

## Reliability and validity of the short version of the Dental Anxiety Inventory (S-DAI) in a Japanese population

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**Aim:** The aim of this study was to establish the reliability and validity of the Japanese version of the short version of the Dental Anxiety Inventory (S-DAI).

**Methods:** The Japanese translated versions of the S-DAI and Dental Fear Survey (DFS) were administered to patients and attendants who were visiting a general dental office.

**Results:** One hundred and sixty-seven participants (response rate = 90.3%) filled out two questionnaires assessing dental anxiety (The Japanese S-DAI and DFS). Cronbach's  $\alpha$  for the reliability of the Japanese S-DAI in the present sample was 0.908. In the Japanese S-DAI, factor analysis revealed one factor with an eigenvalue  $>1$ . The Japanese S-DAI correlated with the DFS ( $r=0.812$ ,  $p<0.001$ ).

**Conclusions:** The Japanese version of the S-DAI appears reliable and demonstrates cross-cultural validity. It may be a valuable tool for quantifying dental fear in Japanese populations.

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**Key words:** behavioral science; psychometrics; questionnaire; dental anxiety; S-DAI; Japanese population

### Introduction

A majority of dental patients are known to feel a certain level of anxiety regarding dental treatment. Estimates based on surveys indicate that as many as 3-7% of the population suffer from high levels of dental anxiety, resulting in avoidance of dental procedures<sup>1-4</sup>. Previous studies have suggested that anxiety about dentistry-related objects and situations often leads individuals to avoid seeking treatment for diseased teeth, resulting in deterioration of the oral condition and elevated phobia severity, posing a threat to both mental and general health, as well as quality of life<sup>5-8</sup>. In terms of general health, various studies have suggested associations between oral health and cardiovascular diseases<sup>9,10</sup>, cancer<sup>11,12</sup> and adverse birth outcomes<sup>13</sup>. In terms of mental

health, some investigations have suggested similarities between dental anxiety and post-traumatic stress disorder<sup>14,15</sup>.

Accurate assessment of dental anxiety is thus important. In Japan, the reliability and validity of Japanese versions of dental fear tests for adults have only been published for the Dental Fear Survey (DFS)<sup>16</sup>. The DFS composed with 20 questionnaires has been translated and used in many countries and found to offer good reliability and validity. However, because the DFS includes a large number of questions, the burden on patients is relatively high and a shortened format would be valuable for researching dental fear in dental clinics. While the short version of the Dental Anxiety Inventory (S-DAI) involves 9 short questionnaires, the questionnaires are based on the Dental Anxiety Inventory (DAI) composed with 36 questionnaires, which covers the whole

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range of dental anxiety and takes into account the multi-component nature of dental anxiety<sup>17,18</sup>. One of the main advantages of the measure is that it takes into account different situations and treatments that may trigger dental anxiety, while assessing physical reactions, thoughts and behavioral aspects of dental anxiety experienced by the individual<sup>19</sup>. This instrument has recently been used in many studies into dental fear<sup>8,20-26</sup>. Short-form questionnaires are easier to take for almost all people. The aim of the present study was therefore to assess reliability and validity of the Japanese version of the S-DAI.

## Materials and Methods

### *Participants*

Patients and attendants (age range, 13-80 years) visiting a general dental office in Omura, Japan, were randomly recruited for this study. Participants were excluded if they were unable to communicate their feelings or if they could not understand the aims of the study or did not complete all the requisite parts of the questionnaire. Participants were adequately informed of the aims of the study in an accompanying letter explaining that all answers would remain confidential and that the patient was free to decline to participate in the study by not completing the questionnaire. The experimental protocol was approved by the Human Investigation Committee of the Nagasaki University Graduate School of Biomedical Science and informed consent was obtained from all patients.

### *Assessment measures*

Two psychometric questionnaires, S-DAI and DFS were administered. We choose DFS psychometric questionnaires to test reliability and validity of S-DAI, because the DFS has only been confirmed good reliability and validity<sup>16</sup> to evaluate dental fear tests for adult patients in Japan. Furthermore, the S-DAI has been well recognized and widely used independent from the DAI in recent years<sup>8, 20-26</sup> after testing reliability and validity against DAI.

### *S-DAI*

The S-DAI comprised 9 questions with responses scored from 1-5, giving a total score ranging from 9 (not anxious at all) to 45 (extremely anxious)<sup>17,18</sup>. We translated the S-DAI into Japanese with the permission of the original authors. To establish full congruity between Japanese and English ver-

sions, the Japanese version was then back-translated into English and tested for consistency.

### *DFS*

The DFS is a well-established scale for assessing dental anxiety and fear<sup>27</sup>, and comprises 20 items with responses scored from 1 (not at all) to 5 (very much). The total score ranges from 20 to 100, with a higher score indicating greater fear. The DFS was designed to elucidate three aspects of dental fear: avoidance [items 1, 2 and 8-13]; physiological arousal [item 3-7]; and fears of specific situations [item 14-20] at the dentist.

### *Statistical analysis*

Statistical analyses were performed using SPSS version 20 software (SPSS, IBM Japan, Tokyo, Japan). Mean scores and standard deviations (SD) were computed for each item of the S-DAI and DFS separately. Mann-Whitney's U test was used to compare between men and women. We used two measures of internal consistency (Cronbach's  $\alpha$  and mean inter-item correlation) to estimate the reliability of the S-DAI and DFS. Pearson's correlation coefficients were applied to determine the degree of relationship "between S-DAI total scores on the one hand and DFS total scores, and DFS's originally hypothesized structures avoidance, physiological arousal, and fears of specific situations scores on the other" and "between age on the one hand and S-DAI total scores and DFS total scores on the other". Factor analysis was undertaken to determine whether the items represent one dimension of S-DAI.

## Results

The response rate was 90.3% (167/185). Eighteen participants were eliminated from analysis because one or more items on the questionnaire were left unanswered. Sample summary statistics are shown in Table 1. The 167 respondents, including 104 women (62.3%) and 63 men (37.7%), completed all parts of the questionnaire. Mean patient age was 48.8 years (SD=16.4; range, 13-80 years). No significant difference in age was apparent between women and men [ $p=0.094$ ]. Mean total S-DAI score was 18.5 (SD=8.1; range, 9-45). Mean total S-DAI score was significantly higher [ $p<0.01$ ] for women (mean=19.9, SD=8.3) than for men (mean=16.2, SD=7.3). No significant correlation was identified between S-DAI score and age ( $r=0.030$ ,  $p=0.698$ ).

**Table 1.** Sample summary statistics (n=167)

|             | N   | %    | S-DAI |     | DFS  |      |
|-------------|-----|------|-------|-----|------|------|
|             |     |      | Mean  | SD  | Mean | SD   |
| Gender      |     |      |       |     |      |      |
| Male        | 63  | 37.7 | 16.2  | 7.3 | 29.2 | 9.7  |
| Female      | 104 | 62.3 | 19.9  | 8.3 | 35.8 | 13.3 |
| Age (years) |     |      |       |     |      |      |
| 13-19       | 4   | 2.3  | 14.0  | 3.7 | 29.0 | 8.8  |
| 20-29       | 25  | 15.0 | 16.8  | 6.6 | 31.0 | 12.5 |
| 30-39       | 21  | 12.6 | 19.2  | 8.1 | 34.4 | 12.8 |
| 40-49       | 36  | 21.6 | 20.8  | 8.9 | 37.9 | 14.4 |
| 50-59       | 33  | 19.8 | 17.8  | 8.3 | 30.2 | 10.8 |
| 60-69       | 29  | 17.4 | 18.7  | 8.8 | 33.8 | 13.6 |
| 70 +        | 19  | 11.4 | 18.0  | 6.9 | 31.8 | 7.7  |
| Total       | 167 | 100  | 18.5  | 8.1 | 33.3 | 12.5 |

**Table 2.** Summary statistics for the S-DAI (n=167)

| Item | Description   | Mean | Standard deviation | Factor loading |
|------|---|------|--------------------|----------------|
| 1    | I become nervous when the dentist invites me to sit down in the chair   | 1.99 | 1.21               | 0.73           |
| 2    | When I know the dentist is going to extract a tooth, I am already afraid in the waiting room                                  | 2.63 | 1.43               | 0.75           |
| 3    | When I think of the sound of the drilling machine on my way to the dentist, I would rather go back                            | 2.04 | 1.2                | 0.73           |
| 4    | I want to walk out of the waiting room the moment I think the dentist will not explain what she/he is going to do in my mouth | 2.05 | 1.16               | 0.66           |
| 5    | As soon as the dentist gets the needle ready for the anaesthetic, I shut my eyes tight  | 2.63 | 1.39               | 0.6            |
| 6    | In the waiting room, I sweat or freeze when I think of sitting down in the dentist's chair                                    | 1.72 | 1                  | 0.84           |
| 7    | On my way to the dentist, I get anxious at the thought that she/he will have to drill   | 1.8  | 1.03               | 0.83           |
| 8    | When I am sitting in the dentist's chair not knowing what is going on in my mouth, I break into a cold sweat                  | 1.98 | 1.15               | 0.65           |
| 9    | On my way to the dentist, the idea of being in the chair already makes me nervous   | 1.69 | 0.97               | 0.82           |

Cronbach's  $\alpha$  for the reliability of the S-DAI in the present sample was 0.908 (0.902 for women, 0.912 for men). Mean inter-item correlation coefficient was 0.541 (0.497 for women, 0.555 for men).

For the S-DAI, factor analysis revealed one factor with an eigenvalue greater than 1 (eigenvalue for first factor = 5.362), with the Kaiser-Meyer-Olkin sampling adequacy measure of 0.891. This factor explained 54.7% of the variance in items. The factor loading is shown in Table 2. All factor loading scores showed sufficient values.

Mean total DFS score was 33.3 (SD=12.5; range, 20-86). Mean total DFS score was significantly higher [ $p < 0.001$ ] for women (mean=35.8, SD=13.3) than for men (mean=29.2, SD=9.7). No significant correlation was seen between DFS score and age ( $r = -0.018$ ,  $p = 0.814$ ). Cronbach's  $\alpha$  for the reliability of the DFS was 0.955 (0.954 for women, 0.948 for men).

S-DAI total scores correlated significantly with DFS total scores and DFS's originally hypothesized structure avoidance, physiological arousal, and fears of specific situations ( $r = 0.812$ ,  $p < 0.001$ ;  $r = 0.709$ ,  $p < 0.001$ ;  $r = 0.712$ ,  $p < 0.001$ ; and  $r = 0.792$ ,  $p < 0.001$ , respectively).

## Discussion

The Japanese version of the S-DAI offers good internal consistency (Cronbach's  $\alpha$ , 0.908), higher than that demonstrated by Aartman in evaluating the original version (Cronbach's  $\alpha$ , 0.88)<sup>18</sup>. This was likely because we administered the questionnaire to an essentially general population, whereas the original was intended for patients with a high degree of dental anxiety. Factor analysis of the Japanese version of the S-DAI showed that all items represent one construct, similar to the findings of Aartman in evaluating the original version<sup>18</sup>.

In our study, age did not correlate with S-DAI score. This result resembled other reports in the literature, suggesting that the nature of these unpleasant experiences is more important in predicting dental anxiety than the age at which they are encountered<sup>28</sup>. The present results showed that total S-DAI score was significantly higher for women than for men. Similar results have been seen in other studies<sup>14,15,18,21</sup>. Peretz and Efrad explained these results by noting that women were over-represented in neurotic categories involving anxiety, worry and fear in several cultures<sup>29</sup>. In terms of mean score, dental patients in this study were highly anxious about tooth extraction. Aartman also reported that tooth extraction was considered the most frightening situa-

tion for both the general and the high dental anxiety populations<sup>18</sup>. Compared with the DFS, the Japanese version of the S-DAI showed comparably high internal consistency and high criterion-related validity.

Potential limitations of this study should be considered. First, the understanding of meaning in questionnaires might be influenced by the regional difference including difference in customs, a regional dialect because this study has been completed in one institution. Second, there might be gender difference on the reliability test because we found a lack of participant's gender balance in this study. However, it has been reported that the rate of women's dental examination in dental office was higher than man in Japan<sup>30</sup>. Although we cannot deny a possible gender influence on reliability of evaluation method, we consider that gender difference observed in our study may be reflected a similar pattern of patients distribution in general population.

Further research in a high dental anxiety group is warranted to validate the Japanese version of the S-DAI for comparative purposes with the general population, which could confirm criterion-related validity. However, we have not yet been able to obtain a dental anxiety group for comparison with the general population, because confirmation of the diagnosis of dental anxiety requires strict psychiatric validation.

## Conclusion

The Japanese version of the S-DAI appears reliable and demonstrates cross-cultural validity. This questionnaire may be a valuable tool for quantifying dental fear in Japanese populations.

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