

Comparison of the Relationship Between Dementia and Oral Health Behavior

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Research Article

Keywords: dementia, health, health behavior, knowledge, oral health

Posted Date: March 3rd, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-265903/v1>

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Abstract

Background: Dementia is a serious social problem worldwide, and dementia and oral health are closely related. Therefore, we confirmed the relationship between dementia prevention behavior and the oral health behaviors.

Methods: The study was conducted by IRB review at Silla University in Korea (No.1041449-201912-HR-002) and decided that 140 people living in South Korea were eligible. The data analysis used IBM SPSS ver. 25.0 (IBM Co., Armonk, NY, USA) and compared oral health knowledge, dementia knowledge, Dementia anxiety and dementia prevention behavior according to oral health behavior.

Results: As a result, the people with high oral health behavior had high oral health knowledge and was not relevant in dementia knowledge and anxiety. Also, as the oral health behavior increased, oral health knowledge and dementia prevention behavior tended to get improve. As the oral health knowledge increased, dementia anxiety and dementia prevention behavior tended to get improve.

Conclusion: Therefore, in order to improve the prevention of dementia, knowledge transfer that dementia is highly relevant to oral health is more important than anything else.

Background

Dementia is a disease that affects the overall life of the person afflicted with it, and requires national responsibility and entails family burden [1]. In South Korea, the cost of managing dementia patients was 13.2 trillion won in 2015 and is estimated to balloon to 34.3 trillion won in 2030 and 106 trillion won in 2050 [2]. Globally, dementia management costs about US\$818 million a year, accounting for 1.1% of the world's gross domestic product (GDP). It has thus become a social problem worldwide as well as in South Korea [3].

Dementia is classified into Alzheimer's dementia, vascular dementia, or dementia caused by central nervous system disease or physical disease. Alzheimer's dementia accounts for about 70% of all dementia cases, but as there is no cure for it to date, prevention is most important [4]. Such type of dementia is irreversible, and the anxiety increases with age. In South Korea, 4 out of 10 people over 60 years of age reported that they fear dementia the most, more than cancer and cardiovascular diseases like stroke [5]. The United States has reported that adults over 55 years of age fear dementia more than cancer [6], and in France, 59.97% of adults over 18 years of age reported in a survey that they fear dementia [7]. As such, as dementia destroys the lives of the patients and their families, the dementia anxiety increases as aging progresses.

As it has been suggested that periodontitis can aggravate the inflammatory status in elderly people and can accelerate the progression of neurodegenerative diseases [8], several studies have reported that dementia and oral health are closely related to each other [9, 10]. Cognitive impairment in dementia patients affects their oral hygiene management, becoming a major impediment to their oral health [11,

12], and the systemic inflammatory responses induced by periodontitis have been reported to increase the risk of developing dementia [13]. In particular, in a previous study, as the serum markers of the periodontal pathogen *P. gingivalis* increased, cognitive functions like word memory were lowered [14]. When 10 dementia patients' brain tissues were examined within 12 hours postmortem, *P. gingivalis*-derived LPS was identified in the brains of 4 dementia patients [14]. In addition, it has been reported that the bacteria in the biofilm of the teeth can penetrate the brain through the blood flow or the nerves, and *Treponema* associated with periodontitis has been found in the brain of dementia patients [13]. As such, it has been reported that the systemic inflammatory response due to periodontal disease increases the risk of cognitive impairment and dementia [16], and causes poor oral conditions in dementia patients, such as fewer residual teeth due to severe dental caries [17, 18]. In a national cross-sectional study in the United Kingdom, there were 2.6 times more cognitive impairment cases in edentulous patients among people aged 65 years and older [19], and in a large community-based research in Japan, the cases of cognitive impairment was 1.71 times higher in people with fewer residual teeth [20]. In South Korea, a community-based study also found that dementia progressed 1.61 times faster in people with missing teeth and without dentures [21], and a cross-sectional study in the United States reported a link between dental caries and cognitive impairment [22]. Therefore, to prevent the progression of dementia, promoting oral health practice is very important by making people realize that dementia and oral health are closely associated with each other.

To practice oral health, regular oral check-ups and proper brushing should be made a habit. A longitudinal study examining the relationship between oral health care and cognitive function changes over 6 years reported a significant correlation between low brushing frequency and progression of cognitive impairment [23]. Brushing is the most basic way to maintain oral health, and as by itself brushing can prevent dementia, efforts should be made to improve one's oral health behavior. Therefore, it is necessary to check people's dementia knowledge, anxiety, and prevention behavior according to the degree of their oral health behavior. Most of the relevant studies to date, however, have confirmed the relationship between dementia and oral disease [8–22], and the relationships among dementia knowledge, dementia anxiety, and dementia prevention behavior in elderly people [24]. There have been very few studies on dementia according to oral health behavior. Therefore, this study aimed to investigate the level of oral health behavior; to determine the relationships among dementia knowledge, dementia anxiety, and dementia prevention behavior according to the level of oral health behavior; and to use the study results as fundamental data for dementia prevention.

Methods

This study was conducted by receiving IRB review from the Institutional Review Board of Silla University (No. 1041449-201912-HR-002). Copies of a questionnaire were distributed to middle-aged people living in Gyeongsangnam-do for about a month from January 10, 2020, and were collected immediately after self-administration. For sample size determination, G*Power 3.1 was used with a 0.01 significance level, 95% power, and a 0.15 medium effect size. As a result, the sample size was calculated to be 119, and

considering the unclear answers, a total of 140 subjects (61 persons aged 60 years and younger, and 79 persons aged 61 years and older) were determined.

1. Study Tools

1.1. Orla health behavior

The questionnaire on oral health behavior consisted of 20 items formulated by referring to the study by Kim et al. [25], and each item was answered based on a 5-point Likert scale where the higher the score was, the higher the oral health behavior. In this study, the Cronbach's α was 0.87, and based on 85 points with a cumulative percentage of 49.3%, those who got a score of 85 or less were classified as belonging to the low-oral-health-behavior group and those who got a score of 86 or higher were classified as belonging to the high-oral-health-behavior group.

1.2. Orla health knowledge

The questionnaire on oral health knowledge consisted of 10 items formulated by referring to the study by Shin [26]. In this study, the Cronbach's α was 0.41.

1.3. Dementia knowledge

The questionnaire on dementia knowledge consisted of 12 items: 3 on the cause of dementia, 3 on the dementia symptoms and diagnosis, 4 on the prevention and treatment of dementia, and 2 on dementia patient care, all of which were developed by Seoul City [27]. The Cronbach's α was 0.57 at the time of development, and 0.45 in this study.

1.4. Dementia anxiety

The questionnaire on dementia anxiety consisted of 5 items formulated by referring to the study by Park et al. [28], and each item was answered based on a 5-point Likert scale where the lower the score was, the lower the dementia anxiety. In this study, the Cronbach's α was 0.87.

1.5. Dementia prevention behavior

For dementia prevention behavior, the instrument developed by Lee et al. [29] was used, which consisted of 12 items: 4 on stress management, 3 on disease management, 3 on lifestyle habits, and 2 on diet. Each item was answered based on a 5-point Likert scale where the higher the score was, the better the dementia prevention behavior. In this study, the Cronbach's α was 0.72.

2. Statistical Analysis

For statistical analysis, IBM SPSS ver. 25.0 (IBM Co., Armonk, NY, USA) was used. The oral health behavior was analyzed through frequency analysis, and the comparison of oral health knowledge and dementia knowledge according to the level of oral health behavior was conducted using chi-square test

and independent t-test. The comparison of dementia anxiety and dementia prevention behavior according to the level of oral health behavior was conducted using Mann-Whitney t-test, a non-parametric analysis method. For the comparison of the associations among the variables, correlation analysis was conducted.

Results

Oral health behavior

For the results of the examination of the subjects' oral health behavior, item 2 ("I get treatment immediately if I have toothache") had the highest level while item 18 ("I do not eat tough and hard foods as much as possible") had the lowest level as seen in Table 1.

Table 1
Oral health behavior M ± SE

Oral health behavior	N = 140
1. I have a regular oral health checkup.	3.71 ± 1.37
2. I get immediate treatment if my teeth hurt.	4.63 ± 0.92
3. I brush my teeth well to prevent cavities.	4.62 ± 0.87
4. I brush my teeth more than three times a day.	4.04 ± 1.27
5. I brush my teeth within three minutes of eating.	3.87 ± 1.25
6. I brush my teeth for more than 3 minutes.	4.09 ± 1.15
7. I brush my toothbrush carefully as I rotate it.	4.20 ± 1.19
8. I also brush my gums and tongue when I brush my teeth.	4.55 ± 1.01
9. I always brush my teeth after a meal, after a snack, before going to bed.	4.01 ± 1.24
10. When I can't brush my teeth, I rinse it with water.	4.43 ± 1.05
11. I don't eat anything after brushing my teeth before going to bed.	4.30 ± 1.04
12. The size of the toothbrush head is adequate for one to two molars.	4.31 ± 1.21
13. I use a new toothbrush before it bends.	4.56 ± 1.01
14. I use dental floss or interdental toothbrush as well as toothbrush.	3.57 ± 1.45
15. I keep my toothbrush head up.	4.51 ± 1.08
16. I try to eat a lot of milk, fruit, and vegetables.	4.16 ± 1.12
17. I don't eat too sweet food for snacks.	3.56 ± 1.48
18. I don't eat tough and hard food as much as I can.	3.32 ± 1.55
19. I chew my food from side to side.	4.31 ± 1.09
20. I use toothpaste with fluoride.	4.27 ± 1.19
Total	83.03 ± 12.65

Oral health knowledge according to the level of oral health behavior

For the results of the examination of the subjects' oral health knowledge according to their oral health behavior level, there were significant differences between the high- and low-oral-health-practice groups in item 3 ("When brushing, the brush head should be inserted between the teeth to clean them thoroughly"), item 4 ("The tongue should also be cleaned during brushing"), and item 9 ("The use of toothpaste

containing fluoride is effective in preventing tooth decay”), and in the total score for oral health knowledge as seen in Table 2 ($P < 0.001$).

Table 2
Comparative on the oral health knowledge correct rate and oral health behavior level

Oral health knowledge	Oral health behavior level		
	Low group (N = 69)	High group (N = 71)	p
1. A tooth decay occurs when a toothbrush is not done well.	61 (88.4)	63(88.7)	.952
2. The cause of gum disease is biofilm.	57(82.6)	61(85.9)	.591
3. When brushing your teeth, you should put a bristle between your teeth to clean them thoroughly.	61(88.4)	70(98.6)	.014*
4. When brushing your teeth, you should brush your tongue, too.	59(85.5)	68(95.8)	.036*
5. You should brush your teeth before going to bed.	49(71.0)	60(84.5)	.055
6. Fruits, milk, and vegetables are foods that help clean teeth.	43(62.3)	53(74.6)	.116
7. Chocolate, cookies, and candy are foods that cause tooth decay.	64(92.8)	65(91.5)	.791
8. Tobacco is harmful to oral health.	63(91.3)	68(95.8)	.281
9. Toothpaste containing fluoride has the effect of preventing cavities.	58(84.1)	67(94.4)	.049*
10. Regular dental examinations have the effect of preventing cavities.	66(95.7)	69(97.2)	.626
≠Total	8.42 ± 1.43	9.07 ± 1.03	.003*
By chi-square test, ≠independent t-test			

Dementia knowledge according to the level of oral health behavior

For the results of the examination of the subjects’ dementia knowledge according to their oral health behavior level, there was a significant difference only in item 2 (“Alzheimer’s disease is the most common cause of dementia”) as seen in Table 3 ($P < 0.01$).

Table 3
Comparative on dementia knowledge correct rate and oral health behavior level

Dementia knowledge		Oral health behavior level		
		Low group (N = 69)	High group (N = 71)	<i>p</i>
Causes of dementia	1. Dementia affects everyone in old age.	59(85.5)	58(81.7)	.542
	2. Alzheimer's is the most common cause of dementia.	32(46.4)	49(69.0)	.007*
	3. Stroke can cause dementia.	40(58.0)	47(66.2)	.316
dementia symptoms	5. Remembering a long time ago is not dementia.	38(55.1)	43(60.6)	.511
	6. Dementia can change your personality.	55(79.7)	60(84.5)	.459
	7. You have to act strangely to see it as dementia.	36(52.2)	34(47.9)	.612
Prevention of Dementia	4. There is no way to prevent dementia.	49(71.0)	48(67.6)	.662
	8. There is a curable dementia.	30(43.5)	36(50.7)	.392
	9. Medication is helpful for dementia.	59(85.5)	65(91.5)	.261
	10. Regular exercise reduces the risk of dementia.	63(91.3)	69(97.2)	.134
dementia care	11. If you have dementia, it is impossible to live with your family.	31(44.9)	26(36.6)	.317
	12. Dementia patients are not judgmental, so they can be cared for without explaining to the patient.	30(43.5)	39(54.9)	.175
≠Total		7.57 ± 2.14	8.08 ± 1.87	.128
By chi-square test, ≠independent t-test				

Dementia anxiety according to the level of oral health behavior

There were no significant differences in all the items on dementia anxiety according to the level of oral health behavior, showing that the dementia anxiety is very high regardless of oral health behavior as seen in Table 4.

Table 4
Comparative on dementia anxiety and oral health behavior level

Dementia anxiety	Oral health behavior level			
	Low group (N = 69)	High group (N = 71)	z	p
1. I'm afraid of forgetting myself.	4.48 ± 0.98	4.69 ± 0.67	- .840	.401
2. I'm afraid it would be burdensome for my family to take care of me.	4.59 ± 0.77	4.72 ± 0.61	-1.043	.297
3. I'm afraid there's no one to look after me.	4.25 ± 1.16	4.15 ± 1.29	- .060	.952
4. I'm afraid because it's not a disease that completely.	4.52 ± 0.87	4.72 ± 0.79	-1.877	.061
5. I am afraid of the cost of nursing.	4.42 ± 1.19	4.54 ± 1.07	- .683	.495
Total	22.26 ± 4.17	22.82 ± 3.59	- .569	.569
By Mann-Whitney t-test				

Dementia prevention behavior according to the level of oral health behavior

For the results of the examination of the dementia prevention behavior according to the level of oral health behavior, there were significant differences in item 4 (“Do you read newspapers or magazines?”), item 5 (“Do you eat enough vegetables or fruits?”), and item 7 (“Do you manage disease well?”), and in the total score for dementia prevention behavior as seen in Table 5 ($P < 0.001$).

Table 5
Comparative on Dementia prevention behavior and oral health behavior level

Dementia prevention behavior	Oral health behavior level			
	Low group (N = 69)	High group (N = 71)	z	p
1. Do you smoke?	3.96 ± 1.39	4.21 ± 1.34	-1.717	.086
2. Do you drink alcohol?	2.80 ± 1.51	3.23 ± 1.48	-1.628	.103
3. Do you eat regular meals?	4.16 ± 1.07	4.37 ± 0.93	-1.260	.208
4. Do you read newspapers, magazines, etc.?	3.19 ± 1.62	3.79 ± 1.46	-2.165	.030*
5. Do you eat enough vegetables and fruits?	3.88 ± 1.27	4.55 ± 0.65	-3.132	.002*
6. Are you maintaining your usual weight?	4.17 ± 1.09	4.44 ± 0.86	-1.425	.154
7. Do you usually take good care of your disease?	4.19 ± 1.09	4.51 ± 0.86	-1.990	.047*
8. Do you exercise more than 20 minutes a day for a week?	3.86 ± 1.20	4.32 ± 0.99	-2.541	.011*
9. Do you usually relieve stress well?	4.29 ± 1.14	4.44 ± 0.77	- .007	.994
10. Are you trying to live happily?	4.64 ± 0.82	4.65 ± 0.78	- .047	.963
11. Do you often do handwork (embroidery, sewing, etc.)?	3.20 ± 1.51	3.38 ± 1.55	- .728	.467
12. Do you often talk or sing with your friends?	4.19 ± 1.14	4.37 ± 0.93	- .713	.476
Total	46.52 ± 7.92	50.24 ± 5.63	-2.847	.004*
By Mann-Whitney t-test				

Correlations among oral health behavior, oral health knowledge, dementia knowledge, dementia anxiety, and dementia prevention behavior

Oral health behavior was positively correlated with oral health knowledge and dementia prevention behavior, while oral health knowledge was positively correlated with dementia anxiety and dementia prevention behavior as seen in Table 6 ($P < 0.001$).

Table 6
The Relationship between Oral Health behavior and Oral Health Knowledge, Dementia Knowledge, Dementia Anxiety and Dementia Prevention behavior

	A	B	C	D	E
A	1				
B	.321**	1			
C	.076	-.137	1		
D	.083	.241**	-.114	1	
E	.324**	.192*	.087	.074	1
A; Oral Health behavior, B; Oral Health Knowledge, C; Dementia Knowledge, D; Dementia Anxiety, E; Dementia Prevention behavior					
**p < 0.01, *p < 0.05. Correlation analysis					

Discussion

Oral health is closely related to dementia, and in particular, poor chewing ability leads to preference for soft, easy-to-eat foods high in saturated fat and cholesterol rather than hard-to-chew fibrous foods or foods high in essential trace elements. As the former is far from a Mediterranean diet that prevents dementia, and actually increases the risk of dementia [30, 31], persistent oral care is necessary. Oral health behavior is a concept that reflects oral-health-related quality of life in a broad sense, and most people have high awareness of the importance of oral health but very low oral health behavior [32]. Therefore, it is necessary to examine the relationships among dementia knowledge, dementia anxiety, and dementia prevention behavior in groups with high and low oral health behavior scores. In this study, the subjects' oral health behavior scores were 83.03 on average, and based on 85 points, with a cumulative percentage of 49.3%, those who got a score of 85 or less were classified as belonging to the low-oral-health-behavior group, and those who got a score of 86 or higher were classified as belonging to the high-oral-health-behavior group. For the results of the examination of the subjects' oral health knowledge according to their oral health behavior level, the group with high oral health behavior had high oral health knowledge. This is consistent with a study [33] that reported that a high interest in oral health and high behavioral awareness lead to high oral health behavior. In the study by Kim and Yang [34], more than half of the subjects had high interest in dementia and high awareness that they were likely to develop it, but their subjective awareness of dementia was relatively low. It was found that in more than 90% of the cases, information on dementia was obtained from mass media and the patients' relatives. Related to this, Kim [35] stressed the necessity of systematic education about dementia from experts because acquiring dementia information through mass media and through one's family and relatives was not related to dementia awareness. In this study, the subjects' dementia knowledge was not related to their oral health behavior level, and low scores were obtained in 4 of the 12 items on oral health behavior

while high scores were obtained in only 2 of such items. In addition, it was confirmed that the subjects' dementia knowledge was not high, with 7 items having less than 60% correct answers. As such, active education to increase dementia knowledge is necessary.

Compared to the subjects' dementia knowledge, their dementia anxiety was very high, with a score of 4 or higher in all the items. Dementia anxiety refers to an emotional response that recognizes the fear of developing dementia [36], and the subjects answered that they feared losing their identity due to dementia [37]. The reason for fear of dementia was the family burden [24] or family damage [28] that it may entail or cause. In Germany, 41.1% of the subjects in a study were concerned about dementia [38], and in South Korea, 78.2% of the subjects in a study reported that they feared dementia [28]. As such, dementia anxiety was very high in all the items on such, regardless of the level of oral health behavior. As the dementia prevention behavior, however, was higher in the group with higher oral health behavior than in the group with low oral health behavior, the oral health behavior should be improved to increase the dementia prevention behavior. In this study, the higher the oral health behavior was, the higher the oral health knowledge and dementia prevention behavior, and the higher the oral health knowledge was, the higher the dementia anxiety and dementia prevention behavior were as well.

Therefore, to improve dementia prevention behavior, transfer of the knowledge that dementia is highly related to oral health is most important, and the oral health knowledge and oral health behavior should be improved to enhance the dementia prevention behavior. In this study, the relationship between dementia anxiety and dementia prevention behavior was not confirmed, but in the 3-year follow-up study by Mah, Binns, and Steffens [39], the higher the dementia anxiety was, the greater the risk of dementia. In particular, the elderly people with severe anxiety were 2.35 times more likely to develop dementia. A 12-year follow-up study by Johansson et al. [40] also reported that the risk of dementia was twice as high in the high-stress group than in the low-stress group. As there is a close relationship between dementia anxiety and dementia prevention behavior, in-depth research on the association between them is considered necessary in the future.

Conclusions

This study examined the associations among oral health knowledge, dementia knowledge, dementia anxiety, and dementia prevention behavior according to the level of oral health behavior. Through the study results, it was confirmed that high oral health behavior increases oral health knowledge and dementia prevention behavior, and high oral health knowledge increases dementia anxiety and dementia prevention behavior. Therefore, to prevent dementia, active education is required on the relationship between dementia and oral health, and efforts should be made to improve people's oral health behavior.

Limitation

The limitations of this study are that the samples were drawn through convenience sampling from a region and the sample size is small; thus, there is a limit to the generalization of the study results. The

relationships among oral health behavior, dementia knowledge, dementia anxiety, and dementia prevention behavior cannot be categorized into causal relations; therefore, further research on this should be conducted.

List Of Abbreviations

Not applicable.

Declarations

i. Ethics approval and consent to participate

The study was approved by Institutional Review Board of Silla University'(No. 1041449-201912-HR-002). Informed consent was obtained from all individual participants included in the study. All methods have been carried out in accordance with the relevant guidelines and regulations.

ii. Consent for publication

Not applicable.

iii. Availability of data and material

The data sets generated and/or analyzed during the current study are not publicly available for reasons of personal and organizational integrity but are available from the corresponding author on reasonable request.

iv. Competing interests

The authors declare that they have no competing interests.

v. Funding

No financial support was received for this study.

vi. Authors' contributions

Y.R Kim wrote the main manuscript text and H.K Kang and M.G Soong prepared tables 1-6. All authors reviewed the manuscript.

vii. Acknowledgements

Not applicable.

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