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Relationship between oral function and general condition among Japanese nursing home residents

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ABSTRACT

The purpose of this study was to clarify the relationship between oral function and general condition among Japanese nursing home residents. The hypothesis was that oral function is one of the most important factors for the maintenance of general condition in dependent elderly. Seventy-nine residents of a nursing home in Japan participated in this study (54 women and 25 men, age range: 65–95 years, mean age: 82.2 ± 8.5). A water drinking test and gargling function were used as indicators of oral function. Indicators of general condition included cognitive function (mini-mental state examination; MMSE), ADL (Barthel index), and nutritional status (body mass index = BMI, and serum albumin level). To clarify the relationship between oral function and general condition among dependent elderly, statistical evaluations of correlations (Spearman rank correlation coefficient) and differences (Mann–Whitney *U* test, Student's *t* test) between groups were conducted. SPSS was used for the statistical analysis. The water drinking and gargling function tests showed a strong correlation ($p < 0.001$) with cognitive function and ADL. The water drinking and gargling function tests showed a correlation with BMI ($p < 0.005$, $p < 0.01$, respectively), and the water drinking test showed a correlation with serum albumin level ($p < 0.05$). However, no correlation was observed between the gargling function tests and serum albumin level. It is concluded that oral function is closely related to cognitive function, ADL, and nutritional status. Oral function may play an important role in maintaining general condition in dependent elderly. To prevent decreases in cognitive function, ADL and nutritional status in dependent elderly, the importance of improvements in oral function cannot be over-emphasized.

1. Introduction

In a number of societies, the proportion of elderly in the population is rapidly increasing. In Japan, the proportion of elderly citizens has been increasing, and the government predicts that by the year 2015 more than 25% of all citizens will be over 65 years of age. With the rise in the elderly population, the issue of their health is becoming a social problem. It is estimated that approximately 3 million elderly Japanese people have physical or mental disabilities, and this number is predicted to rise to 5.3 million by 2025 (Ministry of Health, Labour and Welfare of Japan, 2003). Frail elderly people often have serious dental problems, including impaired oral functions. The main factors in death of elderly people are considered to be nutritional disorders and breathing problems, which are thought to be related to their impaired oral function.

Aspiration pneumonia is a prevalent and costly infection that is a significant cause of morbidity and mortality, especially in the elderly (Bentley, 1984). In addition to the risk factors of impaired cognitive function and ADL, aspiration due to impaired oral function is also recognized as one of the main causes of aspiration pneumonia. It has also been suggested that oral bacterial flora may function as a reservoir of potential respiratory pathogens that facilitate colonization on the oropharynx (Sumi et al., 2002, 2003, 2006, 2007).

In Japan more than 8000 elderly people die annually from asphyxia due to airway obstruction by food. A contributing factor in this is thought to be decreased oral function, including in elderly people who have no problems eating in their daily lives. There are also reports of a relation between the nutritional status of elderly people and their oral function, and the importance of improving oral function in the elderly has been indicated (Ikebe et al., 2006).

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The need to improve oral function was recognized in general society with the introduction in 2006 of measures to improve oral function in the new care insurance prevention benefits in Japan. Thus, it is important to examine the relationship between oral function and general condition among dependent elderly. However, the relationship between general health and oral function among frail elderly people is unclear. The purpose of this study was to clarify the relationship between oral function (water drinking and gargling function tests) and general condition (cognitive function, ADL, and nutritional status) in Japanese nursing home residents.

2. Subjects and methods

2.1. Subjects

Seventy-nine residents of a nursing home in Japan participated in this study (54 women and 25 men, age range: 65–95 years, mean age: 82.2 ± 8.5), after they or a family member fully understood the purpose of the study and gave consent for participation. Participants whose general condition was bad on the day of the examination or who could not be evaluated because of hospitalization or other reasons were excluded from the analysis.

2.2. Methods

Indicators for oral function evaluation were: (1) gargling function, a modified version of the gargling test (Ushiyama, 2003) was used (Table 1). (2) Water drinking test, a modified version of the water drinking test of Tohara et al. (2003) was used for evaluation (Table 2).

Indicators for general function evaluation were: (1) assessment of cognitive function, the mini-mental state examination (MMSE) (Folstein et al., 1975) was used by a psychiatrist. (2) Assessment of ADL, the Barthel index (Collin et al., 1988) was used for assessment. (3) Assessment of nutritional status, nutritional status was assessed with the indicators of serum albumin level and BMI, which were thought to reflect the nutritional status of the participants.

In the statistical analysis, Spearman's rank correlation coefficient was used for correlations. For tests between two groups, the Mann–Whitney U test, Student's t test, and Welch's t test were used with 4 as the threshold in the water drinking test and 2 as the threshold for gargling function. The SPSS statistical software package was used.

2.3. Ethical considerations

The ethical regulations of the National Center for Geriatrics and Gerontology were strictly followed. The study was approved by the National Center for Geriatrics and Gerontology.

3. Results

3.1. Relationship between oral function and cognitive function

The participants were divided into two groups according to gargling function, with 2 as the threshold, and cognitive function was investigated. It was found that the group with low gargling function (gargling function score of 3 or more) had significantly lower ($p < 0.001$) cognitive function (MMSE). In a test of correlation using Spearman's rank correlation coefficient, a negative correlation of $\gamma = 0.766$ ($p < 0.001$) was found between gargling function and cognitive function (Fig. 1).

Participants were divided into two groups of those with a score of 4 or less in the water drinking test and those with a score of 5, and cognitive function was investigated. The group with the lower score (4 or less) in the water drinking test had a significantly lower ($p < 0.001$) cognitive function (MMSE). Correlation was tested using Spearman's rank correlation coefficient, and a positive correlation of $\gamma = 0.634$ ($p < 0.001$) was found between gargling function and cognitive function (Fig. 2).

Table 1
Gargling test

1	Can be executed without problem
2	Can be executed with some difficulty
3	Water can be held in the mouth only
4	Water can be put in the mouth, but is swallowed
5	Water cannot be put in the mouth

Table 2
Water drinking test

1	No swallowing; gulping and/or changes in respiration
2	Swallowing; no gulping; changes in respiration or moist hoarseness
3	Swallowing, gulping
4	Swallowing, no gulping, no moist hoarseness
5	(In addition to 4) Swallowing can be repeated once in 30 s

3.2. Relationship between oral function and ADL

Participants were divided into two groups according to gargling function, with 2 as the threshold, and ADL was investigated. It was found that the group with low gargling function (gargling function score of 3 or more) had significantly lower ($p < 0.001$) ADL (Barthel index). In a test of correlation using Spearman's rank correlation coefficient, a negative correlation of $\gamma = 0.8000$ ($p < 0.001$) was found between oral function and ADL (Fig. 3).

Participants were divided into two groups of those with a score of 4 or less in the water drinking test and those with a score of 5, and ADL was investigated. The group with the lower score (4 or less) in the water drinking test had a significantly lower ($p < 0.001$) ADL (Barthel index). Correlation was tested using Spearman's rank correlation coefficient, and a positive correlation of $\gamma = 0.754$ ($p < 0.001$) was found between oral function and ADL (Fig. 4).

3.3. Relationship between oral function and nutritional status

Participants were divided into two groups according to gargling function, with 2 as the threshold, and BMI was investigated. It was found that the group with low gargling function (gargling function score of 3 or more) had significantly lower ($p < 0.005$) nutritional status (BMI). In a test of correlation using Spearman's rank correlation coefficient, a negative correlation of $\gamma = 0.344$ ($p < 0.005$) was found between oral function and BMI (Fig. 5).

Participants were divided into two groups of those with a score of 4 or less in the water drinking test and those with a score of 5, and BMI was investigated. The group with the lower score (4 or less) in the water drinking test had a significantly lower ($p < 0.05$) nutritional status (BMI). Correlation was tested using Spearman's rank correlation coefficient, and a positive correlation of $\gamma = 0.306$ ($p < 0.01$) was found between oral function and BMI (Fig. 6).

Serum albumin level was investigated in two groups divided according to gargling function, with 2 as the threshold. The group in which gargling function was lower (gargling function score of 3 or more) had a lower serum albumin level, but the difference between the two groups was not significant. In a test of correlation with Spearman's rank correlation coefficient, no correlation was found between gargling function and nutritional status (serum albumin level) (Fig. 7).