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H.O. Babenia, I.V. Harashchuk, S.A. Shnaider, H.O. Nikolaeva, O.E. Kornіichuk[1], T.V. Dieva, Ye.V. Diev
State Establishment "The Institute of stomatology and maxilla-facial surgery National academy of medical sciences of Ukraine", Odesa, [1]Dnipro State Medical University, Dnipro

# ASSESSMENT OF THE DENTAL STATUS IN INDIVIDUALS WITH ALZHEIMER'S DISEASE

e-mail: annababenya@gmail.com

The work was devoted to the assessment of the condition of hard tissues of teeth and periodontal tissues in people with Alzheimer's disease. A total of 27 patients with Alzheimer's disease (62–80 years old) participated in the clinical trials. The study included patients with early or early moderate dementia (disease duration 3–5 years). The patients were assessed for the condition of their hard dental tissues and periodontal tissues. Clinical examination of patients showed that patients with dementia have a greater number of extracted teeth compared to patients of the same age without cognitive impairment, more pronounced atrophic-dystrophic processes in periodontal tissues (100 % gingival recession) and insufficient level of dental care, which justifies the need to develop an integrated approach to maintaining oral health in this category of patients.

**Key words:** Alzheimer's disease, dental caries, generalized periodontitis, non-carious lesions of hard tissues of the teeth.

**Г.О. Бабеня, І.В. Гаращук, С.А. Шнайдер, Г.О. Ніколаєва, О.Є. Корнійчук, Т.В. Дієва, Є.В. Дієв**

# ОЦІНКА СТОМАТОЛОГІЧНОГО СТАТУСУ ОСІБ ІЗ ХВОРОБОЮ АЛЬЦГЕЙМЕРА

Робота була присвячена оцінці стану твердих тканин зубів й тканин пародонту в осіб із хворобою Альцгеймера. Всього у клінічних дослідженнях взяло участь 27 пацієнтів з хворобою Альцгеймера (62–80 років). У дослідження брали хворі з ранньою або початковою помірною деменцією (термін захворювання 3–5 років). У пацієнтів оцінювали стан твердих тканин зубів й тканин пародонту. Клінічне обстеження пацієнтів показало, що хворі з деменцією мають більшу кількість видалених зубів у порівнянні з пацієнтами аналогічного віку без когнітивних порушень, більш виражені атрофічно-дистрофічні процеси в тканинах пародонту (наявність рецесії ясен у 100 %) та недостатній рівень надання стоматологічної допомоги, що обґрунтовує необхідність розробки комплексного підходу до збереження здоров'я ротової порожнини у даної категорії хворих.

**Ключові слова**: хвороба Альцгеймера, карієс зубів, генералізований пародонтит, некаріозні ураження твердих тканин зубів.

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Dementia is a global health problem. It is one of the main causes of disability and dependence in older people worldwide, which has a negative physical, psychological, social and economic impact not only on patients with this disease but also on caregivers and society as a whole [15].

The most common form of primary degenerative brain disease with characteristic neuropathological and neurochemical manifestations in the elderly is Alzheimer's disease (AD), which is the most common form of dementia (60–80 %) [12]. The course of AD is slow and irreversible and ultimately leads to death [9].

The cause of AD is unknown (except for the genetically determined form), but there are many old and new hypotheses about the primary causes of the disease. Among them are the amyloid cascade hypothesis, tau hypothesis, presenilin hypothesis, neurotransmitter hypothesis (involving acetylcholine, serotonin), mitochondrial hypothesis, inflammation hypothesis, oxidative stress hypothesis, neurovascular hypothesis, genetic hypothesis, theory of metal involvement (Cu, Al), hypothesis of glucose hypometabolism ("type 3 diabetes"), calcium hypothesis, microbiome hypothesis, viral hypothesis, etc. [6].

In recent years, after the discovery of periodontal pathogens in the brains of people who died of AD, the scientific community has increasingly begun to talk about the infectious origin of AD and its connection with dental pathology [11].

This relationship is bidirectional. On the one hand, a number of studies have shown the role of oral pathogens in the pathogenesis of AD and proved the relationship between the inflammatory process in the periodontium and systemic inflammation, which leads to the progression of dementia [10]. On the other hand, due to the progression of cognitive dysfunctions, patients with AD lose motivation and the ability to take care of the oral cavity to the required extent, which leads to the development or worsening of dental pathology, i.e., a positive relationship between the progression of dental diseases and the degree of

cognitive impairment has been established, indicating a common inflammation paradigm that represents a clinical overlap between neurodegeneration and chronic oral inflammation [7].

People with dementia experience the same oral health problems as the general population. However, their oral health may be compromised due to the nature of dementia, including the severity of cognitive impairment, social functioning, and behavioral aspects; adherence to dental care; the ability of individuals and caregivers to perform oral health procedures; and the ability of individuals to engage in activities of daily living [8].

Oral care, dental treatment planning, and behavioral management for people with dementia should be tailored to the severity and characteristics of the dental disease [6].

Unfortunately, patients with AD are not always able to recognize and report oral health problems, which leads to the development of dental diseases or deterioration of the dentoalveolar system and a significant decrease in the quality of life of this category of patients. This justifies the need to study the dental status of people with AD with standardized oral health outcomes to provide recommendations that meet the needs in specific settings.

**The purpose** of the study was to assess the condition of hard tissues of the teeth and periodontal tissues in people with Alzheimer's disease.

**Materials and methods**. A total of 27 patients with Alzheimer's disease participated in the clinical trials. The dementia diagnosis was made by the staff of the D.F. Chebotarev Institute of Gerontology of the National Academy of Medical Sciences of Ukraine and the Department of Psychiatry, Narcology, Medical Psychology and Psychotherapy of Odesa National Medical University. The study included patients with early or early moderate dementia (disease duration 3–5 years).

The mean age of patients was 72.07±1.11 years (62–80 years).

The distribution of patients by gender was uneven: the vast majority of patients were women (77.1 %), the number of men was 3.4 times less.

The number of women with AD, which outnumbered men, can be explained by the fact that the average life expectancy of women in Ukraine, according to official data, is 78 years, while men – 68 years (UN Population Fund report, 2023) [14]. And since Alzheimer's disease is most common in people aged 65 and older (although the manifestation of this disease can occur at a much younger age), the percentage of men among the elderly and senile is greatly reduced.

The DFM index and its structure (components D – decayed teeth, F – filling, M – missing) were used to assess the condition of hard tooth tissues. The prevalence and intensity of the caries process and the number of intact teeth were determined (WHO, 1962, 1980).

The level of dental care (LDC) was determined according to the methodology proposed by Leus P.A. [5]. The LDC is a group index used in dental examinations of children and adults, subject to division into age groups according to the WHO. During the dental examination, carious, filled and extracted teeth are recorded (DFM index), and it is also determined how many teeth, among the extracted ones, have been restored with prostheses. LDC is calculated as a percentage. Depending on its value, four levels of dental care are determined according to the following scheme: 0–9 % – poor, 10–49 % – insufficient, 50–79 % – satisfactory, 80 % and more – good.

The state of oral hygiene was assessed using the Green-Vermillion indices (Green, Vermillion, 1960), taking into account the tartar component; Silness-Loe and Stallard [13].

The diagnosis of periodontal disease was made according to the classification of Danilevsky N.F. [13].

The obtained digital data were subjected to statistical processing in accordance with the purpose and objectives of the study. Statistical processing of the results was performed by biostatistical methods of analysis on an IBM PC personal computer using Microsoft Excel 2010 and Statistica 6.1 (StatSoftInc., Serial No. AGAR909E415822FA) in Windows XP mode. A statistically significant difference between alternative quantitative traits with a distribution corresponding to the normal law was assessed using Student's t-test. To establish the relationships between the studied indicators, correlation analysis methods were used: in the presence of a normal distribution law, Pearson's linear correlation coefficient was used [1].

**Results of the study and their discussion**. After taking anamnesis from people with AD, it was found that the main complaints of patients with cognitive impairment in the oral cavity were dry mucous membrane of the oral cavity (MMOC) (92.6 % of the subjects), angular cheilitis (85.2 %), a feeling of "soreness" (66.7 %) and burning in the oral cavity (62.9 %). Difficulties in using removable dentures were experienced by all patients (100 %) who had removable orthopedic structures in the oral cavity, regardless of the period of their placement. A large number of subjects complained of taste sensitivity disorders in the form of hypogeusia (18.5 %) or dysgeusia (55.6 %).

Separately, patients answered questions about the accessibility of a dentist and dental care. The majority of patients (19 people, 70.4 %) were not motivated to visit a dentist and did not see the point in doing so. Over the past 3 years, only 8 people (29.6 %) had been to a dental appointment (mostly for surgical rehabilitation, namely tooth extraction). None of the dementia patients visited a dentist for professional oral hygiene, anti-inflammatory therapy or treatment of MMOC diseases. Despite the fact that oral health problems and complaints were widespread among this category of patients, they were not the main problem.

Determination of dental caries indicators showed that the prevalence of caries in people with AD was 100 %. The DFM index was on average 22.3±0.77 points.

When analyzing the structure of the DFM index, the prevalence of the "M" component in it was found to be 16.0±1.09 units (71.7 %) (Fig. 1).

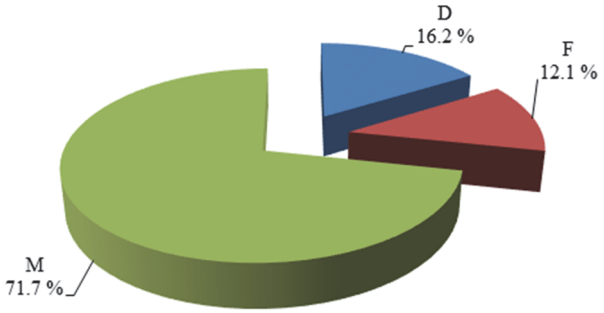


Fig. 1. The structure of the DFM index in people with AD.

The number of retained teeth in people with dementia was 6.32±0.8, which was almost 2 times less than the retained teeth rate recommended by WHO for this age group.

Of the examined persons with AD, only one woman had complete secondary adentia, which amounted to 3.7 % of all examined patients.

To assess the quality of dental care provided to the examined persons, the level of dental care was calculated according to the components of the DFM index, which amounted to 17.1 % and corresponded to an insufficient level.

With regard to non-carious lesions of hard dental tissues, pathological abrasion was found in 23.1 % of persons with dementia, wedge-shaped defects and enamel erosion in 34.6 % and 7.7 % of persons, respectively.

Clinical and laboratory assessment of periodontal tissues in people with AD showed a 100 % prevalence of periodontal disease in the form of generalized periodontitis (GP).

The distribution of patients by the severity of the GP was as follows: the number of people with GP I-II, II degree was 55.6 % (15 people, including 14 women and 1 man), with GP II-III degree – 44.4 % (12 people, including 3 women and 1 man).

As for the course of the disease, the majority of patients (85.2 %) had a chronic form of GP. This can be explained by two factors: firstly, the prevalence of atrophic-dystrophic processes in patients of gerontological age, and secondly, the recruitment and examination of patients took place at the Institute of Gerontology, when patients were undergoing regular scheduled inpatient treatment and complex therapy performed in the hospital could have a positive effect on inflammatory processes in periodontal tissues.

The data of the PMA index % (47.6±4.2 %) corresponded to the average severity of gingivitis, the PI index was 2.8±0.3 points.

The results of the Schiller-Pisarev test (2.07±0.09 points) indicate a moderately pronounced inflammatory process in the periodontium of patients with dementia, which was confirmed by the value of the bleeding index (1.52±0.12 points).

The results of determining the depth of periodontal pocket probing (3.21±0.15 mm) corresponded to mild and moderate GP, but, from our point of view, they did not reflect the true picture of the periodontal condition due to the presence of gingival recession, bifurcation defects, and exposure of the necks of the teeth due to increased dystrophic processes in the alveolar bone associated with the age of the patients.

Gingival recession was diagnosed in 100 % of the examined patients with AD with a mean value of 2.08±0.10 mm.

Dystrophic changes observed in the elderly led to a significant loss of epithelial attachment (5.25±0.15 mm).

The CPITN index values (2.54±0.13 points) indicated the need for periodontal treatment for all patients with AD.

Tooth mobility among people with dementia was recorded in 10 people, which amounted to 38.5 %. Among those with tooth mobility, its index was 0.46±0.05.

As for the hygienic level of oral care, the following results were obtained. When determining the area of dental plaque (Stallard index), staining of 1/3 to 1/2 of the surface of the crown part of the tooth was recorded (1.69±0.12 points).

When determining soft plaque (Silness-Loe index), a sufficiently large amount of it was recorded at the tip of the probe, the plaque was determined visually (1.76±0.14 points).

The amount of tartar was 1.39±0.10 points, which indicates the presence of supragingival and subgingival tartar. The lowest rate of tartar was recorded in a patient with AD in the presence of GP of III degree (2.4 points).

Thus, the determination of dental caries indicators showed that the prevalence of caries in people with AD is 100 %. The DFM index corresponded to the data obtained by Kananovych TN, Voronina IE (2018), who examined senile and elderly people in Kyiv [3]. Thus, in patients with AD, the DFM index was only 8.5 % higher, but the intergroup difference was significant ($p<0.05$).

When analyzing the structure of the DFM index, the prevalence of the "M" component was found, which was 1.7 times higher than in people without AD (41.6 % according to Kananovich TN, Voronina IE) [3].

The level of dental care according to the components of the DFM index was 2.1 times less than that obtained in patients without dementia [3].

With regard to non-carious lesions of hard dental tissues, the number of patients with tooth abrasion was 2.2 times lower among people with dementia compared to patients without AD, and the incidence of wedge-shaped defects was 1.3 times lower.

The statistical analysis showed a direct low correlation between pathological tooth abrasion and the age of the patient with AD ($r=0.226$) and no correlation between age and wedge-shaped tooth defects (Pearson correlation coefficient $r=0.051$).

The structure of periodontal diseases was somewhat different from that of patients without AD [2]. Thus, we did not record a single case of a purely dystrophic process in the periodontium, namely periodontal disease, among people with AD. Also, there were no patients with AD with gingivitis and patients with exclusively grade I GP.

Although, in general, a similar conclusion can be made: in elderly patients with AD, grade II GP is more common than other degrees of the disease, which is consistent with the data of Kananovich TM [2].

The results of the index assessment of periodontal tissue condition showed that the PMA and PI indices in patients with AD almost do not differ from those in patients without dementia [2].

When comparing the hygienic level of the oral cavity in patients with AD and in patients without dementia, it was found that in patients with AD it was not as bad as in people of similar age without cognitive impairment [2].

The obtained clinical data of the index assessment of the state of oral tissues of people with AD were subjected to statistical processing to determine statistically significant correlations.

In the statistical processing of the results obtained with the calculation of Pearson's correlation coefficient, it was found that in people with AD, the intensity of the caries process according to the DFM index did not depend on the patient's age: the correlation coefficient was $r=-0.204$, indicating a low negative relationship.

Regarding the severity of the dystrophic-inflammatory process in the periodontium, a direct significant correlation was obtained with the age of people with AD: the older the person with cognitive impairment, the greater the severity of GP (Pearson correlation coefficient $r=0.819$).

When determining the correlations of the DFM index with the gender factor, no statistically significant correlation was obtained. Thus, the mean value of the DFM index in men was 24.67±1.57 (Me: 24.5; σ: 3.50; Cv: 14.20 %), and in women – 22.05±0.93 (Me: 21; σ: 4.18; Cv: 18.95 %). Although the value of the index of caries activity in men was 11.8 % higher, the differences were not significant ($p=0.163967$).

The correlation analysis revealed a direct relationship between the activity of the caries process according to the DFM index and the severity of generalized periodontitis (Pearson correlation coefficient was $r=0.402$).

When determining the correlation between the DFM index and socioeconomic status in people with AD, a direct significant relationship was obtained, the Pearson coefficient was $r=0.688$.

Thus, the clinical examination of patients with AD showed that patients with dementia have a greater number of extracted teeth compared to patients of the same age without cognitive impairment, more pronounced atrophic-dystrophic processes in periodontal tissues (gingival recession in 100 %) and insufficient level of dental care, which justifies the need to develop an integrated approach to maintaining the health of the oral cavity in this category of patients.

## Conclusions

1. The main oral complaints of people with AD were dryness of the MMOC (92.6 %), angular cheilitis (85.2 %), impaired taste sensitivity in the form of hypogeusia or dysgeusia (74.1 %); a feeling of "soreness" (66.7 %) and burning in the oral cavity (62.9 %). All patients (100 %) who had removable dentures in the oral cavity complained of difficulties in using removable dentures.

2. Assessment of the condition of hard dental tissues in patients with AD showed a 100 % prevalence of caries with an average DFM index value of 22.3±0.77 with a predominance of component "M" (1.7 times more than in patients without AD).

3. The number of retained teeth in people with somatic pathology was 6.32±0.8, which was almost 2 times less than the rate of retained teeth recommended by WHO for this age group.

4. The level of dental care in people with AD was 17.1 %, which corresponded to an insufficient level and was 2.1 times less than the rate obtained in patients without cognitive impairment. 70.4 % of the surveyed people were not motivated to visit a dentist and did not see the point in it, despite the fact that oral health problems and complaints were widespread among this category of patients.

5. Clinical and laboratory assessment of periodontal tissues in patients with AD showed a 100 % prevalence of periodontal disease in the form of GP with a predominance of GP of the second degree of severity, no patients with gingivitis and periodontal disease were detected. The indices of RMA and RI almost did not differ from those of persons without cognitive impairment. The results of the Schiller-Pisarev test and bleeding index indicate a moderately pronounced inflammatory process in the periodontium of patients with dementia, but there is a significant loss of epithelial attachment and gingival recession (in 100 % of patients with AD).

6. The hygienic level of the oral cavity in people with AD was not as bad as in people of similar age without cognitive impairment, which can be explained by the presence of a caregiver in patients with AD and with increased oral care by a loved one.

7. When determining the correlations, a direct high correlation was found between the severity of the dystrophic-inflammatory process in the periodontium and the age of the patient with AD (Pearson correlation coefficient r=0.819), a moderate correlation with the intensity of the caries process according to the DFM index (r=0.502). The DFM index in patients with AD did not depend on the patient's age (r=-0.204) but depended on socioeconomic status (r=0.688).

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