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Original Study

Self-Assessed Kyphosis and Chewing Disorders Predict Disability and Mortality in Community-Dwelling Older Adults

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A B S T R A C T

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Objective: It is clear that each trend of kyphosis with increased age and the ability to eat firm foods with the back teeth (chewing ability) has a strong influence on both the physical and mental condition of older people. Thus, this study aimed to examine whether the combination of kyphosis and chewing disorders was associated with mortality or the need for care under the new long-term care insurance (LTCI) service requirement, over 3 years in community-dwelling older Japanese adults.

Design: A prospective cohort study.

Setting and Participants: We analyzed the cohort data for older adults (65 years or older) from a prospective study in Kami town. The response rate was 94.3%, and we followed 5094 older individuals for 3 years. Thus, we analyzed 5083 older adults using multiple imputation to manage missing data.

Outcome: The outcomes were mortality or new certifications for LTCI services in a 3-year period.

Measurements: We developed 3 groups by asking 2 self-reported questions on both "no kyphosis" and "good chewing ability." The groups were no kyphosis and good chewing ability (GG), kyphosis and poor chewing ability (BB), and kyphosis and good chewing ability or no kyphosis and poor chewing ability (GB/BG).

Results: The prevalence of BB, BG/GB, and GG were 8.9%, 40.3%, and 50.8%, respectively, in our survey. During the 3-year follow-up period, 5.2% (n = 262) died and 13.9% (n = 708) individuals were newly certified as needing LTCI services. As determined by multivariate analyses, BG/GB older adults (adjusted hazard ratio: 1.3 [95% CI 1.1–1.6]) and BB older adults (adjusted hazard ratio: 2.0 [95% CI 1.5–2.4]) had a significantly higher risk of needing LTCI services than GG older adults. Similarly, BG/GB older adults (adjusted hazard ratio: 1.5 [95% CI 1.1–2.0]) and BB older adults (adjusted hazard ratio: 2.3 [95% CI 1.5–3.3]) had a significantly higher risk of mortality than GG older adults did.

Conclusion: The presence of kyphosis or poor chewing ability was related to mortality and new certifications for LTCI services, and we found an additive effect of these 2 factors related to frailty.

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Degenerative changes affecting the spine accumulate and contribute to an overall trend of kyphosis with increased age.^{1,2} Because there is no widely accepted definition of hyperkyphosis,

current estimates of the prevalence of this condition range between 20% and 40% among community-dwelling older people.^{3–5} Particularly, hyperkyphosis is associated with several adverse health

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Table 1
Baseline Characteristics According to Age and Sex (%)

	Missing Data n (%)	Overall n = 5083 (100.0%)	Age, y			Sex		
			65–74 n = 2276 (44.8%)	≥75 n = 2807 (55.2%)	P	Men n = 2118 (41.7%)	Women n = 2965 (58.3%)	P
65–74 years old (vs 75 years and older)	0 (0.0)	44.8	—	—		46.0	43.9	.143
% of women	0 (0.0)	58.3	57.2	59.2	.143	—	—	
Frailty	1186 (23.3)	32.1	19.7	42.1	<.001	31.0	32.9	.153
Mobility disorder	194 (3.8)	33.3	18.8	45.0	<.001	25.4	39.0	<.001
Oral impairment	114 (2.2)	19.7	14.9	23.7	<.001	21.8	18.3	.002
Isolation	161 (3.2)	12.7	6.6	17.6	<.001	9.5	14.9	<.001
Cognitive impairment	85 (1.7)	35.0	28.4	40.3	<.001	40.3	31.2	<.001
Depressive mood	289 (5.7)	25.9	19.6	31.0	<.001	26.9	25.3	.210
Indicator of kyphosis and chewing ability								
Kyphosis (vs no kyphosis)	38 (0.7)	38.4	29.5	45.6	<.001	29.8	44.5	<.001
Poor chewing ability (vs good chewing ability)	57 (1.1)	19.7	19.3	20.0	<.001	19.9	19.6	.736
Two health issues into 3 groups	169 (3.3)							
No kyphosis and good chewing ability (GG)		50.8	50.2	44.8	.542	57.4	46.0	<.001
Kyphosis and good chewing ability or no kyphosis and poor chewing ability (GB/BG)		40.3	34.8	44.8		35.4	43.9	
Kyphosis and poor chewing ability (BB)		8.9	7.0	10.4		7.2	10.1	

All results were analyzed using MI to treat missing data.

Analysis was conducted on responses $\geq 1/2$ for each measure.

P values are based on a χ^2 test for categorical variables.

conditions, including thoracic pain,^{6–8} decreased pulmonary function,^{9–11} limited physical functioning,^{3,5,12–14} increased fall risk,^{12,15,16} increased health-related quality of life,^{3,14,17} increased fractures,^{18,19} and increased mortality.^{4,20,21} There was no significant difference between depressive mood and kyphosis.³ However, it should be noted that these are studies of hyperkyphosis and not of general kyphosis.²²

Our research questions focused on chewing power in common health-related issues of older people caused by frailty. However, it is not a simple mechanism through which aging affects chewing power, unlike any other part of the human body. If tooth loss is not considered as an attribute of physiological aging, then aging per se may not be a risk factor for masticatory dysfunction.^{23,24} Chewing power, which is closely related to quality of life, is essential for maintenance of the activities of daily living in the elderly.^{25–27}

Both these health issues (the presence of kyphosis or chewing disorders) are widely observed in aging people. These 2 adverse health outcomes are easily noticed even by older people themselves and by the others. Furthermore, these health issues are preventable through continued everyday health activities starting in late middle age.

Therefore, our study objectives were to clarify the following 3 research questions: (1) Is the existence of kyphosis or the decrease in chewing ability related to frailty without being affected by age or sex? (2) How much influence does the presence of kyphosis or chewing disorders have on the need for new coverage under long-term care insurance (LTCI) service requirement? (3) How much influence does the presence of kyphosis or chewing disorders have on predicting mortality?

Materials and Methods

Study Setting and Participants

We analyzed the cohort data from a prospective study. In April 2013, as baseline survey, self-reported questionnaires were mailed to 5401 community-dwelling adults aged 65 years or older, excluding individuals who already had an LTCI service requirement certification (n = 1283). The mailed response rate was 73.2% (n = 3952). Those who did not return the questionnaire by mail were then visited at their homes by nursing staff for questionnaire

Table 2
Correlations Among the Indicators of Frailty, Kyphosis, and Chewing Ability (n = 5083)

	Age	Sex (Men)	Frailty	Mobility Disorder	Oral Impairment	Isolation	Cognitive Impairment	Depressive Mood	Kyphosis	Poor Chewing Ability	Kyphosis × Poor Chewing Ability
Age	1.000										
Sex (Men)	0.035*	1.000									
Frailty	0.295 [†]	0.020	1.000								
Mobility disorder	0.312 [†]	0.141 [†]	0.526 [†]	1.000							
Oral impairment	0.130 [†]	−0.043 [†]	0.431 [†]	0.197 [†]	1.000						
Isolation	0.214 [†]	0.083 [†]	0.434 [†]	0.277 [†]	0.160 [†]	1.000					
Cognitive impairment	0.143 [†]	−0.094 [†]	0.373 [†]	0.147 [†]	0.227 [†]	0.132 [†]	1.000				
Depressive mood	0.156 [†]	−0.018	0.578 [†]	0.249 [†]	0.288 [†]	0.236 [†]	0.277 [†]	1.000			
Kyphosis	0.193 [†]	0.148 [†]	0.241 [†]	0.259 [†]	0.158 [†]	0.143 [†]	0.114 [†]	0.165 [†]	1.000		
Poor chewing ability	0.011	−0.004	0.178 [†]	0.106 [†]	0.226 [†]	0.096 [†]	0.089 [†]	0.157 [†]	0.068 [†]	1.000	
Kyphosis × Poor chewing ability	0.155 [†]	0.112 [†]	0.284 [†]	0.260 [†]	0.243 [†]	0.160 [†]	0.139 [†]	0.215 [†]	0.813 [†]	0.614 [†]	1.000

All results were analyzed using MI to treat missing data.

Results shown were calculated using the Spearman correlation coefficient.

*P < .05.

[†]P < .01.

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