

Correlation between Tooth Loss with Cognitive Function and Memory Function in the Elderly

Rahmi Syaflida Dalimunte^{1*}, Fasihah Irfani Fitri², Dina Nazriani³

1. Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Universitas Sumatera Utara, Medan, Indonesia.

2. Department of Neurology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia.

3. Department of General Psychology and Experiment, Faculty of Psychology, Universitas Sumatera Utara, Medan, Indonesia.

Abstract

Aging is a natural process that will be experienced by every individual. In the elderly there are very complex degenerative, physiological and biological changes, one of the changes that occur in the elderly is oral cavity changes.

Tooth loss will affect the quality of life in the elderly such as impaired cognitive function, this is due to a lack of mastication. Dementia is a syndrome of decreased intellectual function compared to the previous one which is quite severe so that it interferes with social and professional activities which are reflected in daily living activities, usually changes in behavior are also found and are not caused by delirium or major psychiatric disorders.

The results of study at USU Hospital showed the mean value of missing tooth was 1.61 with a standard deviation of 0.676 while the mean value severity of dementia was 2.79 with a standard deviation of 0.725 and a p-value of 0.001 ($p < 0.05$). There is a significant relationship between the effect of tooth loss on the severity of cognitive and memory functions in the elderly.

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Introduction

Aging is a natural process that will be experienced by every individual. Aging lead a decrease in physical, psychological and social conditions that are interconnected with one another. In elderly patients, many special considerations are needed in every treatment that will be taken.^{1,2,13} In 2025 the number of elderly people in Indonesia is expected to increase, and elderly is an unavoidable part of the growth process.³

In the elderly there are very complex degenerative, physiological and biological changes, one of the changes that occur in the elderly is oral cavity changes.¹³ The aging process is a physiological process of deterioration in all body functions and physical changes that can affect dental and oral health.^{2,13,15} Elderly adults not only have several dental issues, but also numerous tissue issues.

According to study, the majority of older persons with dementia have high DMFT scores and complain of having dry mouth, which make it difficult for them to eat and communicate.¹⁸ Oral cavity changes in the elderly include dry mouth, pale color of the oral mucosa, thinning of the mucosa, attrition, and tooth loss. Tooth loss usually occurs in elderly and can result masticatory dysfunction, temporomandibular joint (TMJ) dysfunction, and psychological dysfunction such as aesthetics and speech dysfunction. Indonesia has a relatively high number of tooth loss, 24% of the population with toothless conditions in people aged over 65 years.^{3,14}

Tooth loss will affect the quality of life in the elderly such as impaired cognitive function, this is due to a lack of mastication.^{2,14} One of these cognitive disorders is dementia. Dementia is a syndrome of decreased intellectual function compared to before that is severe enough to interfere with social and professional activities which is reflected in activities of daily living, usually also changes in behavior and is not caused by delirium or major psychiatric disorders.^{13,15,16}

Some of these studies have linked the condition of tooth loss with the more rapid loss of cognitive function in a person which leads to a

*Corresponding author:

Rahmi Syaflida Dalimunte
Department of Oral and Maxillofacial Surgery, Faculty of
Dentistry, Universitas Sumatera Utara, Medan, Indonesia
E-mail: rahmi.syaflida@usu.ac.id

senile condition or dementia. As revealed by a study at Baylor College of Medicine which found that chewing activity can increase blood supply to the brain. People who have only a few teeth, or even no teeth at all will tend to chew less so that the blood supply of nutritional intake to the brain is not too much.^{3,15,16} The purpose of this study was to determine the relationship between tooth loss and cognitive function and memory in the elderly.

Materials and methods

This research is a cross-sectional quantitative descriptive study. The study was conducted at the Department of Neurology of USU Hospitalin May – August 2021. The population in this study were all patients from the Department of Neurology at USU Hospital who met the inclusion criteria including being healthy and able to communicate well verbally, at least 60 years old. Healthy here can do basic activities independently (healthy). Health is assessed by the ability of the elderly to perform activities such as getting up, bathing, dressing, eating/drinking, defecating/urinating, and going to bed independently. While the exclusion criteria were not willing to participate in the study until it was completed and the research subject was taking special memory drugs or multivitamins to improve memory based on information obtained from the attending physician. The sampling technique in this study was convenience sampling where the sample was taken as it was available at the time.

Overall, the work procedure in this study was to collect all subjects at an early stage, then the researcher explained the aims and objectives of the study, as well as the benefits. The second stage, research subjects who are willing to participate in the study, signed an informed consent. The next stage of interviews and examinations include; measurement of blood pressure, measurement of height (TB) and weight (BB) to determine body mass index (BMI), and cognitive examination using the Indonesian version of the Montreal Cognitive Assessment (MoCA-INA), with a normal value of > 26 for a minimum education level of 12 years and grouped into 3 categories, mild cognitive impairment (21-24), moderate cognitive impairment (10-20) and severe cognitive impairment (<10)⁶. After an examination of

cognitive function, the research subjects werw examined for oral cavity condition in this case the number of missing teeth.

Using SPSS V.22 for windows program, the data is presented in tabular form to determine the proportion of respondents' characteristics, which consist of age, gender, last education, blood pressure, BMI, physical activity, and illness. The tabulation of the frequency distribution of cognitive functions and memory functions was made based on the categorical tooth loss obtained. The category of tooth loss was divided into 3 groups, namely group I lost 22–32 teeth, group II lost 11–20 teeth and group III lost >20 teeth. The data was homogeneous, it is known through different test examinations. Then the data was compiled and presented based on age group, number of tooth loss, and number of tooth loss in people with dementia according to normal, mild, moderate and severe categories. Then the Kruskall Wallis test was performed when the data were not normally distributed to determine the significance of the relationship between tooth loss and the severity of dementia.

Results

Based on the results of research conducted at USU Hospital, 30 samples were obtained. Based on table 1 shows that of the 30 respondents, the highest number of respondents based on gender in the highest age group was female from the age group 60-74 years (86.6%) and the lowest was male and female from the age group 75 -89 years(6.6%).

Age Groups (Years)	Gender				Total	
	Male		Female			
	N	%	N	%		
60-74	7	23,33	19	86,6	26	86,67
75-89	2	6,6	2	6,6	4	13,33
>90	0	0.0	0	0.0	0	0.0
Total	9	30	21	70	30	100.0

Table 1. Distribution of Age Groups by Gender on the Severity of Dementia.

Based on table 2 shows that of the 30 respondents, the highest number of respondents based on the number of missing teeth by gender was female with the number of missing teeth 11-20 (43.33%) and based on the number of missing teeth the most in category 11 -20 teeth (53.33%).

Number of Missing Teeth	Gender				Total	
	Male		Female			
	N	%	N	%		
1-10	6	20	3	10	9	30
11-20	3	10	13	43,33	16	53,33
>21	0	0	5	16,67	5	16,67
Total	9	30	21	70	30	100.0

Table 2. Distribution of the Number of Missing Teeth by Gender on the Severity of Dementia.

Based on Table 3, data obtained that from 30 respondents, the highest number of respondents with missing teeth and suffering from dementia was in the moderate category with the number of missing teeth as much as 11-20, which was 26.66% and the lowest in the medium category with the number of missing teeth as much as 1-10, which was 3.3%.

Number of missing Teeth	Dementia								Total	
	Normal		Mild		Moderate		Severe		N	%
	n	%	n	%	n	%	n	%		
1-10	2	6,7	6	20	1	3,3	0	0	9	30
11-20	2	6,7	6	20	8	26,66	0	0	16	53,33
>20	2	6,7	3	10	0	0	0	0	5	13,34
Total	6	20,1	15	50	9	29,99	0	0	30	100.0

Table 3. Distribution of the Number of Missing Teeth on the Severity of Dementia.

Table 4 shows that the mean value of missing teeth is 1.61 with a standard deviation of 0.676 while the mean value of severity of dementia is 2.79 with a standard deviation of 0.725. Based on the normality test, the data was not normally distributed and based on the Kruskal Wallis test, the p-value of 0.001 ($p < 0.05$) was significant. It's means that there is an effect of tooth loss on cognitive function and memory function in the elderly.

Variabel	Mean ± SD	Normality Test (p-value)*	Comparative Test (p-value)**
Missing teeth	1.61 ± 0.676	0.026	0.001
Dementia	2.79 ± 0.725		

Table 4. The Effect of Missing Teeth on the Severity of Dementia.

*Shapiro-Wilk test: $p > 0.05$ data distribution normal.

**Kruskall Wallis test : $p < 0.05$ Significant.

Discussion

Based on table 1, obtained 30 respondents with the number of men as many as 9 people and women as many as 21 people. Based on the age group, the 60-74 years old

category is for women with the largest number of respondents, as many as 19 people, followed by men in the same category group as many as 7 people. This is due to the fact that the number of female population is higher than that of males according to life expectancy.⁵

According to Okoisor (1977) study that disease factors such as caries and periodontal disease that cause tooth loss are associated with increasing age. This is in accordance with the presence of tooth loss in all respondents and all age categories where based on table 2, obtained from 30 respondents, the highest number of missing teeth was in the female in the tooth loss category as many as 11-20 teeth.¹⁷ This is in line with Hugo's study, which states that women experience tooth loss more than men because men are much more daring to visit the dentist than women.¹⁰ This is in accordance with Cobert's study which states that the incidence of caries risk is much higher in women because women's dietary patterns and eating habits are more varied than men.^{10,11}

The results of this study indicate that there is a p-value of 0.001 ($p < 0.05$) which indicates a significance, that there is an effect of tooth loss on the severity of cognitive and memory functions in the elderly.^{13,16} This is in accordance with Onozuka's study, which states that tooth loss will cause a decrease in sensory function induced to the brain because of the lack of mastication processes and functions. This is also in line with Yamato's study, lack of nutritional intake will cause a decrease in cell pyramids and acetylcholine in the hippocampus which is related to cognitive function of brain.^{11,12,17}

According to Grabe's study, there is an effect of tooth loss caused by chronic periodontitis with a decrease in cognitive function. This is in line with the results of this study which showed the effect of tooth loss on the severity of cognitive and memory functions in the elderly. In this study, the MMSE was used to determine the relationship between tooth loss and cognitive degradation, which was more common in women. According to Kaye's research, in elderly male respondents, tooth loss and periodontal disease more progressive during adulthood can predict cognitive function test results. The formation of caries will increase the risk of poor test results. In this study the number of tooth loss per decade may indicate a 9% - 12% cognitive function

degradation test results. It is estimated, if 12 teeth are lost per decade it will weaken cognitive function close to 100%. It can be concluded that the risk of cognitive degradation in elderly men will increase according to the number of missing teeth¹⁰⁻¹².

Based on Jianfeng's study, it shows that tooth loss more than 16 teeth causes dementia due to the presence of inflammatory gram-negative bacteria in the oral cavity that spreads to the brain through the trigeminal nerve so that low nutritional intake can cause cognitive impairment.^{15,16} According to Okamoto and Waijenberg, based on the results of their research, it shows that patients who experience tooth loss will be more prone to developing dementia.¹⁰ From some of the opinions above, it can be concluded that there is a relationship between tooth loss and the severity of dementia, this is in line with the results of this study showing a p-value of 0.001 ($p < 0.05$) which indicates that there is a significant effect of tooth loss on the severity of cognitive and memory function in the elderly.

Conclusions

The female from the 60-74 year age group had the greatest number of respondents based on sex for the highest age group, 86.6%, and the male and female sexes from the 75-89 year age group had the lowest, 6.6%. The average missing tooth number is 1.61 with a standard deviation of 0.676, while the average dementia severity is 2.79 with a standard deviation of 0.725. The results were not normally distributed according to the normality test, and a p-value of 0.001 ($p = 0.05$) was significant according to the Kruskal-Wallis test. This implies that tooth loss has an impact on cognitive and memory function in the elderly.

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Declaration of Interest

The authors report no conflict of interest.

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