Oral frailty as a possible fall risk factor in community-dwelling older adults independent of sarcopenia and physical performance

Naoto Kamide (✉ naokami@kitasato-u.ac.jp)
Kitasato Daigaku  https://orcid.org/0000-0003-1566-1015

Masataka Ando
Kitasato University - Sagamihara Campus: Kitasato Daigaku - Sagamihara Campus

Takeshi Murakami
Kitasato University - Sagamihara Campus: Kitasato Daigaku - Sagamihara Campus

Takuya Sawada
Kitasato University - Sagamihara Campus: Kitasato Daigaku - Sagamihara Campus

Wakana Hata
Kitasato University - Sagamihara Campus: Kitasato Daigaku - Sagamihara Campus

Miki Sakamoto
Kitasato University - Sagamihara Campus: Kitasato Daigaku - Sagamihara Campus

Research Article

Keywords: Falls, Older adult, Oral frailty, Physical performance, Sarcopenia

Posted Date: July 7th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-3065792/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License
Abstract

Purpose

This study investigated the direct association of oral frailty with falls in community-dwelling older people, independent of sarcopenia and physical performance.

Methods

The participants were 237 community-dwelling older people (76.0±5.7 years). Oral frailty was assessed using the Oral Frailty Index-8. History of falls, timed up and go test (TUG), and sarcopenia were also assessed. The association between oral frailty and fall incidence was analyzed using multivariate logistic regression analysis adjusted for TUG and sarcopenia.

Results

Forty-six (19.4%) participants fell and 130 (54.9%) had a risk of oral frailty. On multivariate logistic regression analysis, oral frailty was significantly associated with fall incidence (odds ratio=2.38, 95% confidence interval: 1.11-5.07), even after adjusting for TUG and sarcopenia.

Conclusion

Oral frailty is a possible fall risk factor, independent of sarcopenia and physical performance, in community-dwelling older people.

Key summary points

Aim:

This study investigated the direct association of oral frailty with falls in community-dwelling older people.

Findings:

Oral frailty was significantly associated with fall incidence, even after adjusting for the timed up and go test and sarcopenia.

Message:

Oral frailty is a possible fall risk factor, independent of other known fall risk factors, in older people.

Background

Oral frailty, defined as a decrease in oral function accompanied by a decrease in mental and physical function [1], has recently been recognized as one of the geriatric syndromes requiring appropriate care for older people. In fact, about 16% of older adults reportedly had oral frailty in an observational study by
Tanaka et al [2]; therefore, oral frailty is not considered an uncommon geriatric syndrome. Furthermore, previous studies have shown that oral frailty is associated with physical frailty and sarcopenia [2, 3]. Physical frailty and sarcopenia are known to be critical risk factors for falls in community-dwelling older people [4, 5]. Furthermore, oral frailty in older people has been shown to be associated with poor gait performance, which is also a well-known risk factor of falls [6]. However, the direct relationship between oral frailty and falls in community-dwelling older people has not been established due to a lack of relevant studies. Demonstrating evidence for a direct association between oral frailty and falls may contribute to the development of new strategies for fall prevention in older people. Therefore, this study investigated the direct association between oral frailty and falls in community-dwelling older people, taking into account the influence of sarcopenia and physical performance.

Methods

Participants were 237 community-dwelling older adults who were independent in instrumental activities of daily living (IADL). They were volunteers recruited through local newspapers in Sagamihara City, Japan. Independence in IADL was confirmed using a scale of the Tokyo Metropolitan Institute of Gerontology Index of Competence [7]. Inclusion criteria were as follows: 65 years old and older, living independently in their community, and no deficits on assessment of muscle mass, physical performance, or self-rated questionnaire. Institutionalized older adults, those younger than 65 years and those who were dependent in IADL and ADL were all excluded from this study.

Oral frailty was assessed using the Oral Frailty Index-8 (OFI-8) [8] via a self-administered questionnaire. The OFI-8 consists of 8 oral health questions and the score ranges from 0 to 11 points. In this study, oral frailty was defined as an OFI-8 score of 3 points or more, which indicated a risk for oral frailty in the previous study [8]. For falls, history of falls in the previous year was assessed by a questionnaire. In this study, fallers were defined as those who had one or more falls in the previous year. In addition, the timed up and go test (TUG), gait speed, grip strength, and appendicular skeletal muscle mass were measured using validated measurement procedures as potential fall risk factors. In general, TUG can be interpreted as an index of gait ability. Appendicular skeletal muscle mass (in kilograms) was measured by a bioimpedance analysis method that was converted to the skeletal muscle index (SMI) by dividing by the square of body height in meters. The presence of sarcopenia was assessed based on the results of grip strength, gait speed, and SMI. Sarcopenia was defined according to the Asian Working Group for Sarcopenia 2019 criteria [9]. Body mass index, polypharmacy, and comorbidities were also examined as potential confounders. Polypharmacy was defined as ≥ 6 prescribed medications. For comorbidities, the presence of heart disease, kidney disease, diabetes mellitus, or cerebrovascular disease was confirmed by a self-reported questionnaire. The association between oral frailty and falls was analyzed using multivariate logistic regression analysis, with history of falls as the dependent variable and oral frailty as the independent variable, adjusted for TUG, sarcopenia, and potential confounders. Statistical analysis was performed using R Statistical Analysis Software Version 4.0.3 (R Foundation for Statistical Computing, Vienna, Austria), with significance set at 5%.
This study was approved by the institutional review board of the School of Allied Health Sciences at Kitasato University (approval nos. 2018-008B and 2021-031). Written informed consent was obtained from all participants.

Results

The mean age of the participants in this study was 76.0 ± 5.7 years and 56 (23.6%) were male. Forty-six (19.4%) participants had a history of falls (fallers) and 130 (54.9%) were classified as having oral frailty. Fallers had significantly higher OFI-8 scores and oral frailty than non-fallers (Table 1). No significant differences were found between fallers and non-fallers for other potential fall risk factors (Table 1).
Table 1
Summary of participant characteristics and comparison between fallers and non-fallers

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overall (n = 237)</th>
<th>Fallers (n = 46)</th>
<th>Non-fallers (n = 191)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean/n  SD/%</td>
<td>Mean/n  SD/%</td>
<td>Mean/n  SD/%</td>
<td></td>
</tr>
<tr>
<td>Age (years-old)</td>
<td>76.0  5.7</td>
<td>76.2  5.8</td>
<td>76.0  5.7</td>
<td>0.836</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>56  23.6</td>
<td>11  23.9</td>
<td>45  23.6</td>
<td>&gt; 0.99</td>
</tr>
<tr>
<td>Body mass index (kg/m(^2))</td>
<td>22.6  3.0</td>
<td>23.1  3.6</td>
<td>22.5  2.9</td>
<td>0.229</td>
</tr>
<tr>
<td>Polypharmacy</td>
<td>13  5.5</td>
<td>2  4.3</td>
<td>11  5.9</td>
<td>0.956</td>
</tr>
<tr>
<td>Heart disease</td>
<td>17  7.2</td>
<td>3  6.5</td>
<td>14  7.3</td>
<td>&gt; 0.99</td>
</tr>
<tr>
<td>Kidney disease</td>
<td>11  4.6</td>
<td>3  6.5</td>
<td>8  4.2</td>
<td>0.776</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>21  8.9</td>
<td>4  8.7</td>
<td>17  8.9</td>
<td>&gt; 0.99</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>8  3.4</td>
<td>3  6.5</td>
<td>5  2.6</td>
<td>0.389</td>
</tr>
<tr>
<td>Timed up &amp; go test (s)</td>
<td>6.4  1.7</td>
<td>6.7  2.4</td>
<td>6.3  1.4</td>
<td>0.113</td>
</tr>
<tr>
<td>5-m walking time (s)</td>
<td>3.6  0.7</td>
<td>3.7  0.6</td>
<td>3.7  1.0</td>
<td>0.162</td>
</tr>
<tr>
<td>Grip strength (kg)</td>
<td>25.0  6.9</td>
<td>24.4  6.9</td>
<td>25.1  6.9</td>
<td>0.511</td>
</tr>
<tr>
<td>SMI (kg/m(^2))</td>
<td>6.2  0.9</td>
<td>6.3  0.9</td>
<td>6.2  0.9</td>
<td>0.455</td>
</tr>
<tr>
<td>Sarcopenia</td>
<td>26.0  11.0</td>
<td>5  10.9</td>
<td>21  11.0</td>
<td>&gt; 0.99</td>
</tr>
<tr>
<td>OFI-8 score</td>
<td>3.2  2.2</td>
<td>3.8  2.1</td>
<td>3.0  2.2</td>
<td>0.030</td>
</tr>
<tr>
<td>Oral frailty</td>
<td>130  54.9</td>
<td>32  71.1</td>
<td>98  51.6</td>
<td>0.028</td>
</tr>
</tbody>
</table>

SMI: skeletal muscle index, OFI-8: the oral frailty index-8

Polypharmacy was defined as \( \geq 6 \) prescribed medications. Sarcopenia was defined according to the Asian Working Group for Sarcopenia 2019 criteria. Oral frailty was defined as a score \( \geq 3 \) on the Oral Frailty Index-8.

On multivariate logistic regression, oral frailty was significantly associated with falls (odds ratio = 2.38, 95% confidence interval: 1.11–5.07), independent of TUG, sarcopenia, and other potential confounding factors (Table 2).
Table 2
Association of oral frailty with falls by multivariate logistic regression

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio</th>
<th>95%CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (1-year increase)</td>
<td>0.97</td>
<td>0.90–1.03</td>
<td>0.327</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>0.95</td>
<td>0.42–2.16</td>
<td>0.897</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>1.05</td>
<td>0.94–1.17</td>
<td>0.391</td>
</tr>
<tr>
<td>Polypharmacy (yes)</td>
<td>0.60</td>
<td>0.12–3.13</td>
<td>0.547</td>
</tr>
<tr>
<td>Heart disease (yes)</td>
<td>0.73</td>
<td>0.18–2.97</td>
<td>0.664</td>
</tr>
<tr>
<td>Kidney disease (yes)</td>
<td>1.09</td>
<td>0.21–5.65</td>
<td>0.921</td>
</tr>
<tr>
<td>Diabetes mellitus (yes)</td>
<td>1.11</td>
<td>0.33–3.77</td>
<td>0.863</td>
</tr>
<tr>
<td>Cerebrovascular disease (yes)</td>
<td>4.63</td>
<td>0.87–24.60</td>
<td>0.072</td>
</tr>
<tr>
<td>Timed up and go test (1-s increase)</td>
<td>1.14</td>
<td>0.91–1.43</td>
<td>0.243</td>
</tr>
<tr>
<td>Sarcopenia (yes)</td>
<td>0.87</td>
<td>0.27–2.77</td>
<td>0.808</td>
</tr>
<tr>
<td>Oral frailty (yes)</td>
<td>2.38</td>
<td>1.11–5.07</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Hosmer and Lemeshow test: chi-squared = 8.65 (df = 8), p = 0.373

C statistics = 0.633 (95%CI: 0.540–0.727)

CI: confidence interval

Dependent variable was fallers/non-fallers.

Polypharmacy was defined as ≥ 6 prescribed medications. Oral frailty was defined as a score ≥ 3 on the Oral Frailty Index-8. Sarcopenia was defined according to the Asian Working Group for Sarcopenia 2019 criteria.

Discussion

This study investigated whether oral frailty was associated with falls in community-dwelling older people. The main finding was that oral frailty was directly associated with falls in community-dwelling older people who were independent in IADL. Interestingly, the findings suggested that oral frailty was a risk factor for falls, independent of sarcopenia and TUG, a known predictor and risk factor for falls in older people [5, 10]. Thus, regarding the prevention of falls for older people, assessment and oral healthcare should be considered as a new strategy. At the very least, attention to oral frailty may be necessary for older adults who have a fall risk. However, this study was a cross-sectional observational study, and establishing evidence of a causal effect between oral frailty and falls will be indispensable in further studies.
There are multiple oral signs and symptoms of oral frailty. Oral frailty has been shown to consist of 6 oral health conditions, as follows: number of natural teeth, chewing ability, articulatory oral motor skills, tongue pressure, difficulty in eating tough food, and difficulty in swallowing [2]. In a previous study, higher tongue pressure was reported to indicate higher appendicular skeletal muscle mass, which is one of the critical components of sarcopenia [11]. Thus, specific signs or symptoms that are most associated with falls may be present in the 6 oral conditions. However, we could not clarify which conditions of oral frailty were strongly associated with falls, because of limitations in the data from the assessment tool used in this study. Although the OFI-8 is a validated scale for risk of oral frailty [8], the OFI-8 and objective measurement results may not be in complete agreement. Therefore, detailed objective assessment of oral frailty based on the 6 oral conditions is necessary to clarify the mechanism of the association between oral frailty and falls.

As stated above, due to the limitations of the data obtained in this study, we are unable to describe the mechanism of the association between oral frailty and falls. However, as a possible mechanism, oral health status is suggested to influence posture and gait stability. Specifically, poor dental status might deteriorate postural control and gait stability. In fact, a previous study reported that complete dentures improved balance and gait stability in older adults who are edentulous [12]. However, further studies are needed to clarify the mechanism for the association between oral frailty and falls.

This study had several limitations regarding the study design and the oral frailty assessment tool used, but our findings for a direct association between oral frailty and fall risk in community-dwelling older people are meaningful in fall prevention and oral health. This study could not fully evaluate the potential risk factors for falls. In particular, psychological factors such as fear of falls and cognitive function, and socioeconomic factors such as education level and income, were not included for analysis in this study. Furthermore, detailed information on medical conditions and prescribed medications could not be obtained. Therefore, the influence of these factors on the results of the study was unclear.

In conclusion, oral frailty is a possible risk factor for falls, independent of sarcopenia and physical performance, in community-dwelling older people with independence in IADL. For fall prevention, an assessment of oral health might also be useful in addition to the assessment of known risk factors such as physical function.

**Declarations**

**Acknowledgements**

We wish to thank Dr. Yoshitaka Shiba and Haruhiko Sato for their substantial aid in data collection.

**Funding**

This study was funded by JSPS KAKENHI (Grant Nos. 19K11394 and 20K19406). The funders played no role in the design, methods, subject recruitment, data collection, analysis, or preparation of the paper.
Data availability statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no conflict of interest.

Ethics approval

All procedures that involved human participants in this study were performed in accordance with the ethical standards of the Institutional Review Board of the School of Allied Health Sciences at Kitasato University (Approval nos. 2018-008B and 2021-031) and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed consent

Written informed consent was obtained from all participants.

References


