ORAL AND NUTRITIONAL STATUS – IS THE MNA® A USEFUL TOOL FOR DENTAL CLINICS

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Abstract: *Objectives:* To determine the oral status of elderly residents in nursing homes (NH) and long term care wards (LT) and to describe associations between oral status and nutritional status among institutionalized elderly residents. *Design:* Descriptive, cross-sectional study. *Setting:* All elderly residents in all NH and LT in Helsinki, the capital of Finland. *Participants:* The study included 2036 out of 2424 (84 %) eligible subjects in NH, 1052 out of 1444 (73%) eligible subjects in LT, and all wards in NH (N=92) and LT (N=53). *Measurements:* A structured questionnaire, oral examination, and Mini Nutritional Assessment (MNA®) were completed by ward nurses for all participating residents. The structured questionnaire included information on oral status and oral health problems, demographic characteristics, functional status, diseases and medication. One questionnaire for each ward was used to evaluate the daily ward routines related to nutritional care and meal management. *Results:* 11 % of the NH residents and 3 % of LH patients were well nourished. Of NH residents 60 % were at risk of malnutrition and 29 % were malnourished. The respective figures for LT patients were 40 % and 57 %. Nutritional status was significantly associated with oral status and with the number of oral health problems. Those with mixed dentition or complete dentures tended to have better nutritional status than those totally edentulous without prosthesis. Malnutrition increased consistently with the increasing number of oral health problems (including chewing problems, swallowing difficulties, pain in mouth and xerostomia). *Conclusion:* In the population of institutionalized frail elderly, malnutrition was related to both poor oral status and oral health problems.

Key words: Frail elderly, oral health, nutrition, MNA® (Mini Nutritional Assessment).

Introduction

Frailty and malnutrition are common and interrelated conditions in the elderly and make them more vulnerable for adverse health outcomes (1). Frailty is defined by the presence of weight loss, exhaustion, low walking speed, low handgrip strength, and physical inactivity (1). Frailty is associated with the presence of oral inflammation which may lead to the loss in muscle strength increasing the risk of disability (2). Protein energy malnutrition is related to increased risk of inflammation, infections, decreased muscle mass and strength, and disability (3, 4).

Several studies have shown malnutrition is related in general to poor oral health and eating difficulties (5-9). Older age groups have poor oral health and are at risk for malnutrition (9). Common oral problems among older adults are xerostomia, tooth decay, periodontal disease, tooth loss and decreased masticatory function (10). Poor oral health and dental problems can lead to poor diet, impaired food choices (5, 8), and consumption of mashed food or alterations of the diet, which in turn is a risk factor for malnutrition (11).

Older adults also use multiple drugs, many of which may lead to decreased saliva production (12). This can cause dry mouth, which is hazardous to oral health and, along with

chewing and swallowing problems, is related to the risk of malnutrition (6, 13). However, the causal relationship between specific oral disorders and poor nutritional status is weak (11, 13).

Compared with other Nordic countries, in Finland the oral health of older people has been and continues to be poor. Edentulousness is common even though oral health has improved over the last decades. According to the Health 2000 population study, half of the population over 75 years of age was edentulous (14). Even among the dentate, oral health problems are common (14).

The aim of this study was to determine the oral status of elderly residents in nursing homes and long term care wards in Helsinki and to describe the association between oral status and nutritional status of elderly residents.

Materials & Methods

This study comprised all elderly residents in all nursing homes and long term care wards in Helsinki, Finland. The study is part of a larger study, the Helsinki Nutrition Study of Older People, which was designed to obtain a comprehensive picture of nutritional status and related factors of elderly residents. In the Helsinki Nutrition Study of Older People, we

sought information about the nutritional status of institutionalized long-term care residents and the daily routines related to nutritional care. With the aid of this assessment and educational process, our goal was to improve the nutritional care in the wards. In this article we describe the results related to oral health and nutrition in the Helsinki Nutrition Study of Older People.

Study sample

All 92 wards in the private and public nursing homes (NH) and all 53 long-term care wards (LT) in the city hospitals in Helsinki participated to the study. Of the 2424 private and public nursing home residents, 2036 (or 84%) participated in the study. 1052 out of a total of 1444 patients in long-term care wards in Helsinki city hospitals, or 73%, participated in the study. Refusals were due to sickness or fatigue or short length of stay.

Data collection and examination protocol

Ward nurses who were familiar to residents and long-term care patients interviewed and assessed each resident and filled in questionnaires. The nurses received detailed education prior to performing the nutritional assessments. The structured questionnaire included information on demographic characteristics, functional status, diseases and medication. Details of the questionnaire have been described in our earlier studies (15-18).

Oral status was evaluated by ward nurses by interviewing, observing and assessing the residents. Oral status was classified according to the presence and type of dentition and included the following categories: natural teeth only, mixed dentition (partial dentures with or without natural teeth), complete (full) dentures or totally edentulous without prosthesis. The number of teeth was not counted. Oral health problems were categorized as follows: chewing problem, swallowing difficulties, pain in the mouth and xerostomia. Each resident was assessed by the Mini Nutritional Assessment test (MNA®) (19, 20). We collected information about the residents' eating habits and diets to determine the nutritional quality of the diet. The structure (consistency) of food was defined by three categories: any food, soft food, and puréed or liquid food.

In addition, one structured questionnaire was completed for each ward to evaluate the daily ward routines related to nutritional care and meal management on the ward.

Statistical analysis

The data were analyzed by SPSS (NH, LT) and NCSS (LT) statistical programs. The differences between men and women at the baseline were tested by Chi-square test for categorical variables and a two-sided T-test for continuous variables. Three groups of MNA® categories (well-nourished, those at risk of malnutrition and those malnourished) were compared by Chi-square test. The Chi-square test was also used to compare the different categories of oral status and their relationship to eating problems. For modelling purposes, categorical variables with many levels were dichotomised. The results were considered as statistically significant at level $p \leq 0.05$.

Results

Characteristics of study sample

The study population consisted mostly of women; 81 % of NH residents and 75 % of LT patients were female. The mean age was 83 years in NH and 81 years in LT. The male residents were younger than the female residents in both places. Table 1 shows the basic characteristics of the study population.

Table 1
Basic characteristics of the study population

Characteristics (%)	NH[1] (N=2036)	LT[2] (N=1052)
Mean age, years	83	81
Widowed (%)	53	46
Education: primary school or less (%)	61	58
Time of residence, years (mean)	3.3	3.1
Not able to move independently (%)	66	86
Needs lot of assistance or is totally dependent in eating (%)	17	56
Dementia (%)	68	77
Pressure sores (%)	15	22
Prior hip fracture (%)	20	27
Mean number of medications (SD[3])	8.1 (3.8)	10.2 (4.2)

1. Nursing Homes; 2. Long-term care; 3. Standard deviation

Nutritional status

Most of the residents in NH and LT were either malnourished (MNA® <17) or were at risk for malnutrition (MNA® 17-23.5) (Figure 1). Only 11% of the NH residents and 3 % of LH patients were well nourished (MNA® >23.5). Sixty percent of NH residents were at risk for malnutrition and 29% were malnourished. The respective figures for LT patients were 40 % at risk for malnutrition and 57 % malnourished.

Oral status and oral health problems

Only about one third of the subjects had natural dentition and 20 % were totally edentulous with no prosthesis (Table 2). Complete dentures were most common in NH and natural dentition only in LT. The residents also had many oral health problems (Table 2).

Table 2

Basic data regarding subjects' dental characteristics and eating difficulties

Variables	NH[1] (N=2036)	LT[2] (N=1052)
Oral status categories (%)*		
Natural teeth only	28	37
Mixed dentition[3]	21	18
Complete (full) dentures	37	18
Totally edentulous without prosthesis	14	27
Oral health problems (%)#		
Chewing problems	24	34
Swallowing difficulties	14	30
Pain in the mouth	6	7
Xerostomia	11	15

1. Nursing Homes; 2. Long-term care; 3. Partial dentures with or without natural teeth; *one category per subject; #several problems per subject possible

Nutritional status was significantly associated with oral status (Table 3) and with the number of oral health problems (Figure 2). Those with mixed dentition or complete dentures tended to have better nutritional status than those who were totally edentulous and had no prosthesis. Malnutrition increased consistently with the increasing number of oral health problems (including chewing problems, swallowing difficulties, pain in mouth and xerostomia).

Oral status categories were significantly associated with the consistency (structure) of food offered and oral health problems. Puréed or liquid food, chewing and swallowing difficulties and xerostomia, as well as eating less than half of the food offered, were associated with the category "totally edentulous without prosthesis" (data not shown).

Discussion / Conclusions

The population of this study consisted of institutionalized older adults who could be considered as frail elderly. They had serious limitations in ambulation and were dependent on nursing assistance. Most of them were malnourished or at risk for malnutrition. Malnutrition was related to both poor oral status and oral health problems.

The number of residents who were malnourished or at risk for malnutrition in this study corresponds with earlier studies, where the proportions of those with malnutrition has varied between 19-71 % and at risk for malnutrition between 40-60 % in long term care and hospitals (21-27).
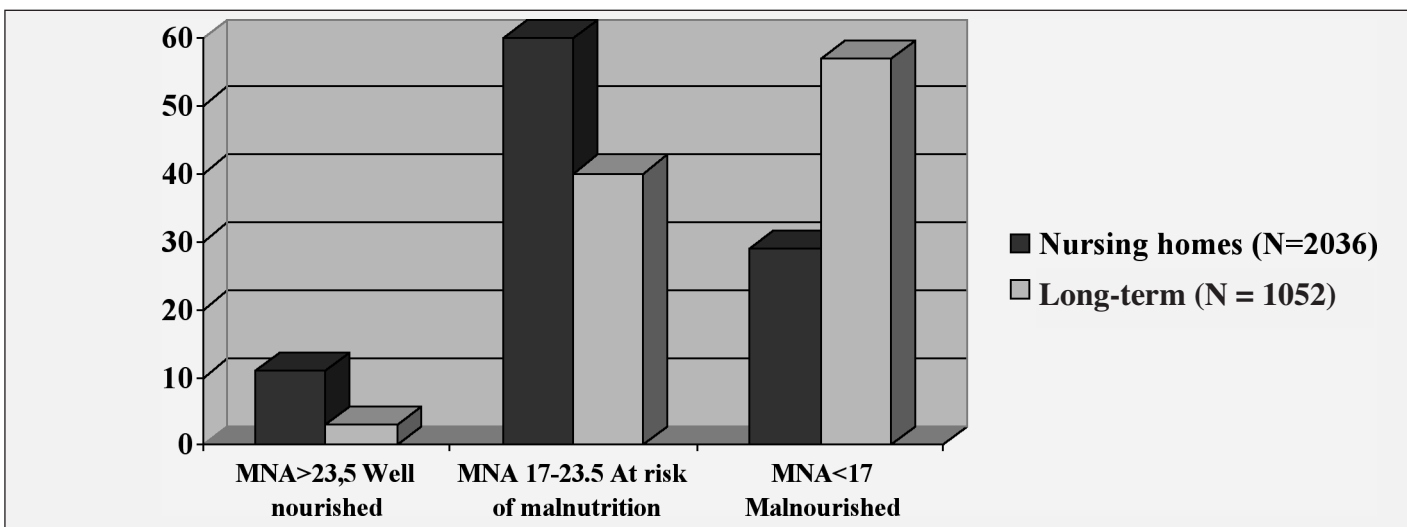
About half of the residents had no natural dentition and one in five had no prosthesis. Compared with earlier studies in England (28) and Spain (13), the number of people with no dentition is higher in our study. Our study shows, with high statistical power, that those who are totally edentulous and have no prosthesis seem to be at particular risk for malnutrition. In addition, the residents had multiple oral health problems. These findings are consistent with earlier studies, which have shown oral problems are common among older adults, especially those in institutions (10, 11).

Nutritional status, oral status and oral health status were associated in many ways. The more oral problems a subject had, the greater his/her risk for malnutrition. This association has also been shown in earlier studies (10, 29, 30).

Among the elderly, those living in institutions are most vulnerable for deteriorating oral health and tooth loss. This tendency is related to life-long exposure to oral inflammation and is influenced by socio-economic factors such as education and household income (31, 32). In our study, more than half of the subjects had a primary school education or less and the proportion of edentulous was high; even the dentate had a

Figure 1

Nutritional status of Nursing Homes and Long-term Care residents by MNA® categories (%)

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Figure 2

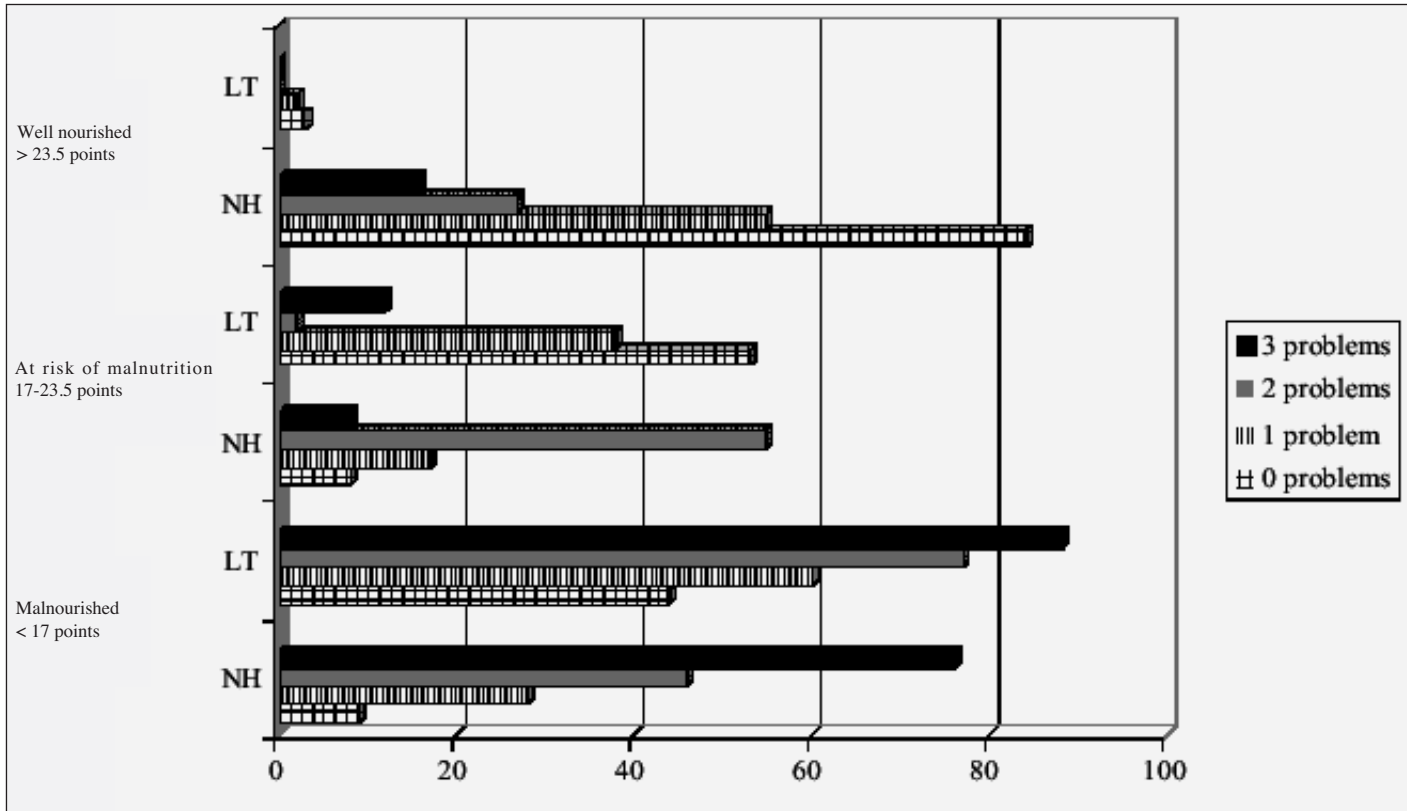MNA®-value and its relationship with the number of oral health problems among NH and LT patients. (%)

Table 3

Oral status and oral problems in the MNA® categories

Factors	<17 (N=590) NH[1]	17-23,5 (N=1222) NH[1]	>23,5 (N=224) NH[1]	P-value	<17 (N=600) LT[2]	17-23,5 (N=421) LT[2]	>23,5 (N=31) LT[2]	P-value
Oral status categories (%)				≤0.001				≤0.001
Natural teeth only	29	28	30		37	38	30	
Mixed dentition[3]	20	21	21		16	21	37	
Complete dentures	30	39	38		14	22	29	
Totally edentulous[4]	21	12	10		33	19	4	
Oral health problems (%)								
Chewing problems				≤0.001				≤0.001
No	59	80	91		59	75	86	
Yes	41	20	9		41	25	14	
Swallowing difficulties				≤0.001				≤0.001
No	72	90	98		59	84	91	
Yes	28	10	2		41	16	9	
Pain in the mouth				≤0.001				ns
No	90	95	98		92	94	100	
Yes	10	5	2		8	6	0	
Xerostomia				≤0.001				≤0.001
No	82	91	93		81	91	96	
Yes	19	9	7		19	9	4	

1. Nursing Homes; 2. Long-term care; 3. Partial dentures with or without natural teeth; 4. Totally edentulous without prosthesis

variety of oral problems. Poor oral status is associated with oral inflammation, which may lead to a loss in muscle strength increasing the risk of disability (2). Therefore, good dental care throughout the life span may decrease the risk of disability in old age (2). Given the tendency for older adults to use less dental services than younger age groups (14), it is important to support the use of regular dental services by the elderly.

There are profound and complex interactions between nutrition and oral health (33). Both are related to disability, which in turn is influenced by socio-economic factors such as education and household income (34). In the frail elderly, problems arise when functional ability decreases and the need for assistance in performing activities of daily living increases. Those elderly with poor functional status need support with daily oral health care including brushing teeth or cleaning dentures (35). The crucial question is how to preserve the oral function and oral health of older adults, even in institutions.

Daily oral health care is crucial in preserving good oral health. All caregivers who work with older adults should be aware that decreasing functional ability increases the need for assistance in performing daily oral care. Nurses in home care, acute care settings and long term care need support from dental personnel to provide good daily oral care. Nutritional assessment by MNA® and the number of drugs are significant indicators for dental treatment needs. The information provided by the patient's MNA® is pivotal for planning dental treatment.

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DISCUSSION

Riva Touger-Decker, PhD, RD, University of Medicine & Densitry of New Jersey, Newark, NJ, USA: *I am thrilled to see what you have done in this study because we do not do enough of that in this country. We looked at something similar in a small nursing home population. Using the MDS and nutrition screening, not the Mini Nutritional Assessment (MNA®), we found that biting, chewing and swallowing problems were, by far, the biggest predictor of nutrition risk. I would like to know how you interpreted question (a) when using the MNA®. Question (a) asks whether intake has declined over the past three months due to loss of appetite, digestive problems, chewing or swallowing. However, points are awarded for loss of appetite rather than for the specific problems. The reason why we could not use the MNA® in our study was that we found that while the patient's appetite is good, they still may have problems biting, chewing and swallowing. The options given in the MNA® only deal with appetite. They do not deal with the functional disabilities. The question refers to several problem areas, but the options given deal only with appetite, not the problems themselves. How has that been interpreted?*

Bruno Vellas, MD, Toulouse University, Toulouse, FR: *The importance of question (a) of the MNA® is to see whether the patient is at risk for a low food intake. For purposes of this question, it does not matter whether the low intake is due to loss of appetite or other problems, such as swallowing difficulties for example.*

Riva Touger-Decker: *If the problem is functional, that would be a pointer to refer the patient to the dentist before their nutrition status is compromised.*

Bruno Vellas: *When the health professional performs the MNA®, they are free to ask why the person has a low intake of food. If, at that point, the patient says that the low intake is not due to a loss of appetite but rather a difficulty with swallowing or chewing, they should then visit the dentist.*

Cameron Chumlea, PhD, Wright State University, Dayton, OH, USA: *This may be a translation issue. You want to ask whether food intake has declined. Food intake differs from appetite. Appetite is the desire for food, whereas intake is the amount of food ingested. Perhaps the words 'loss of appetite' should be replaced by 'severe loss of food intake'. Intake might be a better word in this case. It is a wording issue.*

Riva Touger-Decker: *Appetite and intake are two different animals. We could not use the MNA® because of this. This is a very important point.*

Cameron Chumlea: *A low appetite is also an important consideration, but may form a separate question.*

Bruno Vellas: *It is important to bear in mind, that when we use a tool to help us in making an assessment, we can only formulate the clinical aspects of the tool. The people using the tool have to interpret the individual questions, such as what appetite means in the context of question (a). It is important that this be included in the MNA® manual. It depends on the individual patient. The health professional must adapt the tool as appropriate.*

Riva Touger-Decker: *If you want standardization, the question must address the issue which it is intended to address. It is two different animals. We did a study in our dental clinics, which included people of all age ranges. The key predictors of nutrition risk, with high specificity and sensitivity, were BMI, chewing problems and lack of saliva. I think it would be interesting and give you patient perceived as well as clinically evident measures of chewing and lack of saliva with the MNA®.*

Bruno Vellas: *Perhaps after the symposium we can consider making some changes to the tool. It may be a translation problem. We could perhaps ask whether food intake has declined over the past three months due to loss of appetite, digestive problems or swallowing difficulties, with score of zero indicating severely, one indicating moderately and two indicating not at all. Perhaps we do not have to refer to appetite in this case.*

Cornel Sieber, MD, Erlangen-Nürnberg University, Nürnberg, DE: *It appears to be a semantic problem. You cannot grade appetite against appetite. The question is stated differently in the German version. In that version, both appetite and anorexia (less intake) are mentioned. It is simply a semantic problem arising from the translation into different languages. It will have to be changed in the English version.*

Helena Soini, RN, PhD, Elderly Care, City of Espoo, Espoo, FI: *The most important factor in answering this question is the decline in food intake. Of course, it should also be noted, that having any of the problems listed, does not always result in a lower intake.*

David Thomas, MD, Saint Louis University, St. Louis, MO, USA: *The following questions have always puzzled me. You found that not having teeth, being dentureless, was associated with malnutrition. Several years ago there was a trial in a nursing home. Grant money was used to replace dentures throughout the home in a randomized fashion. It was found, that replacing the dentures did not increase food intake. The first question is whether you have any information about whether providing dentureless patients with dentures makes a difference with regard to intake. Secondly, some dentists consider that dentures are mainly cosmetic because they are ill fitting as a result of bone loss. In fact, the older population finds it very difficult to get dentures that fit well enough to eat properly. Therefore are better off eating their meals without teeth.. The two questions are: is there any data suggesting that making dentures for people helps, and should people then eat with or without their dentures?*

Riva Touger-Decker: *We did a study a decade ago, which found that a third of the patients coming in to get new dentures, took the dentures out to eat. They got the dentures for social reasons. The bone loss relates to the inflammatory process question. There is a relationship between several oral diseases and chronic diseases which affect bone loss, but we cannot say whether we are seeing more bone loss today or we are just detecting it better. The other factor is that edentulous patients develop great ridges, which are quite tough and allow for the sensory perception and stimulation of eating that an upper denture prevents to some degree. With upper (maxillar) dentures, patients lose some sensory perception with foods because their palate is covered by plastic. Often patients who are edentulous do much better with no teeth than with full dentures. Meanwhile the people who do characteristically worse are the people with partial edentulism or lack of occlusal contacts, for example where they have three remaining teeth in the front and two at the back. In these cases the remaining teeth do not come together.*

Helena Soini: *The population used in our study may have had their dentures for over fifty years. In these cases they are used to them. On the other hand, in some studies it has been shown that when patients are over 60, for example 65 or 70, when they get new dentures, they might not*

learn to use them properly.

Cameron Chumlea: *The follow up question is why is this showing up in your study? Why is the factor of edentulism showing up, when, in fact, it does not help to correct it?*

Helena Soini: *We found that we could relate a low MNA® to those with natural dentition or those who were edentulous. Those who had complete prostheses scored better.*

Phillip Garry, MD, University of New Mexico, Albuquerque, NM, USA: *I note that one of your recommendations was vitamin D supplementation. What is the basis for such supplementation?*

Helena Soini: *It is a national recommendation. In Finland, it is dark with very little sunlight in the winter and old people generally stay indoors. There is research, which shows that Finnish people do not get enough vitamin D. A certain amount of vitamin D is recommended for the elderly.*

Tommy Cederholm, MD, Karolinska University Hospital Huddinge, Stockholm, SW: *Politicians tend to overestimate the role of teeth when it comes to the health of the elderly. In Sweden, free dental care for the elderly is a very hot topic in the upcoming election. One reason would be to improve the health and nutrition of the elderly. Poor condition of teeth is mainly an effect of general poor health conditions. We did a study of about 250 nursing home residents, where we saw a relationship between early signs of malnutrition and poor masticatory function. The relationship disappeared when it came to more severely malnourished individuals. This does not mean that I do not find dentition important for the elderly. On the contrary, it has a very large impact on the person's quality of life. However, I have a feeling that, in Sweden in particular, we will spend a lot of money on dental care for elderly people without having scientific evidence of the positive effects of such care on nutrition and health.*

Yves Guigoz, PhD, Nestlé Product Technology Center, Konolfingen: *The Lamy study in 1999 (Lamy M, et al. J Dent 1999; 27:443-448), used a chewing test, to test the fit of the dentures. It examined whether people wearing dentures could chew and swallow cubes of carrot in a certain amount of time. They also counted the number of chews.*

Gordon Jensen, MD, Vanderbilt University, Nashville, TN, USA: *I would like to reiterate a point about oral health concerns. While oral health concerns have clearly and consistently been associated with malnutrition and micronutrient deficiencies, part of its utility as a predictive parameter is probably because of the observation, that it is also a great proxy indicator for underlying disease and inflammation. For example, there is very strong data relating gum disease and smoldering inflammation to increased risk of cardiovascular disease. People with very poor dentition are often in ill health, with multiple inflammatory conditions.*

Cameron Chumlea: *Is there any data to indicate the age of prevalence of onset of dentures is or which would describe tooth loss against age in people?*

Riva Touger-Decker: *What we see now reported in literature is that edentulism is at its lowest rate. The problem is that this is a highly selective viewpoint. When you look at it in certain pockets of the country, like Newark for example, 30 year olds are getting full dentures. This is not reflected yet because Medicaid does not cover dentures. There is no public assistance for the dental work required, except in the HIV population, who receive Medicare. This is a major problem. The data indicates a mean age somewhere in the 40's but that is constantly shifting. There is a prediction, that the mean age will shift even more with the greater incidence of type II diabetes and other diseases arising earlier as a result of obesity. There is a major socio-economic link. A comparison of our clinic to a clinic at the University of Connecticut would show very different results.*

David Thomas: *It is fascinating. A dentist in St Louis has found that one of the strongest associations with cardiovascular disease is having one or two teeth, because of the chronic inflammation involved. C-reactive protein is directly associated with the inflammation. Patients without any teeth are better off. The real question is whether patients should be provided with dentures, once the teeth with periodontal disease have been removed?*

Riva Touger-Decker: *I would be interested to hear a comment from someone from the Department of Veteran Affairs (VA). My interest and move into oral health education came as a result of directing the dietetic internship at a VA. At that time, the dental service provided people who needed dentures with dentures. The dentures were often not used. They were used to go to social events or to sit in the dining room. The patients would then take the food back to eat in their rooms when they took out their teeth.*

Bruno Vellas: *Do you have information in your study on the link between MNA® score and mortality, based on a two-year follow up?*

Helena Soini: *For the purposes of this follow up we did not revisit every resident. We collected information but not at that level. We plan to do this follow-up in three years. We will assess every resident again. We might connect the results with the Minimum Data Set, in order to get a full follow up in individual level.*

Tommy Cederholm: *Just a very short comment. The dentists that I work with at Karolinska Institute in Stockholm, are very interested in the relationship between chewing capacity and dementia. They have seen a very strong relationship between the ability to chew and the onset of dementia. By taking the teeth out of rats' mouths, they found that the rats become demented, without doing anything else. They do not know why and I do not attempt a guess.*