Adapting A Dental Anxiety Measure To Consider Previous Dental Trauma And Provide Higher Quality Care

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Abstract

Background: The aim of this study was to improve upon the Modified Dental Anxiety Scale (MDAS) by developing the empathy-based International-Modified Dental Anxiety Scale (I-MDAS). This measure was produced and utilized to compare the dental experiences and anxiety levels of international patients versus national patients in the United States.

Methods: The I-MDAS is composed of the International scale and the original MDAS scale. Of 465 participants, 41.3% comprised the national population and 58.7% comprised the international population. Information about demographics, past negative dental experiences, and current dental anxiety was collected.

Results: There was no significant difference in dental anxiety levels between the international and national populations. The new measure shows evidence of validity and reliability. There was a significant and positive relationship between the International scale items and the MDAS scale items, indicating the criterion validity of the I-MDAS. In comparison to the MDAS, content validity was also strengthened by expanding the inquired topics in the new measure. The Cronbach's alpha values show that the I-MDAS is reliable for clinical applications. Further, there was a significant difference in I-MDAS scores for women compared to men and nonbinary groups.

Conclusions: The I-MDAS improves upon the MDAS by providing dentists with a tool for encouraging empathy. Dental clinicians across nations can use the I-MDAS to provide more personalized dental care.

Trial registration: Not applicable

Background

Anxiety is defined as an extreme level of stress or worry and physical distress. It will typically lead to impairment, irritability, lower levels of focus, and muscle fatigue [1]. These symptoms are often identified in dental patients; however, the intensity level of anxiety in each patient varies widely. Studying dental anxiety has been a popular focus in psychological research in order to improve the dental patient's experience. Currently, research has identified specific factors that can induce anxiety. These include injections or needles [2], numbing and anesthetics, the possibility of surgery, distrust in dentists due to previous adverse experiences, smoking, poor oral hygiene, the high cost of dental visits, bruxism [3], the perceived lack of control [4], the lack of empathy from dentists to patients, tooth drilling, and the clinical environment.

In comparing patients in Northern Ireland, Finland, and Dubai, results showed a correlation between older age and lower anxiety levels [5]. It has also been found that women have higher dental anxiety levels than men, and the severity of anxiety increases as women age [6]. Oral hygiene is critical for all individuals; thus, it is important to study these anxiety-inducing factors to alleviate the fears of many patients and prevent individuals from avoiding dental visits [7].

While much research has been conducted toward understanding dental anxiety and its various roots, there are limited sources that specifically study immigrant dental anxiety. A study looking at the oral health practices, dental care services, and dental fears of asylum seekers and immigrants coming to Finland found that asylum seekers lacked dental care and suffered from more tooth pain than the immigrant participants [8]. Another study displayed the general use of dentists within the immigrant population of Canada and found that, initially, newer immigrants visit the dentist less often; however, for those who have resided in Canada for 10 or more years, there is a 60% rate of immigrants visiting the dentist [9].

Current studies on dental experiences and anxiety-inducing factors provide an understanding for the critical role of dental anxiety in a variety of specific demographics. Yet, there are no definitive conclusions regarding how it explicitly varies cross-culturally and what can be done to alleviate dental anxiety in ethnically diverse nations, especially the United States. Thus, the United States' demographic diversity provides a prime opportunity to contrast different cultural backgrounds in correlation to dental anxiety.

This study developed a new measure, the International Modified Dental Anxiety Scale (I-MDAS), to compare the dental experiences and anxiety levels of international versus U.S.-born citizens. This is a standard measure that can be implemented throughout dental clinics both in the U.S. and internationally to provide more personalized care, foster positive patient-dentist relationships, and reduce dental anxiety. The I-MDAS is an adapted version of the Modified Dental Anxiety Scale (MDAS), which is utilized as the foundation for this study due to its strong reliability and validity. A variety of previous studies have researched the reliability and validity of the MDAS in accordance with different patient populations.

For Turkish patients, results showed evidence of reliability for the MDAS with a Cronbach's coefficient alpha of .81 [10]. There was also evidence of validity for the MDAS as results showed a statistically significant correlation to Corah's Dental Anxiety Scale. For patients in Nepal, results showed that the MDAS was valid as its scores were significantly and positively correlated to the Visual Analog Scale (VAS) [11]. A Cronbach's coefficient alpha of .78 was found, which was slightly less than other translated versions of the MDAS, including the Japanese version (.88) [12], Spanish (.88) [13], Greek (.9) [14], Arabic (.91) [15], and Italian (.92) [16]. It was about the same as the Indian version (.78) [17]. It also aligned with the MDAS given at a student dental clinic (.89) [18]. Overall, these various translations of the MDAS have collectively produced high Cronbach's coefficient alpha values, which provides evidence for the strength in the MDAS's reliability across a variety of patient populations.

Furthermore, in developing the I-MDAS, this study focused on increasing content validity by introducing inquiries regarding two key anxiety-inducing elements: the lack of empathy and patients' distrust of dentists [4]. For reference, content validity demonstrates that the items of a test represent the conceptual domain which the measure is designed to cover [19]. In developing this new measure to incorporate empathy and increase patients' trust in dentists, two scales were used to compose the I-MDAS: the International scale and the original MDAS scale.

Being empathetic toward patients in healthcare has shown more positive patient and doctor relationships [20]. Empathy toward patients is also linked to greater satisfaction. Empathetic communication skills from health professionals have even been shown to improve patient adherence to treatments and perceptions of health outcomes. Yet, while research has displayed the positive impact of empathy in health settings, findings have also demonstrated that empathy is difficult to maintain over time, and professionals' communication skills often decline over the course of their medical careers [21, 22]. As a result, training interventions have been implemented to help reinstate empathy among healthcare practitioners [23]. However, these training sessions have received mixed results and do not ensure the improvement of patient-doctor relationships [24]. Unlike the empathy training interventions, the I-MDAS measure can be utilized consistently and objectively with each patient to hold dentists accountable for their empathetic communication toward the individuals they treat.

For this study, it was hypothesized that 1) the international population would have higher MDAS scores than the national population, and 2) the International scale and the MDAS would be positively correlated.

Methods

Study Design and Procedure:

For this study, participants were required to be 18 years or older. In order to achieve a comparison between a national and international population, data responses were collected through Qualtrics from dental patients of a participating dental clinic, various online platforms including SurveySwap where the survey was posted both nationally and internationally, and by providing a scannable QR code that was randomly distributed to various neighborhoods and institutions. Participants were required to have the capacity to give consent and be willing to complete the requested surveys and share their thoughts and experiences. All participants who met the inclusion criteria also provided consent. Overall, this study consisted of 465 participants; see Table 1 for the demographic data. This study focused on two subsets of participants: a national population (n = 192) and an international population (n = 273).

Table 1

Demographics of the total study population

Total sample (N = 465)	
Gender (%)	
Men	37.0
Women	61.9
Nonbinary	1.1
Age (%)	
18–24	60.4
25–34	25.6
35–44	5.6
45–54	5.2
55–64	2.6
65–74	0.4
75+	0.2
Ethnicity (%)	
White	68.4
Hispanic or Latinx	6.0
Black or African American	2.4
Native American or American Indian	0.2
Asian American/ Pacific Islander	14.2
Other	8.8
Have received dental care (%)	
Yes	95.1
No	4.9
National or International subpopulation (%)	
National	41.3
International	58.7

Measurements:

This study adapted the Modified Dental Anxiety Scale (MDAS) [25], which is provided to the public, online. The MDAS is composed of five items for which participants respond on a scale from 1 (not anxious) to 5 (extremely anxious). The total score ranges between 5 to 25. Participants who score above 19 have

extreme levels of dental anxiety. The five items measure anxiety in context to having treatment tomorrow, being in the waiting room, having a tooth drilled, having teeth scaled and polished, and having a local anesthetic injection. Importantly, the MDAS was selected because it has very strong reliability and validity across numerous studies, and it requires a minimal amount of time for completion

With the addition of five new empathy-based questions, the MDAS was adapted into the International Modified Dental Anxiety Scale (I-MDAS; Appendix A). The I-MDAS surveys retrospective and internationally comparative dental experiences. Overall, it contains two scales the International scale and the original MDAS scale; together, these comprise the ten items of the I-MDAS. The I-MDAS was created as an empathy-based survey because, while dentists are not expected to be therapists, research has shown that discussing one's challenges and stressors helps to improve their anxiety [26]. Thus, the I-MDAS asks empathy-based items which dentists can utilize to listen, inquire, understand, and connect with the emotions of their patients to help reduce their dental anxiety.

The I-MDAS also has an adapted scoring system according to its two scales (Appendix A). The adaptation was based on the original MDAS scoring methods [5]. The International scale is made up of items one through five. The MDAS scale is made up of items six through ten. Overall, "yes" responses are 1 point, "no" responses are 0 points. Following the scoring of the original MDAS, the possible scores for the I-MDAS are between 7–38. Additionally, the MDAS indicates severe dental anxiety for any score of 19 or above, therefore the I-MDAS score of 28 out of 38 will indicate severe dental anxiety.

Data Analysis

The data collected was analyzed by using the Statistical Package for the Social Sciences (SPSS) Version 28. To compare the anxiety levels of the national population and the international population, an independent sample t-test was used. A bivariate correlation was used to find the Pearson correlation to show the relationship between the original MDAS and the International scale and was utilized to indicate the criterion validity of the measure. Reliability analysis for the MDAS and the overall I-MDAS was completed by using Cronbach's coefficient alpha. Lastly, a One Way Anova test was utilized to compare the I-MDAS scores of the gender categories.

Results

In regard to the first hypothesis, which states that the international population would have a higher MDAS score than the national population, a t-test showed that the mean MDAS score for the national population ($M=12.73$, $SD= 5.13$) was not significantly different from the international population the ($M= 12.76$, $SD= 5.06$); $t(463)=-0.58$, $p=.95$.

To test the second hypothesis, which states that the International scale and the MDAS would be positively correlated, a correlational analysis was used and produced a Pearson coefficient of $r(463)= .60$, $p<.001$. Thus, as Figure 1 depicts, the new items of the I-MDAS have a significant and positive correlation with the items of the original MDAS. This correlation indicates the criterion validity of the I-MDAS.

The Cronbach's coefficient alpha for the I-MDAS in this study was .85 indicating that this new measure is reliable. The Cronbach's alpha coefficient for the MDAS scale alone in this study was .88. Table 2 presents the reliability analysis and item-total statistics, which shows the strength of each item in reference to the Cronbach's coefficient alpha and reliability of the I-MDAS. The deletion of any items has a negligible effect on the Cronbach's coefficient alpha.

Table 2 Results of Item-total statistics for the I-MDAS (N=465)

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1. Have you ever received any form of dental care?	17.43	43.56	.08	.86
2. Have you had any perceived difficult or adverse experiences with previous dental treatments within the country?	18.08	42.77	.16	.86
3. Have you ever had any perceived difficult or adverse experiences with previous dental treatments outside the country?	17.95	42.25	.22	.86
4. How do you feel about attending a current dental visit based on your past negative experience?	16.04	32.59	.74	.82
5. If you were told a story of someone else's difficult dental visit, how would you feel at a dental appointment?	17.64	42.49	.21	.86
6. If you went to your Dentist for TREATMENT TOMORROW, how would you feel?	15.91	30.32	.83	.81
7. If you were sitting in the WAITING ROOM (waiting for treatment), how would you feel?	15.87	31.13	.79	.81
8. If you were about to have a TOOTH DRILLED, how would you feel?	15.04	31.65	.75	.82
9. If you were about to have your TEETH SCALED AND POLISHED, how would you feel?	16.03	32.21	.70	.82
10. If you were about to have a LOCAL ANAESTHETIC INJECTION in your gum, above an upper back tooth, how would you feel?	15.23	32.57	.66	.83

Additionally, it was found that there was a significant difference ($F= 9.65$, $p<.001$, $\eta^2=.04$) between the I-MDAS scores among men ($M= 15.37$, $SD= 6.44$), women ($M=18.29$, $SD= 7.19$) and nonbinary ($M=17.8$, $SD=4.92$), with women producing significantly higher I-MDAS scores on average than men ($p<.001$). These findings are illustrated in Figure 2. However, there was no significant difference in I-MDAS average scores between the nonbinary population in relation to men and women ($p= .99$).

Discussion

The aim of this study was to produce the I-MDAS which illustrates the cross-cultural contrasts of dental anxiety experiences between national patients in the U.S and international patients. Past research has often focused on the specific factors and elements that contribute to dental anxiety in patients of specific nationalities and populations [2–9]. Thus, this study shifted into a new direction of not only providing a deeper understanding of this mental health subject but also developing a new and effective standardized measure that can be effectively utilized in dental offices.

The first hypothesis, stating that the international population would have higher MDAS scores than the national population, was rejected due to the insignificant difference in the means of the MDAS between the national and international populations. Although the hypothesis was rejected, this result still emphasizes the importance of dentists' awareness toward their patients' backgrounds, as dental history from any country may be pivotal to their level of stress during an appointment.

The second hypothesis, stating that the International scale and the MDAS would be positively correlated, was supported as the MDAS and the International scale showed a significant, positive correlation. Thus, the scales' items function together successfully.

Beyond the two hypotheses, the following analyses provided evidence of reliability and validity for the new I-MDAS measure. The I-MDAS increases and strengthens the content validity in which it expands the topics inquired in the original MDAS: it adds new items that question the specific retrospective dental experiences of patients which may impact their present levels of dental anxiety. Additionally, the significant and positive correlation between the MDAS and the International scale supports the criterion validity of this new measure. The I-MDAS is also valuable in that it increased validity, in comparison to the original MDAS, with the addition of new items while there was a negligible impact on the reliability of the original MDAS as shown by the Cronbach's alpha scores. In fact, the MDAS score from this study strongly aligns with the findings of other MDAS reliability studies [10–17]. Overall, the adapted measure itself produced highly reliable scores.

Furthermore, the I-MDAS was developed to provide an answer to the anxiety-inducing factors that are the lack of empathy and distrust in dentists [4]. The International scale items of the I-MDAS, or the first five questions (Appendix A), accomplish this by inquiring retrospective information that opens a safe space for patients to express their concerns and for dentists to connect with them, utilizing such information to reduce their patient's dental anxiety. Over time, this empathetic communication from dentists or hygienists will likely improve patients' attendance to dental appointments and better their perception of the dental clinic setting [19].

Another finding was that the I-MDAS scores were significantly higher for the women participants of this study compared to the men and nonbinary groups. This finding aligns with previous results where women showed higher MDAS scores compared to men [6]. This is critical in demonstrating how the I-MDAS

aligns with the MDAS, not only in its psychometric properties, but also in its evidence for producing accurate anxiety level scores in correlation to gender.

Additionally, this study experienced few limitations. Due to the use of online platforms and a participating dental clinic, a wide variety and a large number of participants were reached; however, these participants did center around the 18–34 years old populations. This study also included a larger number of white, female participants. Thus, for future research, it would be beneficial to branch out to other patient populations which could address older age groups and other ethnicities. This could be completed by physically visiting churches, synagogues, mosques, and other culturally dense centers.

Conclusions

Overall, the findings of this study show that the I-MDAS is a population-inclusive measure that has been successfully validated and is reliable for this subject population. The Cronbach's coefficient alpha values show that the I-MDAS is also reliable for clinical applications. The significant and positive correlation between the International scale and the MDAS scale displayed strong validity for their functionality and the overall I-MDAS measure. Importantly, this new measure provides evidence of criterion validity and also increases content validity with a negligible impact on the reliability of the original MDAS. This showcases the strength of this new measure.

These findings encourage dentists across nations to implement the I-MDAS in dental clinics around the world in order to give dentists a quick, accessible tool to further understand each of their patients. It is a guide for the dentist or dental hygienist to perform case-sensitive, empathetic, and individualized treatments to prevent further trauma and promote trust. Future research will include testing the I-MDAS's reliability and validity with other patient populations, as well as further testing for gender differences in I-MDAS scores. This will also allow for test-retest reliability analysis in reference to the future patient populations.

Declarations

Ethics approval and consent to participate

This research received ethical approval through the Institutional Review Board (IRB) at Pepperdine University (IRB# 20-06-1391). Additionally, all authors are certified for Social and Behavioral Research through the Collaborative Institutional Training Initiative (CITI Program). All participants agreed to informed consent in keeping of their rights to privacy. The consent form was provided prior to participating in the research survey. All methods were carried out in accordance with the ethical guidelines and regulations of the Institutional Review Board.

Consent for publication

Not applicable

Availability of data and materials

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MT and TM conceptualized the study in expanding the MDAS and applying it to compare international and national populations' dental anxiety. MT developed the new International Scale questions. MT and BJ analyzed and interpreted the patient dental anxiety data. MT and BJ analyzed the data to find correlations, validity, and reliability of the new measure. TM supervised and reviewed the final conclusions. MT wrote the manuscript and prepared all figures and tables. All authors read and approved the final manuscript.

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Figures

Figure 1

Positive and significant correlation between MDAS and International scale scores

Figure 2

Comparison of mean I-MDAS scores among gender groups (N=465)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [IMDASOfficial.SupplementalAppendix.docx](#)
- [IMDASrawdata.xlsx](#)