Long-term physical inactivity and oral health in Finnish adults with intellectual disability

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Physical inactivity is prevalent among patients with intellectual disability. Because little is known about the oral effects of poor mobility, we reviewed the medical and dental charts of institutionalized dentate patients ($n = 214$;40.2 years ± 12.1) of the Special Welfare District of Southwestern Finland. The number of decayed, missing, and filled teeth (DMFT), the number of retained teeth, dental treatment visits, and the type of the first treatment visit were recorded. Physical activity was good in 55% and severely reduced or completely absent in 45% of the patients. The degree of intellectual disability was mild or moderate in 40% and severe or profound in 60% of the patients. The walking patients weighed more (64.3 (19.6) versus 44.4 (14.4) kg; $P < 0.001$), had fewer secondary diagnoses (1.4 (1.3) versus 2.2 (1.4); $P < 0.001$), fewer daily medications (4.0 (2.1) versus 4.8 (2.4); $P < 0.02$), higher DMFT scores (18.5 (8.2) versus 14.8 (9.2); $P < 0.05$), and more dental treatment visits (2.7 (2.4) versus 2.0 (1.3); $P < 0.03$) than patients with poor physical activity. Periodontal treatment given as the primary type of dental care was more common among subjects with poor mobility than among those with good motor activity ($P < 0.002$). Poor physical activity was related to better dental health, higher need for periodontal therapy, and fewer dental visits than in patients with good motor activity. □ *Dental health; intellectual disability; osteoporosis risk; periodontal treatment; physical inactivity*

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Earlier reports on the oral problems of patients with intellectual disability (ID) show a poor level of oral hygiene and a significant need for periodontal treatment (1–6) as compared with subjects of similar age with no ID or with non-institutionalized patients with ID. Institutionalized patients with ID seem to lose more permanent teeth due to periodontal problems than the normal population of similar age range (7). Interestingly, the level of oral health of the institutionalized patients appears to be the same as or better than that of patients living in a less restrictive environment (4, 7–9).

A considerable proportion of institutionalized patients with ID have severely reduced or complete immobility (10, 11). Physical immobility is known to change the calcium turnover of the human body so that, in spite of sufficient dietary intake of calcium or exposure to sunshine, more calcium is lost from than reloaded to the skeletal bones and excreted through urine, sweat, and feces (12). To our knowledge, the effect of physical inactivity on oral health has not been studied earlier. This may seem surprising, knowing that physical inactivity is closely related to high risk of osteoporosis (13–17), which again could affect all mineralized structures of the human body and of the jaws as well.

Our aim was to study the oral health and the dental care of institutionalized patients with intellectual disability in accordance with physical activity.

Materials and methods

Our data were collected from the medical and dental records of institutionalized dentate subjects with intellectual disability ($n = 214$), examined and treated at the dental clinic of a mental institute, Peimari Support Center, of the Special Welfare District of South-Western Finland during 1990–95.

Institutional conditions

The patients generally receive five daily food servings, comprising breakfast, lunch, afternoon coffee, dinner, and an evening snack. Although the actual calorie intake was not measured, all patients received the same daily servings. However, walking patients usually eat food of normal texture, whereas patients with more severe levels of retardation and poor mobility eat mostly mashed food. Mashed food requires little or no chewing, and therefore salivary stimulation and self-cleansing of the oral cavity is minimal. The daily diet in the institute is well balanced and is generally received with similar frequency by both walking and non-walking patients. The residents have no access to refrigerators or grocery cupboards and do not participate in preparing meals. About one fourth of the patients visit the in-house cafeteria once a week, and a few of them can visit their relatives once or twice a year.

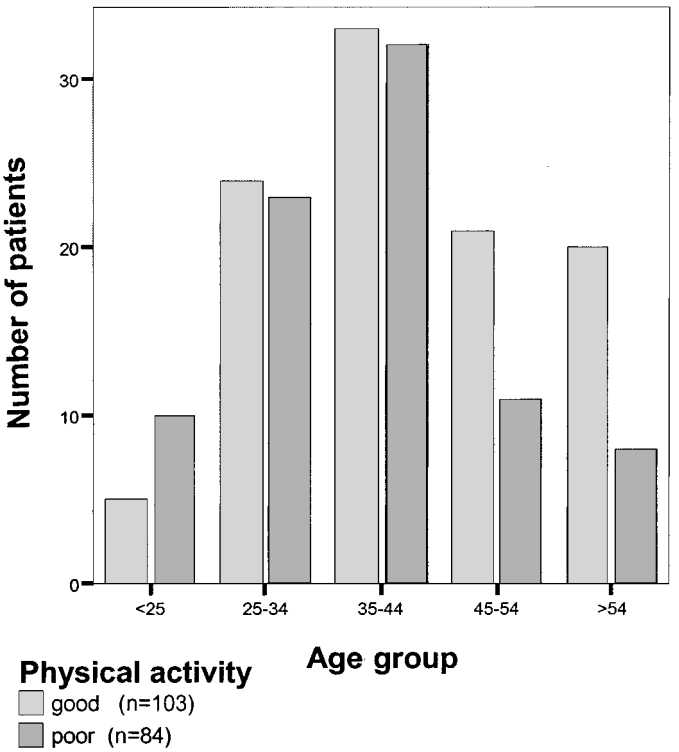

Fig. 1. The distribution of patients into the two physical activity groups in accordance with age group.

Interview of the personnel

The level of physical activity was ascertained by interviewing the personnel—that is, the nurses who had been in charge of the patients' well-being for several years—and was considered 'good' if the patient was able to walk and 'poor' if he or she needed walkers or a wheelchair (40%) or if the patient was completely bedridden (10%). The number of institutional years ranged between 1 and 48 years and had a mean (standard deviation (*s*)) of 18.7 (12.8) years.

Daily tooth brushing was classified as 'self-care' or 'assisted,' depending on the most usual procedure in each case. Since for the past 3 decades only fluoridated toothpaste had been used in the institute and in Finland in general, the use of toothpaste was excluded from the variables analyzed.

Medical status

Age, sex, the level of ID classified in accordance with the WHO criteria (18), body weight, the number of secondary diagnoses, and that of daily medications were recorded. Patients without assessed level of ID ($n = 12$) and those with a diagnosis of NUD (non ultra descriptus; $n = 12$) were excluded from the analyses. Patients younger than 15 years of age were excluded ($n = 3$) due to incomplete permanent dentition. The study group consisted of 106 male and 81 female patients with no significant difference between sexes with regard to the various levels of ID. The present material comprised 39 patients with mild, 35 with moderate, 49 with severe, and 64 with profound intellectual disability. Combination of the two milder and the two more severe forms of disability resulted in two main categories of intellectual disability.

Dental variables

A summary of the dental charts was used to reflect general trends for the profile of oral health and type of treatment provided. Dental health was recorded from the charts by one of the authors (M. Vanhamäki) and double-checked by another (L. Kössi), who has been the chief dental officer of the institute for more than 20 years and who had carried out all examinations and most of the treatment. Dental health, expressed as the sum of decayed (D), missing (M), and filled (F) teeth (T) and the number of retained teeth (RT), was recorded from the dental charts. According to the chief dental officer (L. Kössi) the vast majority of the patients had poor oral hygiene irrespective of who had been taking care of the oral hygiene.

At annual examinations all patients received fluoride varnish treatment, which was repeated three to four times a year for all caries-risk patients. In addition, fluoride tablets were prescribed to all patients who repeatedly presented with new carious lesions. The type of dental care at the first treatment visit after the examination was

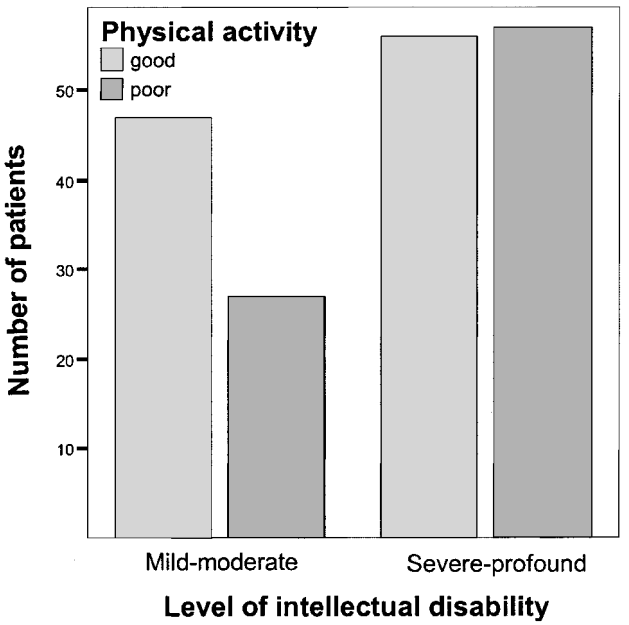

Fig. 2. The distribution of subjects into the two levels of intellectual disability in accordance with physical activity.

recorded. The two main types of dental services provided were classified as 'periodontal' in case of scaling or periodontal surgery and 'caries-related' if restorative or endodontic procedures were provided. Other types of care, like both periodontal and caries-related treatment at the same visit ($n = 10$), extractions ($n = 29$), or mere caries-preventive treatment visits ($n = 24$) were excluded from the distribution analysis of the treatment type.

The study was approved by the joint Ethics Committee of the University and Turku University Central Hospital, and an additional permission was obtained from the authorities of the Peimari Support Center.

Statistical analysis

The distribution of patients with either good or poor physical activity into various age groups is shown in Fig. 1. As the mean age of the walking patients ($n = 103$) was higher than that of the non-walking patients ($n = 84$) (42.3 (12.4) and 37.6 (11.1) years, respectively, $P < 0.008$), we divided the subjects into two age groups so that patients younger than 45 years formed one age group, whereas those 45 years old and more formed the other. As there was also a trend towards uneven distribution of sexes between the two mobility groups (male/female = 65:38 in the good-mobility and 41:43 in the poor-mobility group; $P = 0.05$), we analyzed the data controlling for sex as well. Analysis of variance with the above age grouping and sex as covariates (ANCOVA) and the chi-square test were used to test the significance of differences between groups. All analyses were two-sided, and P values less than 0.05 were considered significant.

Results

The distribution of patients into the two categories of intellectual disability on the basis of physical activity is shown in Fig. 2. The combined group of mild and moderate ID was slightly smaller ($n = 74$) than that of severe and profound ID ($n = 113$). The number of patients with poor physical activity was 84 (45%), whereas 103 (55%) were walking patients. There were more walking patients among the group of subjects with milder forms of ID, whereas among patients with more severe forms of disability, there was an even distribution of the two levels of physical activity ($P < 0.07$) (Fig. 2).

The mean number of years at the Support Center, body weight, the numbers of secondary diagnoses and daily medications, and the numbers of DMF teeth, of retained teeth (RT), and of dental treatment visits in the two age groups in accordance with physical activity are shown in Table 1. When compared with their counterparts with poor physical activity, walking patients had been living longer in the institution (21.4 (12.6) years versus 15.2 (12.2) years; $P < 0.05$), weighed more (64.3 (19.6) kg versus 44.4 (14.4) kg; $P < 0.001$), and had fewer secondary diagnoses (1.4 (1.3) versus 2.2 (1.4); $P < 0.001$) and fewer daily

Table 1. The number of institutional years, body weight, number of secondary diagnoses, daily medications, dental treatment visits, DMFT, and permanent teeth retained (RT) in the two groups of physical activity (ANOVA, general linear model)

Variables	Physical activity		P
	Good ($n = 103$), mean (s)	Poor ($n = 84$), mean (s)	
Institutional years	21.4 (12.6)	15.2 (12.2)	0.001
Body weight (kg)	64.3 (19.6)	44.2 (14.3)	0.000
Secondary diagnoses	1.4 (1.3)	2.2 (1.4)	0.000
Daily medications	4.0 (2.1)	4.8 (2.4)	0.011
Dental treatment visits	2.7 (2.4)	2.0 (1.3)	0.021
DMFT	18.5 (8.2)	14.8 (9.2)	0.040
RT	21.5 (7.7)	21.6 (9.2)	NS

s = standard deviation.
Covariates: age groups (<45- and ≥45-year-olds) and sex (106 men and 81 women).

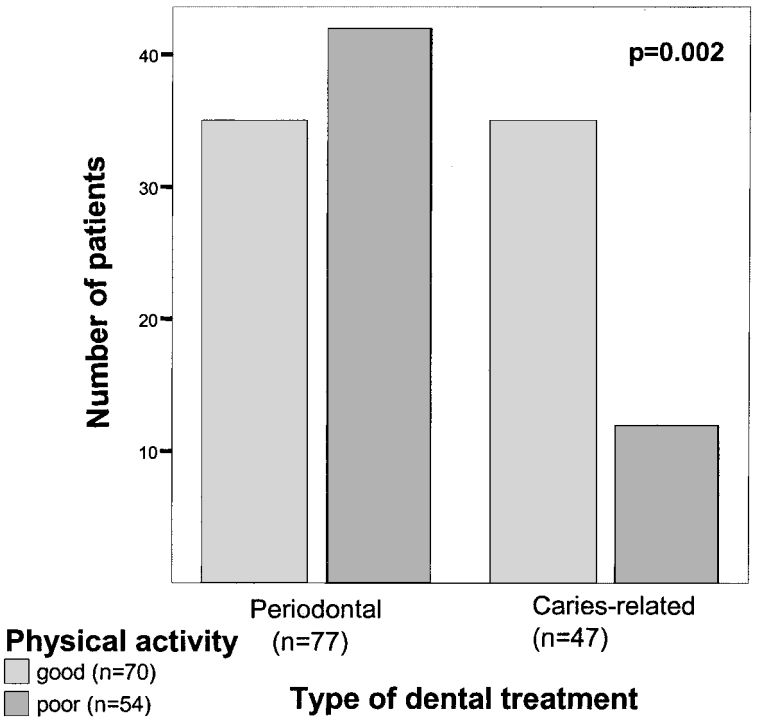

Fig. 3. The distribution of patients into the two dental treatment categories in accordance with physical activity.

medications (4.0 (2.1) versus 4.8 (2.4); $P < 0.02$). In addition, higher DMFT scores (18.5 (8.2) versus 14.8 (9.2); $P < 0.05$) and more dental treatment visits (2.7 (2.4) versus 2.0 (1.3); $P < 0.03$) were found among the walking patients than among those with poor physical activity (Table 1).

The distribution of patients into the two main categories of dental treatment carried out during the first treatment visit is shown in Fig. 3. A total of 42% of all patients received periodontal scaling, curettage, and/or periodontal surgery, and 28% received caries-related treatment like restorations or pulp therapy as the primary type of dental care (Fig. 3). Periodontal treatment was more common in patients with poor mobility than among their counterparts, in contrast to caries-related treatment, which was more common among the walking patients ($P < 0.002$) (Fig. 3). The remaining 30% of the patients received either tooth extractions ($n = 29$) or both periodontal and caries-related treatment ($n = 10$) or did not receive any type of treatment ($n = 24$).

Discussion

The low body weight we found in patients with poor mobility as compared with the walking patients is in line with earlier results for adults with intellectual disability (15) and can be due to several factors; for example, a large percentage of patients with poor mobility need help in eating, and they eat more slowly than their counterparts and hence may get less calories per meal than those who eat by themselves (19). Moreover, difficulties in swallowing (20) and/or excessive energy requirements due to spasticity (21), both common problems among patients with ID, can be contributing factors. Yet another possible explanation for our finding may be related to physical inactivity. Immobilization of experimental animals is known to reduce bone mineral density and muscle volume (13). Although no systematic bone density measurements had been carried out for our patients, reports from earlier studies show a high prevalence of osteoporosis among institutionalized mentally retarded adults (10, 11, 14). All these factors together may contribute to the finding that our patients with poor mobility presented with a lower body weight than walking patients of the same institution.

Our results showed that patients with poor mobility had a lower mean of DMF teeth—that is, a better dental health—but at the same time a higher need for periodontal treatment than their walking counterparts. To our knowledge, the effect of physical inactivity on oral health has not been studied earlier. This may seem surprising, knowing that physical inactivity is closely related to high risk of osteoporosis (13–17), which again may have an effect on all mineralized structures of the human body, including the jaws and the dentoalveolar bony structures as well.

The difference in oral health we found between walking patients and their counterparts with poor mobility cannot

be attributed to the use of fluoride prevention or to the level of oral hygiene. Important differences between the two groups of physical activity were that the food consumed by the non-walking patients was mostly mashed and that they had been exposed to the regular eating routines of the institution for a shorter period than their walking counterparts. These differences, however, should have had the opposite effect on the level of dental health due to the minimal stimulatory effect of mashed food on salivary secretion, on one hand, and due to the longer period of regular eating habits practiced in the institution on the other. According to the personnel, the use of sweets, snacks, and sweet juices was very rare among all inmates and therefore cannot explain the difference in oral health between the groups. Further, we believe that the fluoride applications provided for the caries-prone patients could only reduce the difference between the DMFT values of the two groups. Furthermore, the level of oral hygiene irrespective of who was the main caretaker was generally poor in both groups and could not explain the difference in oral health between them. Moreover, the finding that walking patients had fewer secondary diagnoses and used fewer daily medications than those with poor mobility supports the view that in spite of the probably drug-related reduction in salivary flow (22), some other factors counteracted with the multitude of caries-inducing factors present in the oral cavity of physically inactive patients. One such factor could be a high level of salivary calcium, which has earlier been connected with low caries activity (23–25). Patients prone to osteoporosis seem to have higher levels of salivary calcium than their healthy controls (26–28). Our physically inactive subjects might have had increased level of salivary calcium, which could have modified both the dental and the periodontal health of these patients.

These findings are in line with earlier reports on the oral problems of patients with intellectual disability showing a significant need for periodontal treatment (1–5), but until now these findings have been mainly attributed to poor oral hygiene (7). In accordance with the study above (7) there does not seem to be any striking differences in the number of remaining teeth between patients with intellectual disability and that of normal subjects of similar age range in the same country (29).

In conclusion, physical inactivity in subjects with intellectual disability was related to a better dental health, to a higher need for periodontal therapy, and fewer dental visits than in patients with good motor activity. We believe that the present findings may partly be due to long-term physical inactivity.

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