related issues. Dentists' recommendations are influential in the patient's willingness to engage in treatment (Gilmore et al. 2006), and the majority of adult and elderly patients wish to receive oral health education from their dentists (Abrams et al. 1992). Overall trust in dentists among elderly subjects may be reflected in their positive attitude towards dentists' professional skills and satisfaction with the quality of their services, as is indicated by a Lithuanian study (Petersen et al. 2000). Of the lay population in Australia including the elderly, 65% report private and 20% school dentists as the sources of preventive information (Roberts-Thomson & Spenser 1999), but in China 21% (Zhu et al. 2005). According to the Swedish regional study, the dental team constitutes the main source of information for the lay population of various ages (Hugoson et al. 2005).

Physicians and other health professionals see their elderly patients more frequently than do oral health professionals (SHARE 2005), suggesting that other health personnel could potentially provide the elderly subjects with relevant information to support them in oral self-care. However, the data revealing such a trend are rare: of Chinese adults 15% report gaining information through visual aids in hospitals (Zhu et al. 2005).

Social contacts are important in acquiring information about oral health among adults of various ages. Half of the subjects of the adult lay population in Australia, including those aged 60 and older, report friends and family to be important in gaining preventive information (Roberts-Thomson & Spenser 1999). Friends and relatives appear important sources for Swedish young adults (Hugoson et al. 2005). In Norway, 28% of women and 15% of men among adults report having communicated with friends on oral health matters within the previous six months (Rise & Sögaard 1991).

The media play an increasing role in dissemination of health-related information. Of the lay population, 84% in Australia and 30% in China mention printed media as the source of information on oral health (Roberts-Thomson & Spenser 1999, Zhu et al. 2005). Of the oral health-related articles in five main Japanese newspapers, 48% have underlined the importance of diet, 41% plaque control, and 30% fluoride in caries prevention (Abe et al. 2005).

Leaflets are a simple way to spread oral health-related knowledge and they can be easily accessible to the public; however, the challenge is to properly address the older subject. Generally, the contents of oral health-related leaflets are to present information that is evidence-based, relevant, clear, enhanced with illustrations. However, caution should be used to avoid the possibility of passing on incorrect information (Abe et al. 2005).

Broadcasting sources such as TV and radio are of increasing importance for spreading knowledge of oral self-care. Almost half of the adult lay populations in Australia and China report receiving information on oral health by these means (Roberts-Thomson & Spenser 1999, Zhu et al. 2005). Broadcasting may provide preventive oral health information for the elderly subjects due to present day accessibility of TV and radio, and the fact that an older audience is widely exposed to it. Printed and broadcasted media when combined as leaflets, newspapers, TV, and radio messages have been shown to be effective in increasing correct periodontal health-related knowledge among adult patients in Norway (Rise & Sögaard 1988), and those aged 50-75 in Sweden (Mårtensson et al. 2004). The further challenge in media-based education is developing oral self-care skills (Rise & Sögaard 1988). Furthermore, Kay & Locker (1998) conclude that there is no evidence of mass media programmes significantly altering oral health-related outcomes.

The internet offers a modern way to successfully provide oral health-related information and seems to be on the increase. This appears to be especially relevant among older subjects in more well-off countries. In Japanese elderly, a survey of a home telecare programme examined such a method. It was found to be helpful for home-dwelling elderly men and their caregivers to gain knowledge about skills, diet, and motivation to perform oral hygiene procedures (Tomuro 2004). However, dental professionals remain important guides for their patients to search and evaluate the specific information on the internet, such as that related to periodontal health (Chesnutt 2002).

Knowledge regarding oral self-care

Knowledge is a prerequisite for making informed oral health-related decisions on a personal, group, community, or governmental level (Friedman & Atchinson 1993). Oral health-related knowledge of lay populations, including the elderly, has been studied by asking them to choose from a list of items of the causes and prevention of oral diseases (Schwarz & Lo 1994), by asking questions about the causes of oral diseases (Mariño et al. 2005), by asking them to rank preventive measures in order of importance (Roberts-Thomson & Spenser 1999), or to agree or disagree with given statements (Petersen et al. 2000).

A population study from the 1970s on adult Finns reveals that 65-77% of them have reported knowing the role of oral hygiene in the etiology and 73-83% in the prevention of caries and gingivitis (Murtomaa 1977). Four regional cross-sectional Swedish studies at 10-year intervals (Hugoson et al. 2005) confirm the population being knowledgeable about the etiology of dental diseases. In China, 67% of adults are knowledgeable about the harmfulness of sugar in developing caries (Zhu et al. 2005). In Lithuania, 81% of the elderly recognize the detrimental effect of sweet products on teeth (Petersen et al. 2000). The awareness regarding their own self-care possibilities to prevent dental and gum diseases consists primarily of toothbrushing, as 84-91% of the elderly subjects report in Lithuania and Australia (Petersen et al. 2000, Roberts-Thomson & Spenser 1999). In Sweden, all patients aged 38-78 undergoing periodontal treatment demonstrate substantial knowledge of the etiology of periodontitis and the contribution of negligent oral self-care to development of the disease (Karlsson et al. 2009). The extensive periodontal specialist treatment they have undergone can explain the excellent awareness in this group.

Traditional oral health-related knowledge such as toothbrushing and sugar restriction seems to be well known among today's elderly. However, knowledge of modern aspects of prevention,

such as fluoride, the role of plaque, or preventive check-ups, seems to be less evident. The elderly in many countries lack awareness of caries preventive fluoride vehicles such as toothpaste or fluoridated water (Zhu et al. 2005, Petersen et al. 2000, Roberts-Thomson & Spenser 1999). The importance of oral hygiene is known among 8% of Chinese aged 65-74 (Zhu et al. 2005). Australian elderly consider visiting a dentist as a means of prevention of caries and gum diseases (Roberts-Thomson & Spenser 1999). On the contrary, Lithuanian elderly relate their visit to a dentist apparently as a means of solving their oral health problems (Petersen et al. 2000).

Population-based knowledge does not always correspond to that of scientific evidence (Kim 1998, Horowitz 1995) and people may misunderstand the preventive power of oral self-care practices. Many misunderstandings and under- or over-valuation of oral self-care and prevention possibilities remain common in the elderly regarding the role of mouth rinses, diet, the inevitability of periodontal disease, and tooth loss when aging (Karlsson et al. 2009, Zhu et al. 2005, Roberts-Thomson & Spenser 1999). In Japan, 70% of employees assume that tooth brushing cannot prevent gum disease and 50% that fluoride prevents periodontal disease (Kawamura & Iwamoto 1999). In Finland some 30 years ago 11% of adults assumed that toothpicks could cause gingivitis (Murtomaa 1977). Patients with a low literacy level tend to have incorrect knowledge (Jones et al. 2007) challenging dentists to adequately address their needs.

Together with a range of social and environmental factors, knowledge may influence and modify oral health-related behaviour, and conditions. Better knowledge has been related to improvement in oral health behaviour among young adults (Yalcinkaya & Atalay 2006, Laiho et al. 1991), and adults in general (Keogh & Linden 1991). Corresponding knowledge on elderly subjects is very scarce. Elderly people with a low level of knowledge about the etiology of periodontal disease have the highest CPITN scores (Kiyak et al. 1998). Elderly subjects with a higher level of knowledge more frequently report having used dental services within the previous year (Mariño et al. 2005). Knowledge of current recommendations, together with positive attitudes and a self-identity of being a healthy eater is important in explaining the consumption of the recommended amounts of fruits and vegetables among dental clinic patients aged 45-80 (Bradbury et al. 2008).

2.4. Dental treatment experiences

During the childhood and early adulthood of today's elderly, the number of oral health professionals was limited, unevenly distributed and dental services were not widely available in most countries. In Lithuania, less than 600 professionals practiced dentistry by 1938 indicating a population ratio of 1:4900 (Aidai 2008, Balciuniene 1998). In Finland, the dentist-population ratio was 1:4000 in 1940 (Statistics Finland). In Japan, only a minority of subjects aged 65-80 report frequent dental visits before the age of ten (Fukuda et al. 1997). In Denmark, on the contrary, elderly subjects report attendance of school dental services as children (Petersen et al. 2004).

The American Academy of Paediatric Dentistry (AAPD) and American Dental Association (ADA) underline the importance of prophylaxis' application and the provision of recommendations on oral care from infancy (ADA 2007b, AAPD 2005). In some countries,

such as Finland, an application of the preventive approach is required by law (Primary Health Act 1972). However, the elderly today have had no systematic prevention as children and adolescents, due to both the scarce availability of preventive measures and the rare practice of adequate self-care in general at that time. As adults, today's elderly experienced rather minor prevention since the provision of oral health education, increasing oral health knowledge and improving oral health behaviour seem to have remained deficient among lay populations over decades (Murtomaa 1977). Instead, restorative treatments and extractions have dominated, and, as a consequence, the elderly have accumulated the heavy burden of disease and its treatments both as children and adults.

In-office prevention

Prevention in dental care has gained acknowledgment with an ever increasing emphasis on the future (Eklund 1999). Restorative treatment alone fails to address the true etiological factors of caries and periodontal disease and is not enough to combat these diseases (Sheiham 1997). As is seen in the elderly, restorative treatment also fails to assist in adopting a healthier behaviour, such as eating the recommended amounts of fruits and vegetables (Bradbury et al. 2006). Preventive dental treatments, incorporated into the comprehensive dental care for children and young adults over decades in the Nordic countries, have obviously been successful (Nordblad et al. 2004, Marthaler 2004). Consequently, preventive treatments should be also incorporated as part of dental treatment for the elderly at every dental visit. However, the role of oral self-care, dentist-visiting habits and professional preventive measures maintaining oral health, have been emphasized mainly for young subjects and adults, who are, of course, the future elderly.

Preventive treatment emerges as an essential part of dental care for the elderly since it aims at the elimination or at least control of the reasons for dental diseases. A 15-year follow up study in Australia suggests a general trend of increase in the provision of preventive measures for elderly patients (Brennan & Spencer 2003). However, prophylaxis and topical fluoride appear to be applied much less for those aged 65 and older compared to younger adults or children. In Japan, dentists offer preventive services for a smaller proportion of their elderly patients than for adults (Kawamura et al. 1998). Canadian dentists report some prevention being provided during a three-year period for 23% of those aged 50 and older (Locker 2001).

According to dentists' reports, in Australia about 19% of all services for adults, including the elderly, appear preventive within 100 visits (Brennan & Spencer 2006). In the USA, 24% of services for those aged 65 and older during 2005-2006 were prophylaxis (Brown 2008). In the Netherlands, dentists report that 70% of the treatments for their patients during a one year period consist of prevention, oral hygiene, X-rays, and consultations (Bruers et al. 2005). A corresponding share of time that professionals spent at performing prevention for their adult patients ranges between 12% in the USA during one year's time (Brown & Lazar 1998) to nearly half of all the time during two consecutive working days in Canada (Backer et al. 1990). Adults, including the elderly, in Finland and the UK have pointed out that oral hygiene instructions comprise a very minor proportion of their routine dental treatments (Suominen-Taipale 2008, Kelly et al. 2000). In Japan, more than half of working age adults report never being taught professionally how to clean their teeth (Kawamura & Iwamoto 1999). The extent of preventive dental treatments for the elderly varies, depending on whether dentists or the elderly report (Table 2.5).

Table 2.5. In-office preventive measures, reported by elderly subjects as received and by dentists as provided, in population-based studies.

Country & year of study Publication	Age	n	Elderly receiving prevention (%)
Reported by elderly (the most recent care)			
Finland 2000 <i>Suominen-Taipale et al. 2008</i>	65+	964	68 scaling and polishing 23 fluoride varnish 6 toothbrushing instructions
Lithuania 1997-1998 <i>Petersen et al. 2000</i>	65-74	259	11 tooth cleaning 15 oral hygiene instructions 1 fluoride application
UK 1998 <i>Kelly et al. 2000</i>	65-74	431	54 scaling and polishing 44 toothbrushing instruction 33 interdental cleaning instruction
Reported by dentists			
Canada 1989 (baseline) <i>Locker 2001</i>	50+	408	23 prevention (over the three-year period)
Japan 1995 <i>Kawamura et al. 1998</i>	65+	329	9 removal of plaque and calculus (over 2 consecutive days)
Canada 1989 (baseline) <i>Leake et al. 1996</i>	50+	444	76 prevention (over the two-year period)

Conventional dental treatment

The European Consensus Workshop on oral health indicators lists 16 alternatives to describe treatment received at the most recent dental visit (Consensus Workshop 2004). The definition of the procedures of restorative, prosthetic, and surgical treatments vary among countries (Suominen-Taipale et al. 2008, Brenan & Spenser 2006, Bruers et al. 2005, Kelly et al. 2004, Locker 2001, Kawamura et al. 1998, ADA 1972). Generally, diagnostic and preventive treatments form their own categories in all reports. Prevention usually covers removal of plaque and calculus, fluoride therapy, and counseling on oral self-care whereas diagnostics cover examinations and radiographs, restorative treatment fillings, root canal treatment and fixed prosthesis.

Today it is a well-acknowledged fact that dentate elderly need extensive and complicated treatment (Dolan & Atchinson 1993) to maintain dentitions, as their own teeth or their own teeth with dentures.

Restorative treatment for elderly subjects ranges from fillings to prosthetics. The bulk of research on treatment for elderly subjects has been concentrated on prosthetics, probably due to its importance in rehabilitation of mastication and appearance. The use of fixed partial dentures (FPD) in the treatment of the elderly has steadily increased during the past decades. In Sweden, prescriptions of FPD for 70-year-olds have increased from 26% to 78% during the past three decades (Österberg & Carlsson 2007). Patients prefer FPD to removable partial dentures (RPD) (Wöstmann et al. 2005, Jepson et al. 2003). A proportion of the elderly will, however, remain in need of RPD (Wöstmann et al. 2005). Such treatment well restores proper mastication, function and is a relatively cheap solution. Table 2.6 presents an overview of dental treatment for elderly subjects.

Table 2.6. Types of dental treatments reported by elderly subjects as received and by dentists as provided, in population-based studies.

Country & year of study Publication	Age	n	Diagnostics (%)	Restorative treatment (%)	Dentures & extractions (%)
Reported by elderly <i>(the most recent care)</i>					
Finland 2000 <i>Suominen-Taipale et al. 2008</i>	65+	964	87 examination 27 X-rays	59 fillings 12 endodontics 9 crown or bridge	13 dentures 17 extractions
UK 1998 <i>Kelly et al. 2000</i>	65-74	431	22 X-rays	25 fillings 5 crowns	12 partial denture 20 extractions
Lithuania 1997-1998 <i>Petersen et al. 2000</i>	65-74	259	43 examination 11 X-ray	32 fillings 9 endodontics 25 crown or bridge	33 removable denture 44 extractions
Reported by dentists					
Japan 1995 <i>Kawamura et al. 1998</i>	65+	329	13	20 fillings 12 endodontics	32 prosthetics 3 oral surgery (two consecutive days)
Canada 1991 <i>Leake et al. 1996</i>	50+	444	96	74 fillings 11 endodontics 4 bridge	15 removable denture (two-year period)

Provision of oral health care in Lithuania

In Lithuania, dental manpower has been on a steady increase; between 2000 and 2008 such an increase has been reported regarding dentists (2650 vs. 3010), hygienists (40 vs. 261) and dental assistants (890 vs. 1722); the dentist and population ratio being 1:1396 in 2000 and 1:1118 in 2008 (Kravitz & Treasure 2008, GDS International 2004). Oral health services are available in public clinics and increasingly in private ones. In private dental clinics patients pay fully out of their own pockets. Older Lithuanians preferably visit public dental clinics (Pūriene et al. 2008). Treatments in public dental services are financed by the Sick Fund of the State Social Insurance Fund, and are completely free-of-charge for all under age 18, adult patients paying only small fees for filling materials. Pensioners (aged 60 and older) and disabled subjects are eligible for the free-of-charge prosthetic treatment. Due to the high number of elderly subjects and limited resources, waiting lists for prosthetic treatment are commonly long. In Lithuania, recalls for check-ups are not the rule. Patients book dental appointments themselves, and, even highly educated middle-aged subjects, rarely report going habitually for check-ups (Sakalauskiene et al. 2009). To record oral health status and treatments, no uniform documentation exists nationwide.

2.5. Prevention of oral diseases in the elderly

Dental caries and periodontal disease are among the most common diseases in the elderly. These diseases are bacterial in nature, but related to behaviour, and are preventable irrespective of the patient's age (Lamster & Crawford 2008, Brunton 2003). Prevention of these diseases among older subjects emphasizes elimination of plaque retentive factors, fluoride treatment, counselling on oral hygiene and diet (Curson & Preston 2004, Axelsson et al. 2002).

Theoretical basis for dental prevention

Primary prevention (WHO) aims at forming healthy dental habits in individuals through adoption of proper oral health behaviour from birth. Actions are taken before the onset of a disease to prevent individuals from falling into risk groups. Secondary prevention aims at changing behaviour in order to achieve disease inactivity in subjects who have adopted unhealthy behaviour. Actions cover screening and early identification of disease and interventions to arrest its progress and reduce risk factors. Tertiary prevention aims at treating disease results and encouraging change of behaviour. This includes treating disease, preventing its recurrence and minimizing disease effects on function and activity.

The main strategies in prevention are population-based and high-risk based approaches. Population strategy aims at the whole community to control diseases. High-risk strategy supplements population strategy, aiming to identify most-at-risk individuals and targeting additional prevention for them. It is suggested that these strategies be combined in order to achieve the best outcomes rather than be applied separately (Pine & Haris 2007). Such a combination of the whole population approach with the sub-population approach to improve environment and living conditions that would lead to habits conducive to oral health has been recommended for low-income countries (Baelum et al. 2007).

The common risk approach focuses on several behavioural risk factors such as hygiene and diet which are frequently causes of oral and other chronic diseases and are often found in the same subjects (Sheiham & Watt 2000). Baelum et al. (2007) have suggested how dental health goals could be integrated into general health goals in low income countries, based on Health and the Millenium Development Goals by WHO (Health and the Millenium Development Goals)

Encouraging individuals to adopt healthier lifestyles is essential in health promotion (Ottawa Charter 1986). This would include initiating a public health policy, creating a supportive environment, strengthening community action, developing personal skills, and re-orienting health services. On the basis of the Ottawa Charter, a geriatric oral health promotion matrix has been developed as a framework for promotion and education, according to the older individual's functional dependency (Chalmers & Ettinger 2008).

Individual-dependent measures: oral self-care

Active preventive measures by subjects cover oral health-maintaining behaviour. Recommended oral self-care consists of toothbrushing twice daily, use of fluoride toothpaste, daily interdental cleaning, and avoidance of sugar (ADA 2007a, van Loveren & Duggal 2004, Brunton 2003, Mobley 2003, Loe 2000, ADA 2000).

Mechanical cleaning

Toothbrushing twice daily with fluoride toothpaste is an established cornerstone in oral self-care helping to reduce or eliminate caries and to maintain hygiene consistent with periodontal health (Murray & Steele 2003). The modern concept of plaque biofilm strongly advocates mechanical plaque removal due to bacteria that is protected by the surrounding matrix (Thomas & Nakaishi 2006, Marsh 2005). Elderly subjects may benefit from powered toothbrushes since those with oscillating rotation reduce plaque and gingivitis better than manual ones, according to systematic reviews (Dreery et al. 2004, Sicilia et al. 2002). Such toothbrushes are suitable for individuals with suboptimal plaque control and higher risk for caries and periodontal disease (Loe 2000), thus naturally for the elderly.

Interdental cleaning supplements toothbrushing by helping to clean otherwise hard-to-reach places by means of dental floss, interdental toothpicks and brushes. Interdental brushes seem to be more effective than floss, and the routine recommendation for use of floss lacks scientific evidence; triangular wooden toothpicks show their effectiveness in reducing bleeding if there is inflammation but not for the presence of visible interdental plaque, according to the recent systematic reviews (Hoenderdos et al. 2008, Slot et al. 2008, Berchier et al. 2008). Effective interdental cleaning is generally a demanding procedure even for adults, and may be particularly challenging for elderly subjects to perform, thus any particular cleaning method should be advised individually, according to the capability of the older person.

Fluoride and chemical agents

Toothpaste is the most preferred vehicle of fluoride application which has contributed to the decline of caries in industrialized countries (ten Cate 2004, Bratthal et al. 1996). Effectiveness of fluoride toothpaste is supported by evidence including randomized clinical trial (RCT) in adult and elderly populations (Jensen & Kohout 1988). In elderly subjects with a high risk of developing caries, conventional 1100 ppm fluoride toothpaste could be replaced by 5000 ppm which has been shown to be effective in RCT for the reversion of root caries (Baysan et al. 2001, Lynch & Baysan 2001). Minimal post-brushing rinsing should be advised since it affects the anticaries efficacy of toothpaste (Sjögern & Birkhed 1993). However, long-term evidence of the importance of fluoride toothpaste is based mainly on studies for age groups other than the elderly (Twetman et al. 2003).

Rinses containing sodium fluoride, as a rule 0.05%, being traditionally prescribed for children (Kumar & Moss 2008), have also been shown to be effective in reducing the incidence of coronal and root caries among elderly subjects (Fure et al. 1998). Fluoride rinse has been advised in xerostomic patients as a fluoride retention vehicle (Billings et al. 1988). However, evidence is lacking on the effectiveness of fluoride mouth rinse to prevent caries in older adults due to the confounding role of the use of other fluorides, according to the systematic review (Twetman et al. 2004). In Australian elderly, the use of fluoride rinses is on the decline due to the availability of a high concentration of fluoride in toothpastes (Chalmers 2006). Fluoride tablets have shown the potential of being effective for treating root caries (Arneberg et al. 2005, Stephen 1993), and both coronal and root caries in the elderly (Fure et al. 1998).

Chlorhexidine (CHX) is available as 0.12% and 0.2% solutions. Application of a spray containing 0.2% CHX once daily has been shown to be as effective as a twice daily application in reducing plaque accumulation and gingival inflammation in elderly subjects (Clavero et al. 2003). However, a number of reports conclude that there is a lack of evidence to support a claim that CHX rinses prevent caries in elderly subjects (Wyatt et al. 2007, Wyatt & MacEntee 2004, Powell et al. 1999). Consequently, a recent review recommends no use of CHX rinses due to the absence of long-term clinical evidence and to numerous side effects (Autio-Gold 2008). A clinical trial in adults with reduced salivary secretion has revealed anticaries properties of casein-binded amorphous calcium phosphate (Hay & Thomson 2002); such a product may be recommended for the elderly undergoing polypharmacy treatment.

Avoidance of sugar

Beginning as early as 1954, there has been evidence that the restriction of sugar use is very effective in preventing caries (Moynihan 2005, Gustafsson et al. 1954). However, due to the effect of fluoride, the relationship nowadays is stated to be weaker (Zero 2004). The current recommendation of a safe use of sugar relates to less than 15-20 kg per capita per annum of “free sugars” and their limitation to four meals per day (Moynihan 2005). This is particularly relevant in cases with increased oral clearance time, such as in the elderly. In the elderly and adults the association of frequent intake of sugar and the presence of root caries has been documented (Steele et al. 2001, Vehkalahti & Paunio 1988). Among elderly subjects, an additional potential danger related to sugar use can be the increasing use of medications and energy supplements containing sugar (Maguire & Baqir 2000).

Xylitol is a comparatively new sugar product with the potential of reducing levels of *S. mutans* by inhibiting its metabolism and adherence to teeth (Maguire & Rugg-Gunn 2003). Chewing gum with CHX and xylitol has been documented as effective in reducing plaque scores in institutionalized elderly (Simons et al. 2001). However, such use is restricted only to those elderly who can chew properly. In addition, possible gastrointestinal side-effects, the absence of recommendations regarding the effective dose for elderly subjects, and the expense of sufficient daily amount may limit the use of xylitol in the elderly.

Dental attendance

The venue for prevention can include dental and medical offices, old people’s homes and residential care settings (Chalmers 2003, Choo et al. 2001). Elderly persons can be reached through community groups, various services, governmental organizations, families, and caregivers. Actions via these groups may have an influence on geriatric oral health issues (Chalmers & Ettinger 2008).

Recommendations issued for the public in industrialized countries by authorities underline the importance of seeing a dentist regularly for check-ups (CDA, NHS, NICE 2004). Fixed recall intervals for all patients are lacking evidence (Beirne et al. 2005, Davenport et al. 2003), and individual needs-related intervals are recommended. The available recommendations cover mostly children but not the elderly. In Finland, intervals of 1.5-2 years between examinations are suggested for children and adolescents at low caries risk (Lahti et al. 2001). In the UK, The National Institute for Health and Clinical Excellence (NICE) recommends that risk-based individual recall intervals be between 3 to 12 months for those aged below 18, and between 3 to 24 months for those aged 18 and older (NICE 2004). In Norway, 12-24 months and longer recall intervals are recommended for those aged 20 and older (Wang et al. 1992).

Dental office as a setting for prevention

Dental offices are natural locations for individual prevention. Dentists have the trust of their patients and the ethical duty to strive for the promotion of oral health (Ottawa Charter 1986). In Finland, oral health education is fundamental in public dental care (Primary Health Act 1972). Dental professionals possess a large set of preventive measures and can motivate and support an individual to actively take part in his or her oral self-care, or passively apply clinical preventive measures to an individual (Vehkalahti 1997, Silversin & Kornacki 1984). Consequently, active and passive measures should be incorporated into routine dental treatment to assist an individual to practice adequate oral self-care, have motivation to see a dentist, and undergo professional measures for the maintenance of oral health.

Active professional prevention

To support and keep a patient highly motivated, professional guidance should be on a regular basis, individualized, needs-related, and provide feedback on the patient's improvement during regular dental visits (Yamalík 2005, Axelsson et al. 2004, Løe 2000). Guidelines for the elderly should be presented in such a way that the individual's capabilities are taken into account. Advice should be simple and allow enough time for the patient to absorb the information (Choo et al 2001, Newton 1995). Promoting oral health among the elderly seems to be successful if it is culturally relevant, with easily understandable print and in one's native language. Offering an interactive approach combining the information given along with the development of skills and discussion in small groups has proven to be effective (Mariño et al. 2005, 2004).

Chair-side education undergoes criticism regarding its effectiveness on behaviour change, long-term improvement in oral hygiene, and gingival bleeding (Watt & Mariño 2005, Kay & Locker 1998, 1996). The feasibility of educational interventions in real clinical settings with the clinician involved (Renz et al. 2007, Phillippot et al. 2005), costly dentists' manpower, coverage of only a limited target group, possible conflicting messages from different health professionals, not involving the community (Watt & Fuller 2007), and even a possible increase of inequalities (Watt & Sheiham 1999) are some of the concerns that have been raised.

Group-based interventional studies have been successful in increasing knowledge, dental visits, and improving self-care skills in elderly subjects (Mariño et al. 2004, Little et al. 1997, Schou & Locker 1994). At the dental office, an important part of a routine dental treatment is individualized instruction, showing oral self-care items, and providing an elderly patient with visual information or samples of oral hygiene devices. Despite the fact that such face-to-face oral health education should be part of routine dental treatment for elderly patients, data on the activity of dentists in this area are very limited.

Passive professional prevention

Scaling and cleaning aim at removing supra- and subgingival plaque and calculus, and are important for professional prevention of both dental caries and periodontal disease (Pattison & Pattison 2006). Evidence supports the effectiveness of mechanical cleaning in terms of reducing gingivitis, probing depth and clinical attachment level (Tunkel et al. 2002, van der Weijden & Timmerman 2002). Comparable results have been obtained whether ultrasonic, sonic or manual techniques were used, or whether supra- or subgingival prophylaxis was performed, as shown by systematic reviews (Heasman et al. 2002, Tunkel et al. 2002). There is a lack of scientific evidence on performing professional mechanical cleaning at fixed intervals. Intervals for professional tooth cleaning should be risk-based and individualized (Løe 2000).

Professional use of fluorides is based on a patient's risk assessment (ADA 2007a, Hawkins et al. 2003). Fluoride varnish (22 600ppm) and gel (12 000ppm) provide high concentrations of fluoride to the tooth surface for a prolonged period of time, supporting remineralisation and inhibiting demineralisation. Use of fluoride gel is on the decrease along with the increasing availability of toothpastes with a high concentration of fluoride (Chalmers 2006, Saunders & Meyerowitz 2005).

Fluoride varnish has been proven to be effective in children and adolescents (Kumar & Moss 2008, Petersson et al. 2004). Fluoride varnish has been successfully used to prevent root caries in adults (Schaeken et al. 1991) and its use has been recommended based on the risk assessment (ADA 2007a, Weintraub 2003). Fluoride varnish is especially effective for the elderly due to the ease of its application, the low frequency of its use, good toleration results, the low risks of swallowing (Hawkins et al. 2003, Weintraub 2003), and that there is no need for previous professional prophylaxis (Saunders & Meyerowitz 2005). Fluoride varnish is routinely applied in the Nordic countries but not in Lithuania.

CHX applications in the form of 1% and 10% gel and varnish alone, have been shown to be effective in inhibiting caries, and especially for the prevention of secondary caries (Wallman & Birkhed 2002, Banting et al. 2000). They have proven to prevent root caries when combined with fluoride varnish (Brailsford et al. 2002). However, chlorhexidine-thymol varnish has shown no effect in reducing plaque and gingivitis in the elderly (Clavero et al. 2006). A review by Autio-Gold (2008) states that clinical evidence on the use of CHX gel and varnish is inconclusive, and should not be recommended in caries prevention, as based on current evidence.

TO SUMMARIZE:

Nowadays a broad range of measures leading to better oral health is available under the umbrella of prevention (Murray & Steele 2003). Caries and periodontal diseases are preventable; however, the body of evidence relates to age groups other than the elderly. Proper oral self-care and going for check-ups remain the key-measures of active prevention among elderly subjects. Toothbrushing twice daily with fluoride toothpaste and avoidance of sugar are the evidence-based means of oral self-care for various age groups. For elderly subjects, these means may be modified, such as preferring a higher fluoride concentration in toothpaste. For elderly subjects, individualized intervals of scaling, cleaning, and fluoride varnish applications may be even more important than for younger subjects. The provision of oral health-related guidance for elderly patients on a regular basis presents a challenge for dental professionals as the main source of such information. Preventive measures have been included in routine care for elderly subjects in the Nordic and other industrialized countries. According to the scarce reports from Lithuania and other countries, now undergoing changes in their oral health care, the preventive approach seems to be limited, particularly in the dental care of the elderly.

3. AIMS OF THE STUDY

3.1. Working hypotheses

The study was based on the working hypotheses that better oral self-care among elderly subjects correlates with higher levels of self-assessed knowledge of oral self-care and with a higher intensity of professional guidance received. It was also hypothesized that better dental and periodontal conditions in elderly subjects correlate with better oral health behaviour and a higher level of self-assessed knowledge of oral self-care among this age group.

3.2. General aim

The general aim of the present study was to assess oral health behaviour, dental and periodontal conditions, dental care, and their relationships, focusing on preventive aspects among elderly dentate patients in Lithuania.

3.2. Specific aims

The following specific aims were set

- to assess oral health behaviour among elderly dentate patients
- to assess their dental and periodontal conditions
- to investigate their sources and self-assessed knowledge of oral self-care
- to investigate the contents of their dental treatments

4. MATERIAL AND METHODS

4.1. General description of the study

The present survey is part of a co-operative Finnish-Lithuanian project, started in 1999. The cross-sectional survey included a questionnaire on oral health behaviour, self-assessed knowledge and sources of information about oral self-care, dental treatment received, and clinical examination, covering basic dental and periodontal conditions. The study was approved by the Ethics Committee of The Institute of Dentistry, University of Helsinki.

The data collection took place between the autumn of 1999 and the winter of 2001 in Kėdainiai, an average-sized city with about 65 000 inhabitants in the city and surrounding countryside. Lithuania is one of the three Baltic countries (Figure 4.1) and has a population of 3.4 million, those aged 60 and older comprising 21% of it (Statistics Lithuania). Lithuania has been ranked by the World Bank (2007) as an upper-middle-income economy country.

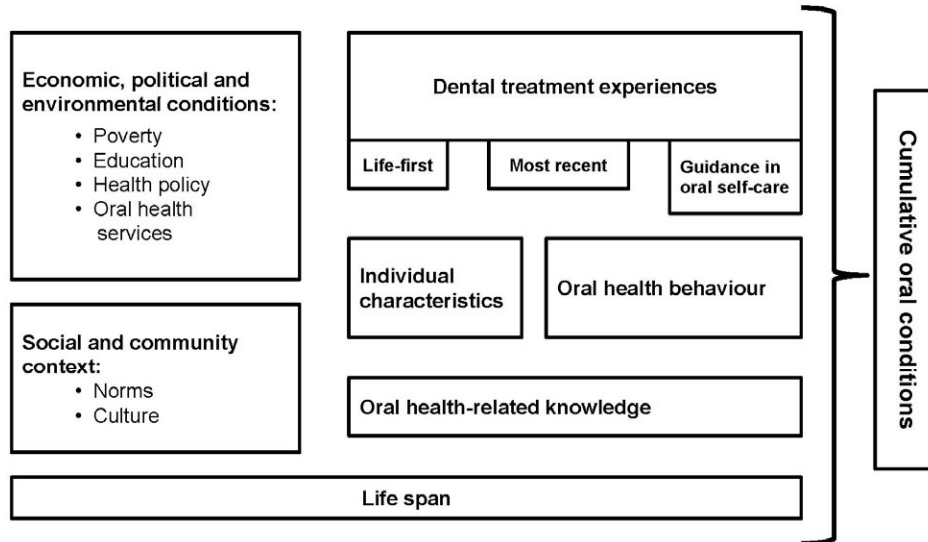


Figure 4. 1. Location of Lithuania in Europe.

4.2. Theoretical framework

The theoretical framework of the present study (Figure 4.2) was developed on the basis of the conceptual model of the factors affecting the oral health status of an individual (Chen 1995) and the social determinants of oral health summarized by Watt and Fuller (2007). According to the present framework, an older subject's oral conditions are cumulative during his or her life span. Oral conditions of an elderly subject are influenced by individual characteristics, oral health behaviour, knowledge of oral self-care, and life-long dental treatment experiences. The framework assumes that oral health behaviour and conditions may be modified through increasing knowledge and by providing various dental treatments, including guidance in oral self-care. Further, these actions take place within the broad social, economic, political, and environmental context.

Figure 4.2 Theoretical framework of the study, modified from Watt & Fuller (2007), and Chen (1995), explaining factors contributing to cumulative oral conditions and oral health behaviour in elderly subjects.



4.3. Study population

The target population consisted of dentate patients aged 60 years and older at two public dental offices. Such patients were asked to give their verbal consent to participate in the study, being assured that they would remain anonymous in regard to their personal data. Collection of the data took place only on days with somewhat lighter appointment schedules at the dental offices to give the respondents all the assistance they needed. On average, three to four such days per month were available.

The questionnaire data were originally intended to be collected from about 200 subjects and a clinical examination to be performed on half of those answering the questionnaire. The respondents filled in a questionnaire during their visit to the dentist. Of all the subjects asked, 15 to 20 refused to participate excusing themselves as being too old, too tired, unwilling or not interested in taking part in any research. In all, 174 subjects filled in the questionnaire of which 100 underwent a clinical examination (Table 4.1).

Table 4.1. The studied subjects by gender and age.

Data sets	All	Gender		Age (years)	
		Women	Men	60-69	70-85
Questionnaire Papers I-III	174	82	92	98	76
Clinical examination ¹ Paper IV	100	47	53	57	43

¹ After the questionnaire: targeted for half of those filling in the questionnaire

4.4. Questionnaire

The two-page questionnaire in English (Appendix 1) was discussed within the research group and afterwards translated into Lithuanian. The questionnaire inquired about oral health behaviour, received dental treatments, sources and self-assessed knowledge of, and professional guidance in oral self-care; in addition, an inquiry was made about the subjects' basic socio-demographic characteristics. The questions were mainly based on population studies in Finland (Vehkalahti et al. 1991) and in the UK (Todd & Lader 1991), and some new items were developed for the present study.

Oral health behaviour

Questions regarding oral self-care covered toothbrushing frequency and timing, the use of fluoride toothpaste and sugar, and interdental cleaning. The question: "How often do you brush your teeth?" offered five answer alternatives, and were later categorized into three: twice daily or more (more often than once a day), once daily (once a day), and less frequently (weekly, less frequently, and never). The timing for toothbrushing was inquired about separately, offering five options: in the morning, in the evening, before a meal, after a meal and before socializing. The frequency of interdental cleaning was to be chosen out of five alternatives, later categorized into three: daily (once a day, more often), seldom (weekly, less frequently), and never (never).

The question inquiring about the frequency of using fluoride toothpaste, which is most prevalent on the Lithuanian market since 1990s, offered five answer alternatives, later categorized into: always (always), almost always (almost always), and less frequently (occasionally, seldom, and never).

The subjects were questioned about the use of sugar by asking the number of teaspoons or lumps per cup of coffee or tea, and categorized as none, one, two, or more teaspoons or lumps.

Recommended oral self-care was defined as tooth brushing twice daily, the use of fluoride toothpaste always, and avoidance of sugar (ADA 2007a, van Loveren & Duggal 2004, Mobley 2003, Loe 2000, ADA 2000).

Regarding visits to the dentist the subject was asked to give an accurate answer as to the year and month of the most recent dental visit, categorized as: within one year, more than one up to two years, more than two up to four years, and more than four years.

Habitual dental attendance was inquired about by asking: “Do you visit a dentist for check-ups even if you do not have any problems or toothache?” The answer alternatives were: yes annually, yes once every two years, yes more seldom, no never. The answers were dichotomized as going for check-ups or not.

Sources of information on oral self-care

To the question “What are your sources of information about oral self-care?” the respondents were offered a list of 16 options to mark all possible sources. Later these sources of information were grouped into:

- health professionals (dentist, dental hygienist, physician, nurse)
- social contacts (friends, relatives, social workers, shop assistants, clubs)
- printed media (newspapers, magazines, printed ads, books)
- broadcasted media (radio, TV)

Self-assessed knowledge of oral self-care

The respondents were asked to assess their knowledge regarding oral self-care as one of these six alternatives: excellent, very good, good, average, poor, no knowledge. Later these alternatives were categorized into three levels of knowledge: good (excellent, very good, good), moderate (average), and poor (poor, no knowledge). For further analysis, self-assessed knowledge was dichotomized as good (excellent, very good, good) and below good (average, poor, no knowledge).

Dental treatment experiences

Regarding the most recent treatments the subjects were asked to mark all the dental treatments they had received out of 16 options. All the treatments were later grouped into four categories: diagnostic, preventive, conservative, and non-conservative (Table 4.2). The categorization of treatments was modified from previous classifications (Brown & Lazar 1998, Ahlberg et al. 1997, ADA 1972). Dental treatment experience was presented as the distributions of subjects with each treatment they had received, and the frequency of each type of treatment.

Table 4.2. Classification of treatments reported by dentate elderly patients that were received during the most recent treatment course.

Categories of treatment	Contents of treatment
Diagnostic	<ul style="list-style-type: none"> • Clinical examination • Radiography
Preventive	<ul style="list-style-type: none"> • Cleaning or scaling • Polishing of fillings • Fluoride varnish
Conservative	<ul style="list-style-type: none"> • Filling therapy • Endodontics • Fixed prosthesis (crown and bridge)
Non-conservative	<ul style="list-style-type: none"> • Tooth extraction • Acute treatment • Surgery on teeth and gums • Removable prosthesis and/or repair

Professional guidance in oral self-care

Respondents were asked about the guidance they received by the following question: "How has your dentist guided you in oral self-care?", separately for each of 17 different items. These were later grouped as the following six aspects describing active professional prevention:

1. Toothbrushing (whether the dentist told or showed how to brush, gave a toothbrush, or recommended any particular toothpaste)
2. Interdental cleaning (whether the dentist told or showed how to clean or gave a device for interdental cleaning)
3. Home use of fluorides (whether the dentist recommended fluoride pills or rinsing)
4. Dietary advice (whether the dentist recommended xylitol chewing gum or gave any dietary advice)
5. Dental attendance (whether the dentist recommended a check-up visit or a professional tooth cleaning)
6. Visual aids regarding oral conditions, treatment and oral self-care (whether the dentist gave a brochure on oral self-care, showed pictures of oral diseases and treatment options, or showed the patients' own radiographs)

Within these six aspects, professional guidance was described as percentages of the subjects that had ever received any items of guidance. Further, it was analyzed as the intensity scores. Each of the 17 items offered three alternatives as answers, with later given scores as follows: 2=yes, recently, 1=yes, previously, 0=never. These scores were summed (theoretical range 0-34). According to the distribution of the summed scores, the intensity of professional guidance was classified, into high (score 6 and more), moderate (3-5), low (1-2), and none (0). The intensity of professional guidance was also described as the mean of the summed scores of professional guidance per subject.

Socio-demographic background and self-assessment of dentition

Background information covered the respondents' age as year of birth, which was then categorized into the age groups of 60-69, and 70 and older, the subject's gender, and education attained. The amount of education received by the subject was listed in the questionnaire as less than primary, primary, secondary, or university. Later the three following categories were formed: low (up to 4 years, including primary and less), medium (totalling 11 years, including secondary), and high (totalling 16 years and more, including university) levels. For further analyses, education was dichotomized as university, and less than university. In addition, the respondents were asked to report their number of teeth and the presence of removable dentures, both separately for the upper and lower jaw. The number of teeth was analyzed using the following cut-offs: 21 and more, 16-20, and less than 16.

4.5. Clinical examination

A clinical examination took place in a dental chair, using a standard operating light, a dental mirror and a WHO probe. No cleaning of teeth preceded the clinical examination. Table 4.3 shows the recorded measurements of dental conditions.

Table 4.3. Measurements of dental conditions in dentate elderly patients (n=100).

Condition	Recording
Number of teeth	By tooth group, separately for molars, premolars and anterior teeth
Presence of removable dentures	0=no, 1=partial denture, 2= full denture, by jaw
Presence of fixed prostheses	Yes or no; any crown and/or bridge
Presence of caries	Present or absent by tooth; as a clear cavitation (WHO 1997)

Table 4.4. Measurements of periodontal conditions in dentate elderly patients (n=100).

Indicator	Target teeth and sites	Scores
Dental plaque¹	<ul style="list-style-type: none"> • most distal upper molar, buccal surface • most distal lower molar, buccal and lingual surfaces • upper lateral incisor, labial surface • lower canine, labial surface 	0 = clean 1 = only by probe on gingival margin 2 = visible on gingival margin 3 = abundant, covering most of the tooth surface Scored by surface
Calculus²	<ul style="list-style-type: none"> • upper molars, buccal surfaces • lower premolars, lingual surfaces • lower incisors, lingual surfaces 	0 = none 1 = supragingival 2 = supra-and/or subgingival Scored by type of tooth
Deepened periodontal pockets²	<ul style="list-style-type: none"> • upper molars • upper premolars • lower premolars • lower molars <p>four measurements per tooth: mesio-, mid-, and distobuccal, and midlingual/palatal</p>	0 = no deepened pocket 1 = at least one pocket 4-5mm 2 = at least one pocket 6mm+ Scored by type of tooth
Overhangs of restorations²	<ul style="list-style-type: none"> • upper molars • upper premolars • lower premolars • lower molars 	0 = no overhang 1 = one or more overhangs Scored by type of tooth
Bleeding on probing²	<ul style="list-style-type: none"> • upper molars • upper premolars • lower premolars • lower molars 	0 = no bleeding 1 = bleeding on one or more sites Scored by type of tooth

¹ Modified from Silness and Løe (1964); ² The highest score described the status in each type of teeth

Periodontal findings were recorded as half-mouth excluding third molars. Findings of first and third quadrants were recorded for patients entered into the database by odd numbers, and of second and fourth quadrants for patients entered by even numbers. Table 4.4 gives details of the measurements of the periodontal findings.

The descriptive analyses for all periodontal findings were based on the maximum values per subject. Further, to obtain a more detailed picture of the severity of the findings of dental plaque, calculus, and deepened periodontal pockets in the present elderly subjects with varying numbers of missing teeth, these findings were also shown as mean values of the scored recordings per subject.

4.6. Statistical analysis

The basic descriptive statistics included chi-square tests for evaluation of the differences in the frequencies and t-test and ANOVA, in the mean values. For the mean values, their 95% confidence intervals (95% CI) were calculated. For showing the relationship between two variables at a time, the correlation coefficient was estimated.

The logistic regression models analyzed the relationships between selected variables, simultaneously controlling for other factors in the model. The estimates of the fitted models served for calculations of odds ratios (OR) and their 95% CI.

5. RESULTS

5.1. Oral health behaviour (I, II)

Table 5.1. Oral health behaviour among Lithuanian dentate elderly patients (n=174) according to age, gender and level of education.

Aspects of oral health behaviour	All (n=174) %	Age		Gender		Level of attained education		
		60-69 (n=98) %	70+ (n=76) %	Women (n=82) %	Men (n=92) %	Low (n=53) %	Medium (n=82) %	High (n=39) %
Tooth brushing								
Twice daily or more	30	39	20	39	23	11	26	67
Once daily	37	41	31	33	40	27	47	28
Less frequently	33	20	49	28	37	62	27	5
		p<0.001		p=0.07		p<0.001		
Time of brushing								
In the evening	45	57	30	54	37	28	43	74
		p<0.001		p=0.02		p<0.001		
Time of brushing								
In the morning	79	86	70	80	77	66	82	90
		p=0.01		p=0.62		p=0.02		
Time of brushing								
After eating	17	19	16	24	12	21	13	21
		p=0.63		p=0.05		p=0.46		
Interdental cleaning								
Daily	19	25	11	23	14	9	21	26
Seldom	47	44	50	46	48	47	46	28
Never	34	31	39	31	38	44	33	46
		p=0.06		p=0.29		p=0.17		
Use of F toothpaste								
Always	57	67	43	62	52	38	54	87
Almost always	30	29	33	28	33	35	38	10
Less frequently	13	4	24	10	15	27	8	3
		p<0.001		p=0.32		p<0.001		
Sugar in coffee/tea								
None	8	9	5	12	3	2	5	21
One lump/teaspoon	26	31	21	35	19	19	22	46
Two lumps/teaspoons	46	42	52	38	53	51	52	25
More	20	18	22	15	25	28	21	8
		p=0.32		p=0.003		p<0.001		
Time since the most recent dental visit								
Within 1 year	36	43	27	46	27	29	38	41
1+ to 2 years	13	15	9	13	12	10	10	23
2+ to 4 years	22	19	26	15	28	19	27	15
4+ years	29	23	38	26	33	42	25	21
		p=0.02		p=0.04		p=0.07		
Going for check-ups								
Yes	30	33	26	37	24	17	26	56
No	70	67	74	63	76	83	74	44
		p=0.37		p=0.07		p<0.001		

Statistical evaluation of differences by age, gender and education: chi-square test

Toothbrushing twice daily was indicated by 30% of the subjects, 39% of women vs. 23% of men (Table 5.1). Those with the highest level of education most frequently reported brushing their teeth twice daily (67%). A total of 45% reported brushing in the evening, 79% in the morning, and 17% after a meal; 19% of the subjects indicated daily interdental cleaning. Of all the subjects, 57% reported using fluoride toothpaste always; the younger ones did so more frequently (67%) as well as the highly educated (87%), with no gender-difference.

Use of sugar in coffee or tea was a common habit. A total of 8% reported using no sugar, with women and the highly educated taking sugar less frequently than their counterparts.

A dental visit within the previous year was indicated by 36% of the subjects, and more frequently by younger ones and women. In all, 30% reported the habit of going for check-ups, highly educated subjects more frequently than their counterparts.

5.2. Dental and periodontal conditions (I, IV)

Based on their self-report, 25% of the subjects had 21 or more teeth, more frequently those under the age of 70 and the highly educated. In all, 32% indicated wearing removable dentures with no differences by background factors (Table 5.2).

Table 5.2. Self-reported status of dentitions in Lithuanian dentate elderly patients (n=174) according to age, gender and level of education.

Description of dentitions	All (n=174) %	Age		Gender		Level of attained education		
		60-69 (n=98) %	70+ (n=76) %	Women (n=82) %	Men (n=92) %	Low (n=53) %	Medium (n=82) %	High (n=39) %
Number of teeth								
21+	25	34	13	28	22	11	23	46
16-20	35	33	37	31	39	28	43	28
1-15	40	33	50	41	39	61	48	26
		<i>p=0.005</i>		<i>p=0.43</i>		<i>p<0.001</i>		
Presence of dentures								
None	68	75	60	66	71	60	67	82
In one jaw	19	14	25	23	15	21	22	10
In both jaws	13	11	15	11	14	19	11	8
		<i>p=0.12</i>		<i>p=0.38</i>		<i>p=0.19</i>		

Statistical evaluation of differences by age, gender and education: chi-square test

The number of teeth reported ranged from 2 to 31 the range being wide for each educational group: from 2 to 23, from 5 to 30, and from 8 to 31, for low, medium, and high levels of education respectively. The mean number of teeth reported was 16.2 (CI 95% 15.4-17.1). Those reporting wearing no dentures had an average of 18.4 teeth (95% CI 17.6-19.3); those wearing a denture in one jaw 13.4 teeth (95% CI 12.0-14.7), and those in both jaws 8.6 teeth (95% CI 7.2-10.1).

According to the clinical examination (n=100), the average number of teeth was 16.1 (CI 95% 15.0-17.2), ranging from 2 to 30. All molars were missing in maxilla in 23% and in mandible in 40% of the subjects; the corresponding figures for premolars were 20% and 13%. Table 5.3 shows the distributions of the subjects according to the clinical findings. In all, 25% had 21 or

more teeth with no gender-difference. Dental caries was present in 94% of the subjects and none of the subjects was free from plaque, calculus, bleeding on probing, or deepened pockets. These findings showed no variation according to age, gender and level of education. Overhangs of restorations were present in 73% of the subjects, being more common among younger ones and those with the highest level of education ($p=0.001$).

Table 5.3. Clinical findings of dental and periodontal conditions in Lithuanian dentate elderly patients (n=100) according to age, gender and level of education.

Indicators of dental health	All (n=100) %	Age		Gender		Level of attained education		
		60-69 (n=57) %	70+ (n=43) %	Women (n=47) %	Men (n=53) %	Low (n=33) %	Medium (n=48) %	High (n=19) %
Number of teeth								
21+	25	35	12	28	23	15	25	42
16-20	29	32	25	30	28	18	35	32
1-15	46	33	63	42	49	67	40	26
		$p=0.006$		$p=0.78$		$p=0.03$		
Dental cleanliness								
No plaque detected	0	0	0	0	0	0	0	0
Detected by probe	13	16	10	20	8	10	13	21
On gingival margin only	52	51	54	54	50	45	52	63
Abundant plaque	35	33	36	26	42	45	35	16
Missing cases (n=2)		$p=0.86$		$p=0.10$		$p=0.30$		
Calculus								
None	0	0	0	0	0	0	0	0
Supragingival only	5	5	5	4	6	6	2	11
Supra- and/or subgingival	95	95	95	96	94	94	98	89
Missing cases (n=1)		$p=0.99$		$p=0.96$		$p=0.91$		
Deepened periodontal pockets								
None	0	0	0	0	0	0	0	0
Shallow only (4-5mm)	30	31	28	36	24	23	30	39
Deep (6mm+)	70	69	72	64	76	77	70	61
Missing cases (n=5)		$p=0.94$		$p=0.39$		$p=0.86$		
Overhangs								
None	27	15	45	36	20	57	15	11
Present	73	85	55	64	80	43	85	89
Missing cases (n=5)		$p=0.001$		$p=0.07$		$p=0.001$		
Dental caries (DT>0)								
None	6	5	7	6	6	9	4	6
Present	94	95	93	94	94	91	96	94
		$p=0.72$		$p=0.88$		$p=0.65$		

Statistical evaluation of differences by age, gender and education: chi-square test

Of all the recordings on periodontal pockets, those with no pockets comprised less than 1%, those with pockets 4-5mm 60%, and those with pockets 6mm and deeper 39%. For those having 1-15 teeth recordings with pockets of 6mm and deeper totaled in 53%, as compared with 35% and 34% for those with 16-20 and 21 and more teeth, correspondingly.

For further analysis the severity of each type of periodontal findings was estimated by the mean values of the scored measurements per person. Those with periodontal pockets only 4-5mm had the mean severity score of 0.96, and those with pockets 6mm and deeper had the score of 1.63. Overall, the severity indicator of periodontal pockets positively correlated with the maximum value of the subject's pocket recordings ($r=0.78$). The results showed that subjects with a higher education demonstrated better periodontal health in terms of dental plaque, dental calculus, and deepened periodontal pockets; women demonstrated less severe dental plaque findings than men (IV).

5.3. Information sources on and knowledge of oral self-care (III)

Information sources

As their sources of information on oral self-care, 82% of the subjects named dentists, 64% named friends, 59% relatives, and 57% television; 24% to 31% named printed ads, radio, newspapers, and magazines, and 21% named physicians (III). The only gender-difference was for magazines, named by 32% of women and 17% of men ($p=0.03$). After combining the sources into four types, health professionals dominated (82%), followed by social contacts (72%), broadcasted media (58%), and printed media (42%) (Table 5.4). Younger and highly educated subjects more frequently indicated printed and broadcasted media.

Table 5.4. Sources of information on oral self-care, as reported by Lithuanian elderly dentate patients (n=174) according to age, gender and level of education.

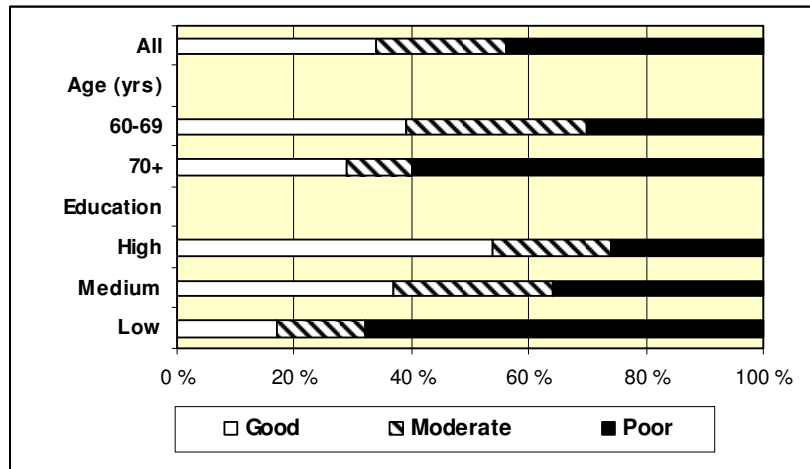
Sources named	All n=174 %	Age		Gender		Level of attained education		
		60-69 (n=98) %	70+ (n=76) %	Women (n=82) %	Men (n=92) %	Low (n=53) %	Medium (n=82) %	High (n=39) %
Health professionals								
Yes	82	84	80	83	81	76	82	92
No	18	16	20	17	19	24	18	8
		$p=0.56$		$p=0.80$			$p=0.11$	
Social contacts								
Yes	72	68	76	66	77	77	67	74
No	28	32	24	34	23	23	33	26
		$p=0.25$		$p=0.10$			$p=0.40$	
Broadcasted media								
Yes	58	64	50	57	59	45	59	74
No	42	36	50	43	41	55	41	26
		$p=0.06$		$p=0.85$			$p=0.02$	
Printed media								
Yes	42	50	32	49	36	28	38	69
No	58	50	68	51	64	72	62	31
		$p=0.01$		$p=0.08$			$p<0.001$	

Statistical evaluation of differences by age, gender and education: chi-square test

Self-assessed level of knowledge of oral self-care

In total, 34% of the subjects ranked their self-assessed level of knowledge of oral self-care as good, 22% as moderate, and 44% as poor, with gender-differences remaining insignificant (III). Those aged 70 and older ($p<0.001$) and with a low education level ($p<0.001$) more frequently ranked their knowledge as poor compared to their counterparts (Figure 5.1).

Figure 5.1. Distributions (%) of Lithuanian elderly dentate patients (n=174) according to their self-assessed level of knowledge of oral self-care, by age and level of education.

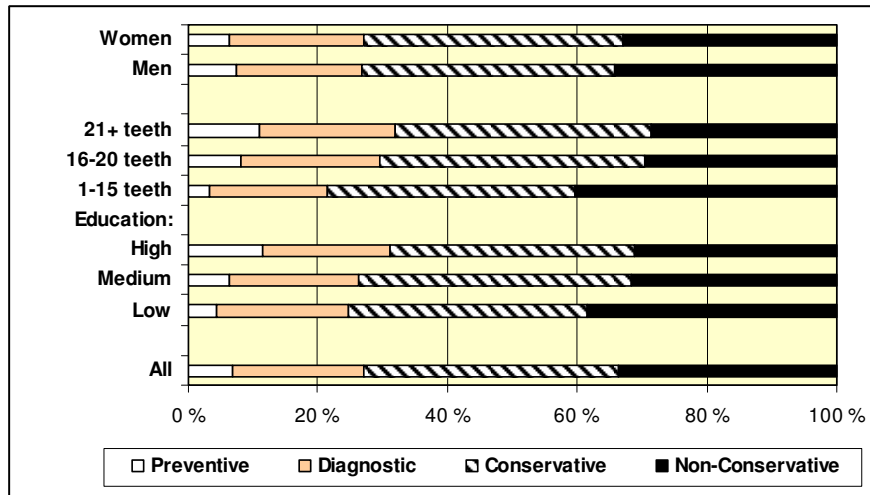


5.4. Dental treatment experiences (II, III)

During their most recent dental treatment, 78% of the elderly reported having received fillings, 50% endodontics, 48% extractions, 21% radiography, 19% fixed and 21% removable prosthetics (II). Of chair-side prevention, 10% of the subjects indicated they had received scaling or cleaning, and 6% polishing of fillings with no gender, age, or educational differences; none reported having received fluoride varnish. Filling therapy was more frequently reported by men than women (85% vs. 72%, $p=0.04$) and extractions by those with a low education compared to higher (64% vs. 43% and 41%, $p=0.02$).

After combining all reported treatments into four types, conservative (39%) and non-conservative (34%) treatments dominated, followed by diagnostic (20%) and preventive (7%) treatments (Figure 5.2). Preventive treatments were more frequently reported as being received by those with a higher level of education and a higher self-reported number of teeth. Subjects going for check-ups were more likely to report receiving preventive treatment (OR 4.8, $p<0.001$) (II).

Figure 5.2. Distribution (%) of types of dental treatments reported as received by Lithuanian dentate elderly patients (n=174) during their most recent dental treatment course according to their gender, number of teeth and level of education.



Active professional prevention

Active professional prevention consisted of guidance in toothbrushing, interdental cleaning, home use of fluorides, diet, dental attendance advice, and provision with visual information. Table 5.5 shows details of the active professional prevention that the subjects reported receiving.

Guidance in toothbrushing was the most frequently (54%) reported item, followed by visual information (33%), and guidance in interdental cleaning (32%) with no age and gender differences in these figures.

The sum of the intensity scores for professional guidance received ranged from 0 to 28 (III); the mean score was 3.7 (CI 95% 2.9-4.5). The higher the level of education and the greater the number of teeth of the subjects, the higher the mean intensity scores were (III).

A self-assessed level of knowledge of oral self-care was clearly positively correlated with the intensity of received professional guidance in oral self-care (r=0.52) (III). Table 5.6 shows that of the subjects reporting the highest amount of professional guidance, 90% had a good level of knowledge compared to 18% of those reporting a low amount or no guidance.

Table 5.5. Active professional prevention as guidance in oral self-care reported as ever received (%) by Lithuanian dentate elderly patients (n=174).

Items of professional guidance	Reported (%)
Tooth brushing	
• Dentist told how to brush	53
• Dentist showed how to brush	15
• Dentist gave a toothbrush	3
• Dentist recommended a toothpaste	14
At least one of these	54
Interdental cleaning	
• Dentist told how to clean interdental spaces	31
• Dentist showed how to clean interdental spaces	12
• Dentist gave a device for interdental cleaning	5
At least one of these	32
Home use of fluorides	
• Dentist recommended fluoride pills	2
• Dentist recommended fluoride rinse	5
At least one of these	5
Dietary advice	
• Dentist gave any dietary advice	9
• Dentist recommended use of xylitol chewing gum	20
At least one of these	23
Dental attendance	
• Dentist recommended check-up visits	16
• Dentist recommended a visit for cleaning	11
At least one of these	17
Visual information	
• Dentist gave a brochure on oral self-care	7
• Dentist showed pictures on oral diseases	11
• Dentist showed pictures on treatment alternatives	10
• Dentist showed patient's own radiographs	29
At least one of these	33

Table 5.6. Self-assessed level of knowledge of oral self-care in relation to the intensity of professional guidance reported as received among Lithuanian dentate elderly patients (n=174).

Levels of self-assessed knowledge on oral self-care	Intensity ¹ of received professional guidance on oral self-care			
	High n=29 %	Medium n=39 %	Low n=55 %	None received n=51 %
All subjects (n=174)				
Good	90	38	18	18
Moderate	7	36	24	17
Poor	3	26	58	65
		<i>p<0.001</i>		
Women (n=82)				
Good	92	42	24	23
Moderate	8	37	20	16
Poor	0	21	56	60
		<i>p=0.001</i>		
Men (n=92)				
Good	88	35	13	12
Moderate	6	35	27	19
Poor	6	30	60	69
		<i>p<0.001</i>		

Statistical evaluation by means of chi-square test

¹Based on the sum of the scored answers to 17 items of professional guidance in oral self-care, each scoring as reported having received: 0 (never), 1 (yes, earlier), 2 (yes, recently). Categories formed according to the distribution of summed scores: High (6+), Medium (3-5), Low (1-2), and None (0).

5.5. Oral self-care in relation to knowledge and professional guidance (I, III)

Following the recommended oral self-care correlated positively with the level of self-assessed knowledge (Table 5.7). In particular, differences were seen in those with a poor level of knowledge: 88% reported not following the practice of twice daily toothbrushing, and 68% reported not using fluoride toothpaste always. Differences in the avoidance of sugar in coffee and tea were minor.

Table 5.7. Following the recommended oral self-care in relation to self-assessed knowledge of oral self-care as reported by Lithuanian dentate elderly patients (n=174).

Aspects of recommended oral self-care	Self-assessed level of knowledge on oral self-care		
	Good (n=60) %	Moderate (n=38) %	Poor (n=76) %
Tooth brushing twice daily			
Followed	53	32	12
Not followed	47	68	88
		<i>p<0.001</i>	
Use of fluoride toothpaste always			
Followed	82	66	32
Not followed	18	34	68
		<i>p<0.001</i>	
No use of sugar in coffee or tea			
Followed	13	8	3
Not followed	87	92	97
		<i>p=0.06</i>	

Statistical evaluation by means of chi-square test

Similarly, following the recommended oral self-care positively correlated with the extent of professional guidance received (Table 5.8). Subjects, who reported receiving no professional guidance, less frequently indicated twice daily toothbrushing than did those reporting a high intensity of received guidance (18% vs. 59%). A similar difference appeared regarding the statement of always using fluoride toothpaste (33% vs. 90%).

Table 5.8. Following the recommended oral self-care in relation to the intensity of professional guidance received as reported by Lithuanian dentate elderly patients (n=174).

Aspects of recommended oral self-care	Intensity ¹ of received professional guidance on oral self-care			
	High n=29 %	Medium n=39 %	Low n=55 %	None received n=51 %
Tooth brushing twice daily				
Followed	59	28	29	18
Not followed	41	72	71	82
			<i>p=0.002</i>	
Use of fluoride toothpaste always				
Followed	90	71	51	33
Not followed	10	29	49	67
			<i>p<0.001</i>	
No use of sugar in coffee or tea				
Followed	14	5	9	4
Not followed	86	95	91	96
			<i>p=0.37</i>	

Statistical evaluation by means of chi-square test

¹ Based on the sum of the scored answers to 17 items of professional guidance in oral self-care, each scoring as reported having received: 0 (never), 1 (yes, earlier), 2 (yes, recently). Categories formed according to the distribution of summed scores: High (6+), Medium (3-5), Low (1-2), and None (0).

Factors related to twice daily toothbrushing were further analyzed by means of logistic regression (Table 5.9). Reporting twice daily toothbrushing was strongly associated with a university education (OR 5.6, $p < 0.001$), and a good self-assessed knowledge of oral self-care (OR 4.1, $p < 0.001$). Gender and age remained statistically insignificant in this model. Professional guidance in oral self-care had no role and was omitted from the final model.

Table 5.9. Twice daily toothbrushing among dentate elderly patients (n=174) in Lithuania, as explained by self-assessed knowledge of oral self-care and the subjects' characteristics, by means of the logistic regression model.

Parameters in the model	Estimate of strength		Odds ratio (OR) and its 95% confidence intervals		
	Estimate	s.e.	OR	95% CI	<i>p-value</i>
Gender: 1=male, 2=female	0.70	0.39	2.0	0.9-4.3	0.07
Age in years	-0.06	0.03	0.9	0.8-1.0	0.09
Level of education: 0=Less than University, 1=University	1.70	0.44	5.6	2.4-13.2	< 0.001
Self-assessed knowledge: 0= Below good, 1=Good	1.41	0.39	4.1	1.9-8.8	< 0.001
Constant term	0.91	2.32			

Deviance 163.67; df=169.

5.6. Dental and periodontal conditions in relation to oral health behaviour and knowledge (I, II, III, IV)

Following the recommended oral health behaviour indicated a higher self-reported number of teeth (I). Subjects indicating twice daily toothbrushing, use of fluoride toothpaste always, avoiding sugar in coffee or tea, and going for check-ups more frequently possessed 21 or more teeth, compared to their counterparts (Table 5.10).

Table 5.10. Number of teeth among Lithuanian dentate elderly patients (n=174) in relation to various oral health behaviours.

Number of teeth	Tooth brushing		Use of fluoride toothpaste ¹		Use of sugar in coffee or tea		Going for check-ups	
	2+/day (n=53)	<2/day (n=121)	Always (n=98)	Not always (n=75)	No (n=13)	Yes (n=161)	Yes (n=52)	No (n=122)
	%	%	%	%	%	%	%	%
21-32	45	16	36	11	54	22	37	20
16-20	38	34	32	40	23	36	36	34
<16	17	50	33	49	23	42	27	46
	<i>p < 0.001</i>		<i>p < 0.001</i>		<i>p = 0.04</i>		<i>p = 0.02</i>	

Statistical evaluation by means of chi-square test

¹One case missing

Having 21 or more teeth was further analyzed by means of the logistic regression (Table 5.11). Subjects with a good self-assessed knowledge of oral self-care (OR 4.1, $p < 0.001$) and those with a university education (OR 2.2, $p = 0.06$) were more likely to possess 21 or more teeth. When adding frequency of toothbrushing to the model, neither it nor the level of education reached statistical significance, whereas self-assessed knowledge remained a strong factor (OR=3.5, $p = 0.002$) in explaining the presence of 21 or more teeth. Professional guidance in oral self-care had no role and was omitted from the final model.

Table 5.11. Having 21 or more teeth among dentate elderly patients (n=174) in Lithuania, as explained by self-assessed knowledge of oral self-care, and the subjects' characteristics, by means of the logistic regression model.

Parameters in the model	Estimate of strength		Odds ratio (OR) and its 95% confidence interval		
	Estimate	s.e.	OR	95% CI	<i>p</i> -value
Gender: 1=male, 2=female	0.16	0.39	1.2	0.5-2.4	0.68
Age in years	-0.09	0.03	0.9	0.9-1.0	0.01
Level of education: 0=Less than University, 1=University	0.80	0.43	2.2	1.0-5.2	0.06
Self-assessed knowledge: 0= Below Good, 1=Good	1.40	0.39	4.1	1.9-8.9	< 0.001
Constant term	3.91	2.44			

Deviance 161.04; df=169.

The impact of the frequency of toothbrushing on periodontal findings included the results of the subjects' clinical examinations. Subjects following the recommended twice daily toothbrushing exhibited less severe findings of dental plaque and deepened pockets (Table 5.12). The impact of toothbrushing frequency on the severity of calculus findings remained insignificant (IV).

Table 5.12. Periodontal findings in a group of elderly Lithuanians (n=100) in relation to the frequency of toothbrushing.

Indicators of periodontal findings	Frequency of tooth brushing	
	Twice daily (n=25)	Less than twice daily (n=75)
Severity¹ of dental plaque		
Mean (SD)	1.6 (0.6)	2.0 (0.6)
95% CI	1.4-1.9	1.8-2.1
Missing cases (n=2)		
	<i>p</i> =0.01	
Severity¹ of deepened pockets		
Mean (SD)	1.2 (0.3)	1.5 (0.4)
95% CI	1.0-1.3	1.4-1.6
Missing cases (n=5)		
	<i>p</i> <0.001	

Statistical evaluation by ANOVA

¹ Severity of periodontal findings was calculated as the mean of the scored recordings by subject using the following scores: for dental plaque: 0=clean, 1=by probe only, 2=visible on gingival margin, 3=abundant; for periodontal pockets: 0=none, 1=4-5 mm, 2=6 mm and deeper

In the logistic regression model, toothbrushing twice daily appeared as a strong factor to explain subjects' least severe findings of deepened periodontal pockets (IV). A further model explained the presence of pockets of 6mm and deeper (Table 5.13). Such pockets were more likely in subjects with a poor level of dental cleanliness (OR=2.7, p=0.02) and in those assessing their knowledge of oral self-care as below good (OR=3.0, p=0.04). Age, gender and level of education remained statistically non-significant. Professional guidance in oral self-care had no role and was omitted from the final model.

Table 5.13. Factors explaining the presence of periodontal pockets 6mm or more, according to the severity of dental plaque, self-assessed knowledge, and the subjects' background, by means of the logistic regression model in a group of elderly Lithuanians (n=100).

Parameters in the model	Estimate of strength		Odds ratio (OR) and its 95% confidence interval		
	Estimate	s.e.	OR	95% CI	<i>p-value</i>
Gender: 1=male, 2=female	-0.31	0.49	0.7	0.3-1.9	0.52
Age in years	-0.02	0.04	1.0	0.9-1.1	0.67
Level of education: 0=Less than University, 1=University	0.11	0.68	1.1	0.3-1.3	0.87
Dental cleanliness	1.01	0.4	2.7	1.2-6.3	0.02
Self-assessed knowledge: 0=Good, 1=Below good	1.10	0.5	3.0	1.1-8.6	0.04
Constant term	0.05	3.1			

Deviance=102.01; df=88

6. DISCUSSION

6.1. Methodological aspects

The target subjects of the present study were elderly dentate patients aged 60 and older attending public dental services. In Lithuania, 60% of adults visit a public dentist (Widström & Eaton 2004). In 2006, 65% of those aged 65 and older reported attending only public and 18% public and private dental services (Pūriene et al. 2008). It may be considered that the present subjects well represent the elderly visiting a dentist, and reasonably well the Lithuanian elderly population in general, who commonly visit a dentist for a problem-based reason (Statistics Lithuania).

The data collection included a self-administered questionnaire and a clinical examination. The questionnaire was developed on the basis of earlier population-based studies in Finland and the UK (Vehkalahti et al. 1991, Todd & Lader 1991) and revised within the research group with some items developed to reveal more details on oral health-related aspects in the elderly. The questionnaire covered oral health behaviour, a self-reported number of teeth, dental treatments, sources of information and knowledge of oral self-care, and the subjects' demographic factors. Self-reports on oral health behaviour, such as toothbrushing, or use of services, are common basic oral health indicators (Consensus Workshop 2004). On the other hand, as in all questionnaire studies, socially desirable actions may be over-reported (Sjöström & Holst 2002).

Self-reporting one's number of teeth gives good estimates among adult (Pitiphat et al. 2002, Unnel et al. 1997) and elderly subjects (Buhlin et al. 2002, Douglass et al. 1991). This was true also in the present study showing very close estimates for self-reported and clinically determined numbers of teeth. Furthermore, self-reported dental treatments, such as fillings, root canal therapy, and dentures strongly correlate with clinical records among adults and elderly (Buhlin et al. 2002, Pitiphat et al. 2002, Unnel et al. 1997).

The clinical examination, targeted to about half of those filling in the questionnaire, included basic aspects of dental and periodontal conditions. Dental caries was finally analyzed only as present or absent, since a more detailed diagnosis was impossible due to the abundant dental plaque in all the subjects. An accurate caries inspection requires cleaning of teeth; for these subjects it could not be performed since the vast majority of the patients required treatment for their acute dental problems, thus allowing no time for cleaning.

Periodontal conditions were examined using half-mouth recordings. Such a method has been justified for periodontal and dental measurements in prevalence studies, especially where time and patient fatigue are of importance (Mack et al. 2006, Dowsett et al. 2002, Thomson & Williams 2002, Hunt & Fann 1990, Hunt 1986), obviously suitable for studies on the elderly. Deepened periodontal pockets were recorded per tooth group in molars and premolars using common cut-offs of 4-5mm and 6mm and more. Due to the varying numbers of teeth in elderly subjects, the analysis of the severity of periodontal conditions, in addition to the maximum values, was presented as mean values of the scores per subject to describe periodontal findings in more detail. This method revealed well the variations in the severity of periodontal conditions by background information and toothbrushing frequency. Furthermore, the severity indicator for periodontal pockets strongly correlated with the subject's maximum value of pocket recording ($r=0.78$), thus suggesting its usefulness among elderly patients.

6.2. Results of the study

Oral health behaviour

The oral health behaviour of the present subjects was found to be poor compared to the recommendations. The overall rate of twice daily toothbrushing (30%) was lower than those reported in Finland, Denmark, the UK, and the USA (54%-97%) (Suominen-Taipale et al. 2008, Christensen et al. 2003, Kelly et al. 2000, Davidson et al. 1997). However, the present finding is slightly higher than the finding on Lithuanian elderly (21%) by Petersen et al. (2000), and in line with reports from all the Baltic countries among those aged 55-64 (Grabauskas et al. 2007, Pudule et al. 2007, Kasmel et al. 1999). An encouraging finding about the present elderly subjects was that those with the highest education exhibited comparable rates (67%) of twice daily toothbrushing to those in industrialized countries.

Generally, women report twice daily toothbrushing more frequently than men do, as was seen in Finland, Denmark, the UK (Suominen-Taipale et al. 2008, Christensen et al. 2003, Kelly et al. 2000) and also in the Baltic countries (Grabauskas et al. 2007, Pudule et al. 2007, Kasmel et al. 1999). However, gender difference remained minimal in the present elderly, as was the case in the previous study for Lithuanians aged 65-74 (Petersen et al. 2000). Interdental cleaning seems to be a challenge with increasing age in general, but is still an under-used measure in the present elderly compared to their counterparts in industrialized countries (Christensen et al. 2003, Davidson et al. 1997).

Use of sugar in coffee or tea was very common in the present subjects, which is consistent with the reports from all the Baltic countries for those aged 55-64 (Grabauskas et al. 2007, Pudule et al. 2007, Kasmel et al. 1999). Such a high consumption of sugar may be culture-attributed and, regarding the present elderly subjects, may reflect their understanding of well-being. In contrast, a population study in Finland indicates much lower rates of the use of sugar in adults (Suominen-Taipale et al. 2008). The general health-related message that recommends limiting sugar use to meals, preferably no more than four times per day, and no more than 40 grams of "simple sugars" per day (Moynihan 2005, Mobley 2003, WHO 2003) has yet to reach the Lithuanian population and, in particular, the elderly.

Thirty per cent of the subjects reported check-ups as their habitual dental attendance, being much lower than the rates reported in Finland and the UK (50%-68%) (Suominen-Taipale et al. 2008, Kelly et al. 2000). However, in Lithuania check-ups are a rare practice even among highly educated middle-aged adults, according to a recent report (Sakalauskiene et al. 2009), and, 67% of those aged 65-74 visit a dentist only when they have dental problems (Statistics Lithuania). Going for check-ups is the accepted way of using dental services in industrialized countries with the ongoing discussion regarding only the recommended intervals; however, as stated by Petersen (2005), the patterns of the use of dental services favour emergency visits in non-industrialized countries. The recall system for check-ups in Lithuania existed only for school children until the 1990s. The oral health system since then has been undergoing development, but with no emphasis on systematic recalls. The present subjects obviously have had limited access to services as children, and in adulthood they have been accustomed to seeking a dentist on the basis of their own needs, which they obviously consider the norm. This implies a challenge for dental professionals and the whole dental care system to raise the importance of regular check-ups among the present elderly, especially men and those with a lower education.

Dental and periodontal conditions

Only 25% of the present subjects had 21 or more teeth, which is far below the WHO goal for the year 2000, stating that at least 50% of the elderly should have a minimum of 20 teeth (WHO 1982). However, the present finding is comparable to that of a regional study in eastern Germany (Mack et al. 2003), but below the levels in the Nordic countries and the UK (Suominen-Taipale et al. 2008, Holst 2008, Österberg & Carlsson 2007, Petersen et al. 2004, Kelly et al. 2000). Removable dentures were present in 32% of the subjects, which is in line with the data from Finland (Suominen-Taipale et al. 2008).

Oral hygiene of the present subjects was poor and teeth cleaning ineffective since none of them was plaque-free and bleeding on probing was diagnosed in all the subjects. This is alarming as the subjects knew well that they would be examined by a dentist. The importance of cleaning effectiveness has been emphasized and has called for improvement over decades (Löe et al. 1965, Bellini et al. 1981). Lately it has been stated that in industrialized countries oral hygiene is satisfactory allowing control over severe forms of periodontal disease (Sheiham & Netuveli 2002). However, only 22% to 40% have clean teeth in Finland and the UK (Suominen-Taipale et al. 2008, Kelly et al. 2000), implying that ineffective teeth cleaning seems to be particularly common in elderly subjects in general, and, especially among men and those with a lower educational attainment, as the findings of the present subjects show.

The presence of supra- or subgingival calculus in all the subjects indicates their lack of proper oral hygiene in the past, being, in turn, a predisposing factor for further plaque accumulation. Overhangs of fillings were frequently present in those subjects who were younger or had a higher education, possibly due to their greater numbers of teeth. The abundance of calculus and overhangs in the present subjects indicates the dentists' lack of attention to plaque-retentive factors. Therefore, greater emphasis on high quality is called for regarding restorative treatment.

All of the present subjects had deepened periodontal pockets, and as many as 70% had pockets 6mm and deeper. Studies from industrialized countries report a much lower prevalence (6.5% to 44%) of deep periodontal pocketing in the elderly (Suominen-Taipale et al. 2008, Dye et al. 2007, Kristrup & Petersen 2006, Mack et al. 2004, Kelly et al. 2000). However, the present findings are in line with a previous Lithuanian report indicating the presence of deep periodontal pockets in 75% of those aged 65-74 (Skudutyte et al. 2001). The similarity of these figures among the patients visiting a dentist and among the lay population elderly reflects the fact that periodontal conditions are commonly asymptomatic until the late stages and diagnosed late since people do not seek care for them.

Caries occurred in 94% of the subjects revealing very great needs for treatment and obviously being a reason for the visit in the present subjects. A report on the lay elderly population in Lithuania reveals the presence of untreated caries among 68% of the subjects (Skudutyte et al. 2000). The data on patient and lay-populations cannot be compared directly; however, the present figures reveal a huge burden of caries, and the need for treatment and prevention in Lithuanian elderly.

Information sources on oral self-care

As their source of information about oral self-care, an overwhelming majority (82%) of the subjects indicated health-care professionals. Naturally, dentists were the main source of information; however, physicians and nurses were occasionally mentioned. Generally, older subjects visit a physician more often than a dentist (SHARE 2005), as can also be seen in population studies in the Baltic countries even for the age group of 55-64 (Grabauskas et al. 2007, Pudule et al. 2007, Kasmel et al. 1999). Such a trend is obviously stronger in elderly subjects: 74% among Lithuanians aged 65-74 have visited a general practitioner within the previous 12 months in 2008 (Statistics Lithuania). Thus, following the common risk approach (Sheiham & Watt 2000) and Ottawa Charter-based geriatric oral health promotion matrix (Chalmers & Ettinger 2008), oral health-related information should be provided for elderly patients at all general health services, e.g., in the waiting room at a physicians' office in the form of leaflets or posters. In addition, physicians and nurses should provide such information or, at least, raise the awareness of oral health issues verbally during the visit of an older person. Such multi-sector involvement has been successful in terms of increase in dental attendance (McGrath et al. 2009).

The majority (72%) of the present subjects mentioned social contacts, such as family and friends, as their source of oral self-care information, indicating the importance of increasing the awareness of oral self-care aspects in the whole population. About half of the subjects mentioned TV and radio as their information source which may be considered a low percentage since elderly people form a frequent audience for radio and TV. A short ad on TV has been suggested as being potentially effective regarding caries prevention in Lithuania where caries has been reported to be a problem among all age groups (Bjarnason 1998). Rather few subjects indicated printed media as their source of information. These findings may imply that either the message in the media has not been properly targeted for elderly subjects, or that there is an absence of such information.

Dental treatment experiences

Conservative and non-conservative items of treatment dominated revealing a huge need of various extensive dental treatments; however, preventive items were rarely mentioned (7%). Furthermore, half of the subjects underwent extractions, indicating high levels of serious dental diseases. Such a treatment panorama is far beyond that of industrialized countries where extractions are fewer and independent dentate elderly have heavily filled teeth.

Of the present elderly, 19% reported having received fixed prosthetics and 21% removable dentures, the findings being comparable to the previous Lithuanian study (Petersen et al. 2000) but surprisingly higher than in high-economy countries such as Finland, the UK and Canada (Suominen-Taipale et al. 2008, Kelly et al. 2000, Leak et al. 1996). This difference may reflect the fact that the Lithuanian elderly are eligible for a subsidized prosthetic treatment which they seem to use frequently.

It has been projected that provision of complete dentures will be on a clear decrease in the future in industrialized countries (Mojon et al. 2004). RPD, which is probably the cheapest prosthetic solution when cost-related factors are decisive regarding what dental treatments are provided (Palmquist et al. 2001), will continue to be the frequent option for the elderly. However, prosthetic appliances, in particular wearing RPD, bear an increased risk for caries and periodontal disease due to the often abundant plaque retention in areas bordering the surface of

one's own teeth. This exposes an individual to a greater risk of these diseases (Wöstmann et al. 2005, Jepson et al. 2001, Steele et al. 1997b, Isidor & Budtz-Jørgensen 1990). In all elderly patients, with high rates of prosthetic treatments the role of proper oral hygiene should be particularly emphasized during any prosthetic treatment, to keep their own teeth and prosthetic appliance clean.

Chair-side prevention

Chair-side prevention was found to be particularly rare, as only 10% of the present subjects reported scaling and cleaning and 6% polishing of fillings. These figures correspond with previous findings in Lithuania (11%) (Petersen et al. 2000) but are alarmingly low compared to Finland (68%) and the UK (54%) (Suominen-Taipale et al. 2008, Kelly et al. 2000). None of the subjects reported receiving fluoride varnish, also in line with previous findings in Lithuania (1%) but in contrast to Finland (23%) (Suominen-Taipale et al. 2008). The present findings imply that in Lithuania the tools of modern dental care are not part of chair-side prevention since all the present elderly, but particularly men and those with less education could be considered in need of scaling and cleaning. Evidence from systematic reviews (Needleman et al. 2005, Heitz-Mayfield et al. 2002), advocate professional mechanical control of plaque and calculus, along with education and support of a patient, to facilitate effective oral hygiene (Corbet 2007).

Fluoride varnish is available on the market in Lithuania but its use is very limited, and, consequently, should be strongly encouraged. Such obvious under-use of fluoride varnish is certainly harmful for the elderly patients in Lithuania since professional mechanical cleaning together with fluoride therapy, motivation and instruction of the patient (Løe 2000) allow the retainment of teeth for decades (Axelsson et al. 2004).

On the other hand, chair-side prevention is expensive if based on the highly professional workforce of dentists (Davies 2003, Tunkel et al. 2002). Therefore, other dental professionals such as hygienists and other specially trained personnel should be involved in providing fluoride therapy, cleaning, education, and consultation (Axelsson et al. 2002, Haden et al. 2001). In Lithuania the number of hygienists is on a slow increase but still low, as is generally the case in the countries that have recently joined the EU (Kravitz & Treasure 2008), implying that the main responsibility of implementing prevention lies with dentists.

Active prevention for the present subjects as guidance in oral self-care concentrated mostly on toothbrushing (54%) and interdental cleaning (32%) which is consistent with the findings in the UK (Kelly et al. 2000). Active prevention requires little time: for example, arranging the next dental visit and reinforcing a subject in oral self-care. Even a single instruction on toothbrush, along with a single professional prophylaxis can be effective in preventing gingivitis, according to a systematic review (van der Weijden & Hioe 2005).

The visual information that the subjects reported receiving was mostly their own radiographs (29%) which are obviously a good educational tool; however, other tools such as providing the patient with a brochure on oral self-care call for increase. Counseling on diet and home-use fluorides for the present subjects was minimal and in line with the findings in Finland (Suominen-Taipale et al. 2008). Dietary guidance calls for particular improvement in the present subjects as only 8% reported not using sugar in coffee or tea. Recommendations for the next visit were rare. Only 11% reported such recommendation for cleaning and 16% for a check-up.

These findings indicate the importance of an agreement on preventive visits in the present elderly population since elderly subjects perceiving the importance of dental care are more likely to use dental services on a preventive basis (Kiyak & Reichmuth 2005). Of the present elderly subjects, those going for check-ups were more likely to report receiving preventive treatment which is consistent with dentists' reports on the provided treatment (Bruers et al. 2005, Leake et al. 1996).

When analyzed as the intensity summed scores and mean scores, professional guidance may be considered as inadequate, indicating some ignorance on the part of dentists, or that patients do not recognize the importance of the message addressed to them. This calls for integrating a clear educational message into every dental visit, emphasizing the value of proper oral self-care for elderly subjects.

Oral self-care, knowledge of and professional guidance in oral self-care

Elderly subjects should have an adequate knowledge to properly perform oral self-care. In the present subjects only one in three assessed their level of knowledge in oral self-care as good which may reflect their critical attitudes when filling in the questionnaire in the dental office. Oral self-care knowledge in the present subjects was self-assessed, thus subjective. Nevertheless, the present results speak for the justification of such assessment by showing its clear positive correlation with the extent of professional guidance received in oral self-care. Further, self-assessed knowledge was positively associated with reporting twice daily toothbrushing and having better dental and periodontal state. Consequently, an important implication for dentists should be to provide guidance on oral self-care for their patients. That could serve as a motivation tool for the patients to seek corresponding guidance at the dentists' office and to practice the recommended oral self-care.

The level of self-assessed knowledge in the present elderly correlated positively ($r=0.52$) with the intensity of guidance received in oral self-care. This finding coincides with the findings from systematic reviews (Kay & Locker 1998, Kay & Locker 1996), and educational interventions (Mårtensson et al. 2006, Yalcinkaya & Atalay 2006, Mariño et al. 2004, Blinkhorn et al. 2003, Lin et al. 2001). They all concluded that oral health education is effective in increasing knowledge among adults, elderly, and even in disabled subjects. In accordance with a Swedish study (Mårtensson et al. 2006), the present results indicate a huge need for guidance in oral self-care, particularly among subjects with a lower education to improve their level of knowledge in this area.

Oral health behaviour in terms of toothbrushing and use of fluoride toothpaste was better among those who assessed their knowledge of oral self-care as good and reported receiving more professional guidance. This is in line with reports on oral health education being effective among adults regarding plaque removal (Phillippot et al. 2005, Kay & Locker 1998, Kay & Locker 1996) and improved toothbrushing skills (Blinkhorn et al. 2003). The same is true regarding elderly subjects in improving their oral hygiene, self-care skills and practices (Mariño et al. 2004, Little et al. 1997), in increasing dental attendance (McGrath et al. 2009), and in adopting a healthier diet (Bradbury et al. 2006). Oral health education is a cost-effective component in prevention especially of periodontal disease, and, as experts have stated, particularly in countries with limited oral health resources and low levels of oral hygiene, (Axelsson et al. 2002). Consequently, the recommended oral self-care should be emphasized and the related knowledge repeatedly updated among elderly subjects. This would be necessary

even though putting favourable changes into practice is a time-consuming process, as stated by Richards (2008) and Hausen (2005); particular targets could be those with a poor level of self-assessed knowledge.

Dental and periodontal conditions, and oral health behaviour

Dental status in terms of having 21 or more teeth was better for those who reported following the recommended oral health behaviour. This corresponds with population-based studies in Finland on adults and elderly which have shown positive impacts of twice daily toothbrushing and regular check-ups on a greater number of teeth (Suominen-Taipale et al. 2008, Vehkalahti & Paunio 1989). In contrast to the present finding of higher numbers of teeth among those going for check-ups, regularly attending adults in the UK have fewer teeth which the report explained was the result of planned extractions of teeth in poor condition (Richards & Ameen 2002).

Twice daily toothbrushing in the present subjects showed positive impacts on periodontal conditions as less severe periodontal pocketing and dental plaque findings while deep pocketing was more likely among those with poor oral hygiene. Population studies on adults in the UK and Finland report a similar but rather weak relationship regarding the frequency of twice daily toothbrushing, and in Finland regarding the habit of going for check-ups (Suominen-Taipale et al. 2008, Kelly et al. 2000). In the USA, studies have reported positive relationships between meticulous oral self-care practices and less severe dental plaque, calculus, and through these, as concluded, indirectly deepened pockets findings (Lang et al. 1995, 1994), and improved periodontal health measured as plaque index, according to a clinical trial (Phillippot et al. 2005). However, another USA study on older health care professionals reports a lack of evidence associating frequent toothbrushing and daily flossing with the presence of periodontitis (Merchant et al. 2002). In line with this study, a systematic review has revealed a lack of statistically significant differences in periodontal health after personal oral hygiene instructions (Hujoel et al. 2005). Despite such pessimistic reports, toothbrushing has been suggested as the first-choice oral hygiene measure to be introduced to the population level in countries with generally low levels of oral hygiene (Baelum et al. 2007, Corbet 2007). Consequently, in the present elderly subjects with poor oral hygiene and deepened periodontal pockets twice daily toothbrushing clearly correlated with better periodontal conditions, and should thus be strongly encouraged.

The present results revealed the importance of proper oral health behaviour, particularly of twice daily toothbrushing in retaining higher numbers of teeth and having better periodontal health. Consequently, these results imply a huge challenge for dental professionals to disseminate adequate knowledge of oral self-care among the elderly.

7. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

- Better oral self-care is related to higher levels of self-assessed knowledge and to a higher intensity of professional guidance in oral self-care.
- Better oral health behaviour and better knowledge of oral self-care indicate higher numbers of teeth in the elderly subjects.
- Encouragingly, in the present elderly subjects, twice daily toothbrushing, a better level of oral hygiene and better self-assessed knowledge of oral self-care indicate better periodontal conditions.
- For elderly subjects, dentists remain the main informants of oral self-care related knowledge. Such knowledge correlates with the intensity of corresponding professional guidance received.
- In Lithuania, oral health behaviour and oral conditions are far from the levels seen in industrialized countries, and percentages of the elderly possessing 21 and more teeth are far below the target set by the WHO.

RECOMMENDATIONS

For the elderly:

- Twice daily toothbrushing with fluoride toothpaste and avoidance of sugar in general but particularly in coffee and tea should be taken as routine oral self-care habits.
- Going for check-ups should be a habitual dental attendance.

For dentists:

The preventive approach should be adopted as an essential part of dental care for elderly patients. Dentists should:

- Provide elderly patients with updated guidance in oral self-care, motivate them to practice it during every visit and encourage check up-based habitual dental attendance.
- Apply the whole array of chair-side prevention incorporating scaling and cleaning, and application of fluoride varnish.
- Place emphasis on the high quality of all restorative treatment to enable subjects to effectively clean their teeth and prosthetic appliances.

For physicians, nurses, and other health professionals:

- Oral health-related information should be passed on to elderly patients visiting any general health professional.
- During such visits, avoidance of sugar should be one of the main health messages.

At the community level:

- Systematic data should be collected on oral health behaviour and conditions of the elderly for monitoring their treatment needs and for planning oral health services for this growing segment of the population. For such a purpose, a uniform and comprehensive form for documentation is needed.
- Television and radio ads should be used to disseminate elderly-targeted oral health information.
- Health care administration should develop guidelines on preventive oriented dental care for both the lay population and dental professionals.

8. SUMMARY

The number of elderly subjects is on the increase in most populations presenting a challenge for themselves, the dental profession, and communities to maintain their oral health. Data on the oral health of the elderly population in Lithuania as well as in the extended EU countries are scarce.

The aims of the present cross-sectional study were to assess oral health behaviour, dental and periodontal conditions, dental care, and their relationships among elderly dentate patients in Lithuania.

The present study was carried out among subjects aged 60 and older attending public dental services in Kedainiai, Lithuania. The study included a self-administered questionnaire filled in by 174 elderly subjects, 82 women and 92 men, and a clinical examination targeting half of the subjects (n=100). The questionnaire inquired about oral health behaviour, dental treatments received, self-assessed knowledge and sources of information on oral self-care, a self-reported number of teeth, presence of dentures, and the subjects' demographic background.

To describe oral self-care, the frequency and timing of toothbrushing, the frequency of interdental cleaning, the use of fluoride toothpaste, and the use of sugar in coffee or tea were inquired. Regarding visits to the dentist, the subjects were asked the time of their most recent dental visit; habitual dental attendance was inquired by asking if they go for check-ups even if they do not have any problems or toothache. The most recent dental treatments to be chosen from a list of 16 alternatives were categorized into diagnostic, preventive, conservative, and non-conservative. A detailed inquiry on professional guidance in oral self-care as received described active professional prevention by listing 17 different items, later grouped into six aspects: toothbrushing, interdental cleaning, home use of fluorides, dietary advice, dental attendance, and visual aids regarding oral conditions, treatment and oral self-care. Sources of information on oral self-care were to be chosen from a list of 16 options, later grouped into four types: health professionals, social contacts, printed media, and broadcasted media. Knowledge of oral self-care was inquired as one of the six alternatives, later categorized into good, moderate, and poor levels, and, further, as good or below good. The clinical examination included basic dental and periodontal conditions. The presence of teeth was recorded by tooth group, dentures by type and by jaw, and dental caries by tooth. Periodontal findings were recorded as half-mouth, excluding third molars. Dental plaque was recorded on selected surfaces in the upper molar, lateral incisor, and lower molar and canine. Calculus was recorded by type of tooth in upper molars, lower premolars and incisors. Bleeding on probing, deepened pockets, and overhangs of restorations were recorded in upper and lower molars and premolars. Recordings for deepened periodontal pockets were made at four sites.

The subjects' mean age was 69.2 and their mean number of teeth was 16.2. Generally, the present elderly demonstrated rather poor oral health behaviour. In all, 30% reported toothbrushing twice daily, 39% of women and 23% of men, 19% indicated daily interdental cleaning, 57% used fluoride toothpaste always, and 8% did not take any sugar in their coffee or tea. A total of 36% reported visiting a dentist within the previous year and 30% going habitually for check-ups; 25% had 21 or more teeth, being more frequently younger or highly educated subjects, and 32% reported wearing removable dentures.

Dental plaque, calculus, bleeding on probing, and deepened pockets were present in all of the subjects; 70% had pockets 6mm and deeper. Caries occurred in 94% of the subjects; overhangs of restorations appeared in 73% of the subjects, being more frequent in younger or highly educated subjects.

As the source of information on oral self-care health professionals dominated (82%), followed by social contacts (72%), broadcasted (58%), and printed media (42%). Younger or highly educated subjects more frequently mentioned the media as their information source. In all, 34% assessed their oral self-care knowledge as good; again those younger or highly educated subjects most frequently assessed their knowledge as good. Self-assessed knowledge was clearly ($r=0.52$) associated with the intensity of professional guidance reported as received.

During the most recent treatment conservative (39%) and non-conservative (34%) treatments dominated. Preventive treatment comprised a minority (7%) of the reported services. Active professional prevention consisted largely of guidance in toothbrushing (54%), interdental cleaning (32%), and providing the patient with some visual information (33%). Guidance in dental attendance, the use of fluorides, and dietary advice was particularly rare. In general, the intensity of professional guidance was low.

The subjects' self-assessed level of oral self-care knowledge and the intensity of guidance in oral self-care they reported as received correlated with following the recommended oral self-care. In particular, the differences were pronounced in those with a poor level of self-assessed knowledge and no guidance received. Subjects with good self-assessed knowledge or a university education were more likely to report twice daily toothbrushing.

Those with better oral health behaviour had a greater number of teeth. Having 21 or more teeth was associated with good self-assessed knowledge of oral self-care. Subjects brushing their teeth twice daily exhibited less severe periodontal conditions. The presence of periodontal pockets of 6mm and deeper was associated with a poor level of dental cleanliness and below good self-assessed level of knowledge of oral self-care.

Oral health behaviour and conditions call for great improvement in the Lithuanian elderly. Dentists should be encouraged to use the whole array of available preventive tools. Particular emphasis should be placed on active preventive measures to support elderly subjects in their daily oral self-care practices, check-up-based use of dental services, and on providing updated knowledge at every dental visit to improve their oral health. A preventive approach should be strongly emphasized in countries with limited resources for oral health care, such as Lithuania.

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Sonata Vyšniauskaite

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11. APPENDIX

The questionnaire in Lithuanian can be provided upon request

UNIVERSITY OF HELSINKI
INSTITUTE OF DENTISTRY

RESEARCH ON SENIORS
QUESTIONNAIRE

1. When was your most recent visit to the dentist? Year ____ Month ____
2. Was your dentist at a private clinic a public clinic or elsewhere?
3. Was that dentist your regular dentist? Yes/No
4. Was that dentist a man or a woman?
5. How many visits did you make altogether during your most recent dental treatment course?

6. Mark all the dental treatments you have received during your most recent treatment course

- | | |
|--|--|
| <input type="checkbox"/> Clinical examination | <input type="checkbox"/> Cleaning |
| <input type="checkbox"/> Filling | <input type="checkbox"/> Scaling |
| <input type="checkbox"/> Radiography | <input type="checkbox"/> Fluoride varnish |
| <input type="checkbox"/> Removable denture | <input type="checkbox"/> Denture repair |
| <input type="checkbox"/> Bridge | <input type="checkbox"/> Root canal treatment |
| <input type="checkbox"/> Crown | <input type="checkbox"/> Polishing of filling |
| <input type="checkbox"/> Tooth extraction | <input type="checkbox"/> Surgery on teeth or gums |
| <input type="checkbox"/> Treatment for toothache | <input type="checkbox"/> Other treatments; name which ones |

7. How has your dentist guided you in oral self-care? Choose from the alternatives in each line.

DID YOUR DENTIST

- | | |
|---|-------------------------------------|
| - tell you how to brush your teeth? | Yes, recently/Yes, previously/Never |
| - show you how to brush your teeth? | Yes, recently/Yes, previously/Never |
| - give you a toothbrush? | Yes, recently/Yes, previously/Never |
| - recommend any particular toothpaste for you? | Yes, recently/Yes, previously/Never |
| | |
| - tell you how to clean your interdental spaces? | Yes, recently/Yes, previously/Never |
| - show you how to clean your interdental spaces? | Yes, recently/Yes, previously/Never |
| - give you any device for interdental cleaning? | Yes, recently/Yes, previously/Never |
| | |
| - advise you to use fluoride pills? | Yes, recently/Yes, previously/Never |
| - advise you to use fluoride mouth rinse? | Yes, recently/Yes, previously/Never |
| | |
| - recommend xylitol chewing gum for you? | Yes, recently/Yes, previously/Never |
| - give you any dietary advice? | Yes, recently/Yes, previously/Never |
| | |
| - suggest a recall for a dental check-up? | Yes, recently/Yes, previously/Never |
| - suggest a recall for professional teeth cleaning? | Yes, recently/Yes, previously/Never |
| | |
| - give you a brochure on oral self-care? | Yes, recently/Yes, previously/Never |
| - show you pictures of oral diseases? | Yes, recently/Yes, previously/Never |
| - show you pictures of treatment options? | Yes, recently/Yes, previously/Never |
| - show you your own radiographs? | Yes, recently/Yes, previously/Never |

8. How would you assess your knowledge of oral self-care?

Excellent/Very good/Good/Average/Poor/No knowledge

9. What are your sources of information about oral self-care? Mark all possible sources.

- | | | | |
|--|-------------------------------------|--|---------------------------------------|
| <input type="checkbox"/> Newspapers | <input type="checkbox"/> Magazines | <input type="checkbox"/> Printed ads | <input type="checkbox"/> TV |
| <input type="checkbox"/> Friends | <input type="checkbox"/> Relatives | <input type="checkbox"/> Books | <input type="checkbox"/> Radio |
| <input type="checkbox"/> Dentists | <input type="checkbox"/> Physicians | <input type="checkbox"/> Social workers | <input type="checkbox"/> Social clubs |
| <input type="checkbox"/> Oral hygienists | <input type="checkbox"/> Nurses | <input type="checkbox"/> Shop assistants | <input type="checkbox"/> Other _____ |

PLEASE, CONTINUE ON REVERSE SIDE

NEXT QUESTIONS WILL BE ON YOUR ORAL SELF-CARE

10. How often do you brush your teeth? Mark one suitable answer.

- Once a day More often Weekly Less frequently Never

11. Do you use fluoride toothpaste when you brush? Mark one suitable answer.

- Always Almost always Occasionally Seldom Never

12. What time of the day do you brush your teeth? Mark all the alternatives, which describe your habits.

- In the morning In the evening Before a meal After a meal Before socializing

13. How often do you clean your interdental spaces? Mark one suitable answer.

- Once a day More often Weekly Less frequently Never

14. How much sugar do you take with your coffee/tea? _____ cubes or teaspoons per cup?

15. How many cups of coffee/tea do you drink daily? _____

16. How often do you use xylitol chewing gum? Mark one suitable answer.

- Once a day More often Weekly Less frequently Never

17. How often do you use fluoride pills? Mark one suitable answer.

- Once a day More often Weekly Less frequently Never

18. How often do you use fluoride mouth rinse? Mark one suitable answer.

- Once a day More often Weekly Less frequently Never

NEXT WE ARE GOING TO ASK YOU FOR AN ASSESSMENT OF YOUR HEALTH

19. How would you assess your general health status? Choose from these alternatives:

Excellent/Good/Average/Poor/Very poor

20. How would you assess your oral health status?

Excellent/Good/Average/Poor/Very poor

NOW WE SHALL ASK YOU ABOUT THE DENTAL TREATMENT YOU HAVE RECEIVED

21. How many fillings have you had in the past three years?

How many of your teeth have been extracted in the past three years?

How many times have you had fluoride varnish applied to your teeth in the past three years?

22. How old were you when you first went to the dentist? _____

How old were you when you had your first filling? _____

How old were you when you had your first tooth extracted? _____

23. Do you visit a dentist for check-ups even if you do not have any problems or toothache?

Yes, annually/Yes, once every two years/Yes, more seldom/ No, never

24. Are you afraid of going to the dentist?

Extremely/Very much/Much/Somewhat/Slightly/Not at all

25. Have you ever experienced dental fear?

Only when I was a child/Only when I was young/Only as an adult/Always/Never

FINALLY, COULD YOU, PLEASE, GIVE SOME BASIC INFORMATION ABOUT YOURSELF

26. Year of birth _____ Sex _____ Residence as a child: (fluoride or non-fluoride area)

Present residence: Urban Rural

27. Education

- Less than primary school Primary school Secondary school University

28. Do you have any removable dentures in your upper jaw _____ in your lower jaw _____

29. How many teeth are in your upper jaw _____ How many teeth are in your lower jaw _____

Date of questioning _____ Place _____