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The Open Dentistry Journal

RESEARCH ARTICLE

Psychometric Properties of the Japanese Version of the Single Dental Anxiety Question: A Cross-sectional Online Survey

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Abstract:

Background:

Assessment of dental anxiety using a validated questionnaire is important for its management and survey.

Objective:

The aim of this cross-sectional online survey was to evaluate the psychometric properties of the Japanese version of the Single Dental Anxiety Question (SDAQ).

Methods:

The single question was translated into Japanese following the forward-backward method. Four hundred Japanese internet monitors (age 20–79 years) were included in the study. Sensitivity–specificity analysis and the Kappa coefficient were calculated against the Modified Dental Anxiety Scale (MDAS) using the 19 cutoff score for high dental anxiety. Criterion validity was evaluated using age, gender, dental attendance pattern, negative dental experiences, and subjective oral health.

Results:

Among these subjects, 11% were found to have high dental anxiety on the MDAS score and 9% rated themselves as very afraid of SDAQ. The Kappa coefficient between the MDAS cutoff score and the SDAQ classification was 0.58, the sensitivity was 0.56, and the specificity was 0.97. The SDAQ was associated with gender ($P = 0.018$), dental attendance pattern ($P = 0.020$), negative dental experiences ($P < 0.001$), and subjective oral health ($P < 0.001$).

Conclusion:

The Japanese version of the SDAQ has good criterion and construct validity but lower sensitivity than the original version. It can be used to assess dental anxiety in large dental surveys or clinical settings where a multi-item questionnaire is not feasible.

Keywords: Dental Anxiety, Surveys and questionnaires, Psychometrics, Kappa coefficient, Dental health, Oral health.

1. BACKGROUND

Dental anxiety can make patients avoid dental treatment that consequently results in poor oral health, which in turn affects the quality of life [1 - 4]; hence, dental anxiety is not only an individual but also a social problem. Dental health surveys conducted among the general population indicate that

approximately 10%–20% of communities have experienced high levels of dental anxiety [3 - 7]. Assessment of dental anxiety using a validated questionnaire is required in epidemiological surveys, clinical research, and dental anxiety management in clinical settings [8]. Although numerous measures of dental anxiety have been established [9], large epidemiological surveys often use a single question [3 - 7].

A Single Dental Anxiety Question (SDAQ) has been used in nationwide health surveys among the Finnish adult population [4]. A previous study conducted in this regard

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concluded that the single question was suitable for national health surveys or in clinical dental settings where a multi-item dental questionnaire could not be used [10]. Epidemiological and other surveys related to dental anxiety in Japan have been performed only among patients or students [6, 11 - 14]. There is a lack of knowledge regarding the prevalence of dental anxiety based on studies conducted in the wide-age general Japanese population using the validated dental anxiety measure.

Therefore, this study aimed to translate the SDAQ and to evaluate its psychometric properties in a Japanese population using internet research.

2. METHODS

2.1. Participants

The internet survey was conducted in Japan in October 2019. All participants were internet monitors of Rakuten Insight Inc. (Tokyo, Japan) who lived in Japan and were aged ≥20 years.

2.2. Procedure

The adequate sample size was calculated using Raosoft (Raosoft, Inc., Seattle, USA) [15]. When 5% margin of error was accepted with a confidence level of 95%, the population size was >20000, and the response distribution was 50%, and the minimum sample size was 377. The targeted number of participants (overall 400 samples) was determined to represent the latest announced Japanese population structure for age and gender and to reduce sampling bias as much as possible [16]. A total of 5387 monitors received an e-mail invitation to participate in our survey from the research company. When the respondents visited the website for the survey, the policy for the use of data and the protection of personal information was displayed. Only respondents who agreed with the policy were allowed to answer the questionnaire. When a total of 471 participants completed the questionnaire, the survey was closed.

2.3. Measures

SDAQ. The SDAQ [10] is a single question, *i.e.*, "Do you think that visiting a dentist is." The original version was written in Finnish. Responses are recorded on a 3-point Likert-type scale as follows: 1 (not frightening at all), 2 (somewhat frightening), and 3 (very frightening). First, the SDAQ was translated from Finnish into Japanese following the back-translation method to ensure the semantic equivalence of both versions [17]. Accordingly, the question was initially translated from Finnish into Japanese by a Japanese expert in the psychological field. In addition, two Japanese dentists translated the English version of the question into Japanese. The first and second authors integrated the three versions into one version. Then, the Japanese version was back-translated into Finnish by another expert and compared, in which one difference was identified by the third author. The difference was corrected and the same back-translation method was applied. The final Japanese version of the SDAQ is available from the corresponding author upon a request.

The Modified Dental Anxiety Scale (MDAS). The MDAS [18] is a 5-item questionnaire that assesses the respondents' emotional reactions to the following five situations: planning to visit a dental clinic the following day, waiting in the waiting room of a dental clinic, having one's teeth drilled, having one's teeth scaled, and receiving local anesthetic injections. Responses are recorded on a 5-point Likert-type scale ranging from "not anxious" to "extremely anxious." Total scores could range from 5 to 25, with higher scores indicating greater dental fear. A cutoff score of ≥19 was used to identify individuals with high levels of dental anxiety [19]. The Japanese version of MDAS was found to have high reliability and validity [13, 20].

Sociodemographic and dental anxiety-related information. All participants were asked to provide details about sociodemographic characteristics (*i.e.*, age, gender, educational level, occupation, and income) and dental anxiety-related factors (*i.e.*, dental attendance pattern, negative dental experiences, and subjective oral health). Dental attendance was dichotomized to regular check-up and care and only when problems, never or not even when problems. Subjective oral health was trichotomized to extremely good or good and, average, bad or extremely bad.

2.4. Statistical Analyses

Spearman's correlation analysis was used to examine the relationship between the scores yielded by the SDAQ and MDAS. The Mann–Whitney U test and the Kruskal–Wallis test were used to examine differences in demographic characteristics (*e.g.*, sex and age) in the SDAQ scores. Sensitivity and specificity analyses were performed between SDAQ and MDAS. All statistical analyses were conducted using EZR (Saitama Medical Centre, Jichi Medical University, Japan, 2012) [21], which is a graphical user interface for R (version 3.3.1; The R Foundation for Statistical Computing, Vienna, Austria). For all analyses, P values of <0.05 were considered to be significant.

3. RESULTS

Of the 471 participants, 71 were excluded because of nonconformity to the research company's criteria (*e.g.*, samples that were answered within a too short time and composed of the same answers), and the data of the remaining 400 participants were used for analysis. Table **1** shows the sociodemographic and dental anxiety-related factors.

3.1. Criterion Validity

Spearman's correlation coefficients between the SDAQ score and each item and the total score of the MDAS are presented in Table **2**. There was a significant and strong correlation between the SDAQ and each of the single items and the total scores of the MDAS. Results of the Kruskal–Wallis test and the post hoc test suggested that respondents who rated their anxiety as "very frightening" had a significantly higher mean sum score of MDAS (P < 0.001) than those who rated their anxiety as "somewhat frightening" (P < 0.001) and "not frightening at all" (P < 0.001).

3.2. Evaluation of Test Accuracy

Of the study sample, 11% (45/400) were found to have a

high degree of dental anxiety on the MDAS using the 19 cutoff score. In addition, 9% of them (35/400) rated themselves as "very frightening." The Kappa coefficient between the MDAS cutoff score (≥19) and the SDAQ classification (very frightening or the rest) was 0.58, the sensitivity was 0.56, and the specificity was 0.97.

Table 1. Univariate relationship between selected variables and single dental anxiety score.

Variable	No. of Participants (%)	Not Frightening at all/ Somewhat Frightening	Very Frightening
	N (%)	N (%)	N (%)
Total	400 (100)	365 (100)	35 (100)
Gender			
Male	198 (49.5)	180 (49.3)	18 (51.4)
Female	202 (50.5)	185 (50.7)	17 (48.6)
Age group (years)			
20–29	53 (13.3)	49 (13.4)	4 (11.4)
30–39	66 (16.5)	61 (16.7)	5 (14.3)
40–49	80 (20.0)	72 (19.7)	8 (22.9)
50–59	66 (16.5)	58 (15.9)	8 (22.9)
60–69	71 (17.8)	65 (17.8)	6 (17.1)
70–79	64 (16.0)	60 (16.4)	4 (11.4)
Education			
Junior high	6 (1.5)	5 (1.4)	1 (2.9)
High school	118 (29.5)	109 (29.9)	9 (25.7)
Technical college	70 (17.5)	61 (16.7)	9 (25.7)
University	178 (44.5)	162 (44.4)	16 (45.7)
Graduate school	17 (4.25)	17 (4.7)	0 (0.0)
Other	11 (2.75)	11 (3.0)	0 (0.0)
Occupation			
Salaried employment	160 (40.0)	145 (39.7)	15 (42.9)
Self-employed	23 (5.8)	20 (5.5)	3 (8.6)
Housewife	76 (19.0)	70 (19.2)	6 (17.1)
Part-time worker	53 (13.3)	49 (13.4)	4 (11.4)
Student	5 (1.25)	4 (1.1)	1 (2.9)
Unemployed	58 (14.5)	53 (14.5)	5 (14.3)
Other	25 (6.25)	24 (6.6)	1 (2.9)
Dental attendance pattern			
Never had dental treatment	4 (1.0)	3 (0.8)	1 (2.9)
Regular check-up and care	172 (43.0)	167 (45.8)	5 (14.3)
Only when having a problem	218 (54.5)	194 (53.2)	24 (68.6)
Not having dental treatment even when having a problem	6 (1.5)	1 (0.3)	5 (14.3)
Negative experience during dental treatment			
No	219 (54.8)	213 (58.4)	10 (28.6)
I don't know	45 (11.3)	39 (10.7)	6 (17.1)
Yes	132 (33.0)	113 (31.0)	19 (54.3)
Subjective oral health			
Extremely good	7 (1.8)	7 (1.9)	0 (0.0)
Good	139 (34.8)	134 (36.7)	5 (14.3)
Average	147 (36.8)	136 (37.3)	11 (31.4)
Bad	95 (23.8)	81 (22.2)	14 (40.0)
Extremely bad	12 (3.0)	7 (1.9)	5 (14.3)

Table 2. Mean (SD) scores of MDAS and Spearman's correlation coefficients for MDAS and the Japanese version of SDAQ.

-	-	MDAS mean (SD)					
-	N (%)	Visiting a Dental Clinic Tomorrow	Sitting in the Waiting Room	Having Teeth Drilled	Having Teeth Scaled	Receiving Local Anesthetic Injections	Total
Not frightening at all	180 (45.0)	1.33 (0.67)	1.25 (0.59)	1.91 (0.93)	1.39 (0.74)	2.10 (1.12)	7.98 (3.20)
Somewhat frightening	185 (46.3)	2.38 (0.77)	2.39 (0.79)	3.10 (1.04)	2.38 (1.07)	3.26 (1.21)	13.51 (3.66)
Very frightening	35 (8.8)	4.03 (1.04)	3.91 (0.98)	4.14 (1.17)	3.60 (1.26)	4.34 (0.97)	20.03 (4.69)
Spearman's correlation coefficients		0.73	0.76	0.58	0.57	0.53	0.71
All correlations P < 0.001							

Table 3. Construct validity of single dental anxiety question.

	n (%)	Mean	S.D.	P value
Gender*				
Male	198 (49.5)	1.57	0.65	0.018
Female	202 (50.5)	1.70	0.61	
Age (years) †				
20–29	53 (13.25)	1.75	0.59	0.104
30–39	66 (16.50)	1.59	0.63	
40–49	80 (20.00)	1.6	0.67	
50–59	66 (16.50)	1.8	0.64	
60–69	71 (17.75)	1.56	0.65	
70–79	64 (16.00)	1.55	0.62	
Dental attendance pattern *‡				
Regular check-up and care	172 (43.43)	1.54	0.56	0.020
Only when having a problem/ Not having dental treatment even when having a problem	224 (56.57)	1.71	0.68	
Negative experience during dental treatment†				<0.001
No	219 (54.75)	1.52§	0.58	
I don't know	45 (11.25)	1.8	0.66	
Yes	132 (33.00)	1.77	0.68	
Subjective oral health*				
Extremely good/ Good	146 (36.5)	1.44	0.56	<0.001
Average/ Bad/ Extremely bad	254 (63.5)	1.75	0.65	
* Mann–Whitney U test † Kruskal–Wallis test, Steel-Dwass test ‡, Excluding "Never had dental treatment (N = 4)" § This group differs significantly from other groups (P = 0.02, P = 0.002).				

3.3. Construct Validity

Gender: Women obtained significantly higher mean SDAQ scores than men (P = 0.018) (Table **3**).

Age: No significant difference in SDAQ scores was observed among the age groups (P = 0.104).

Dental attendance pattern: The SDAQ scores were significantly different among the dental attendance patterns (P = 0.020).

Negative dental experiences: Participants who reported previous negative dental experiences obtained significantly higher mean SDAQ scores than those who did not report or remember previous negative dental experiences (P < 0.001).

Subjective oral health: The SDAQ scores were significantly different among each level of subjective oral health (P < 0.001).

4. DISCUSSION

The Japanese version of the SDAQ demonstrated good criterion validity and construct validity among the Japanese population in the internet survey.

Strong significant correlations were observed between the SDAQ score and the MDAS in the total score and the single item, namely, "Visiting a dental clinic tomorrow" and "Sitting in the waiting room." Conversely, the SDAQ score correlated with "having teeth drilled," "having teeth scaled," and

"receiving local anesthetic injections" but a little weaker than the aforementioned items. The original version of the SDAQ has the same tendency [10]. This result suggests that the SDAQ is more likely to capture the anticipatory dental anxiety than the treatment-related anxiety factors found with MDAS [22, 23].

Compared with the original, the Japanese version indicated a slightly lower Kappa coefficient, lower sensitivity, and higher level of specificity using the cutoff score of ≥19 on the MDAS and 3 on the SDAQ [10]. Typically, a highly specific test is unlikely to produce false-positive results [24]; therefore, people can be confidently considered as having high dental anxiety if the Japanese version of the SDAQ yields a positive result (*i.e.*, "very frightening"). Conversely, if the Japanese version of the SDAQ yields a negative result, the result can include false-negative owing to its lower sensitivity than the original version.

The difference between the original and the Japanese versions might be owing to the differences in the sampling method as the Finnish population was from a single patient group and a single city only [10]. However, the difference might also be influenced by Japanese culture, *i.e.*, the midpoint response style that tends to choose not both ends but the center [25]. A previous study reported that Japanese people tend to have a higher rate of midpoint response than American and Canadian people [26]. The MDAS has five items and is evaluated by a 5-point Likert-type scale, whereas the SDAQ is evaluated by a 3-point Likert-type scale and has only one question. The Japanese version of the SDAQ might be influenced more by the midpoint response style than the MDAS.

The Japanese version of the SDAQ also demonstrated high construct validity. In the present study, female patients reported higher levels of dental anxiety than male patients. This result is also consistent with earlier findings of studies conducted using the original version of the SDAQ [10] and the MDAS in Japan [13].

Unexpectedly, there was no significant difference in the level of dental anxiety among age groups in the present study. Several studies conducted across the world have reported that younger individuals had higher levels of dental anxiety [3, 4, 27 - 32]. Alternatively, a study from Turkey reported that MDAS scores increased with age [33]. To our knowledge, there is no study related to dental anxiety using samples of a wide age range in Japan, and therefore, we could not compare our results. However, the difference might be owing to an aging population. In Japan, the population is aging most rapidly globally, and the percentage of the population aged ≥65 years was 28.1% in 2018 [34]. Japanese older age groups might have a high degree of dental anxiety similar to that in young individuals. Therefore, it is necessary to conduct further research using population samples with a wide age range in Japan.

Expectedly, people who have an irregular dental attendance pattern, a negative dental experience, and poor subjective oral health showed a high level of dental anxiety in the present study. The results are consistent with the findings of previous studies [4, 27 - 33, 35]. Thus, the Japanese version

of the SDAQ was considered to have a high level of construct validity.

The results of the present investigation were based on a self-reported internet survey using a wide age range of samples, implying that this study has some potential limitations. First, internet surveys have a possibility of a sampling bias. Those without access or capability to use the internet might have been missed. However, the use of samples matched to the Japanese population structure by age and gender may have slightly reduced the sampling bias. For more accurate assessment of the rate of high dental anxiety in Japan, a large epidemiological survey such as a national health survey is needed. Second, a self-reported questionnaire could result in some incorrect or irresponsible answers owing to which the research company removed the samples that were produced within a too short time and composed of the same answers according to their criteria.

CONCLUSION

The Japanese version of the SDAQ demonstrated good psychometric properties among the Japanese internet monitors. Therefore, this questionnaire can be used to quantify dental anxiety in national general dental surveys or clinical settings in which a multi-item dental anxiety questionnaire cannot be used.

LIST OF ABBREVIATIONS

SDAQ	=	Single Dental Anxiety Question
MDAS	=	Modified Dental Anxiety Scale

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Ethics Committee of Fukuoka Dental College, Japan (No. 480).

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Informed consent was obtained in the form of opt-out on the web-site.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during this study are with the [M.O] and can be provided upon reasonable request.

FUNDING

None.

CONFLICT OF INTEREST

The authors report no conflict of interest.

ACKNOWLEDGEMENTS

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