Body Image in Patients with Adolescent Idiopathic Scoliosis

Validation of the Body Image Disturbance Questionnaire-Scoliosis Version

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Background: Appearance concerns in individuals with adolescent idiopathic scoliosis can result in impairment in daily functioning, or body image disturbance. The Body Image Disturbance Questionnaire (BIDQ) is a self-reported, seven-question instrument that measures body image disturbance in general populations; no studies have specifically examined body image disturbance in those with adolescent idiopathic scoliosis. This study aimed to validate a modified version of the BIDQ in a population with adolescent idiopathic scoliosis and to establish discriminant validity by comparing responses of operatively and nonoperatively treated patients with those of normal controls.

Methods: In the first phase, a multicenter study of forty-nine patients (mean age, fourteen years; thirty-seven female) with adolescent idiopathic scoliosis was performed to validate the BIDQ-Scoliosis version (BIDQ-S). Participants completed the BIDQ-S, Scoliosis Research Society (SRS)-22, Children's Depression Index (CDI), and Body Esteem Scale for Adolescents and Adults (BESAA) questionnaires. Descriptive statistics and Pearson correlation coefficients were calculated. In the second phase, ninety-eight patients with adolescent idiopathic scoliosis (mean age, 15.7 years; seventy-five female) matched by age and sex with ninety-eight healthy adolescents were enrolled into a single-center study to evaluate the discriminant validity of the BIDQ-S. Subjects completed the BIDQ-S and a demographic form before treatment. Independent-sample t tests and Pearson correlation coefficients were calculated.

Results: The BIDQ-S was internally consistent (Cronbach alpha = 0.82), and corrected item total correlations ranged from 0.47 to 0.67. The BIDQ-S was significantly correlated with each domain of the SRS-22 and the total score ($r = -0.50$ to -0.72, $p \leq 0.001$), with the CDI ($r = 0.31$, $p = 0.03$), and with the BESAA ($r = 0.60$, $p < 0.001$). BIDQ-S scores differed significantly between patients (1.50) and controls (1.06, $p < 0.005$), establishing discriminant validity.

Conclusions: The BIDQ-S is an internally consistent outcomes instrument that correlated with the SRS-22, CDI, and BESAA outcomes instruments in a scoliosis population. The scores of the patients with scoliosis indicated greater back-related body image disturbance compared with healthy controls. To our knowledge, this user-friendly instrument is the first to examine body image disturbance in adolescent idiopathic scoliosis, and it provides a comprehensive evaluation of how scoliosis-related appearance concerns impact psychosocial and daily functioning.

Level of Evidence: Prognostic Level I. See Instructions for Authors for a complete description of levels of evidence.

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Adolescent idiopathic scoliosis is characterized by a progressive spinal deformity that can cause substantial disability if untreated. It can also cause disfiguring appearance changes that can be difficult to conceal. It negatively impacts psychosocial functioning and may affect adherence to treatment regimens. Low self-esteem, mood disturbances, low self-image, worry over peer relations, suicidal ideation, and alcohol consumption have been reported in patients with this condition[1-6].

Various spinal appearance and self-image outcomes instruments, including the self-image/appearance domain of the Scoliosis Research Society (SRS)-22 questionnaire, the Walter Reed Visual Assessment Scale, and the Spinal Appearance Questionnaire (SAQ), have emerged to assess perceptions of physical appearance and responsiveness to intervention in patients with adolescent idiopathic scoliosis[7-9]. These instruments are not, however, designed to assess how spinal deformity-related appearance concerns affect a patient's thoughts, emotional well-being, and ability to function daily.

There exists a need to assess body image disturbance, or "a persistent report of dissatisfaction, concern, and distress that is related to an aspect of appearance. . . [and] impairment in social relations, social activities, or occupational functioning,"[10] in patients with adolescent idiopathic scoliosis. Such an evaluation is paramount for this patient population because (1) body image is crucial during adolescent development; (2) the condition often results in a visible deformity, with a demonstrated impact on body image; and (3) psychosocial well-being is an integral component of health-related quality of life and total individual health[11-24].

Cash et al. recently validated the use of the Body Image Disturbance Questionnaire (BIDQ), which assesses appearance concerns and related distress and impairment in daily functioning due to these concerns[10]. However, that validation was done in healthy students, and to our knowledge no study to date evaluating this outcome measure in a population with adolescent idiopathic scoliosis has been performed.

The purpose of the present study was to validate a modified version of the BIDQ instrument, the Body Image Disturbance Questionnaire-Scoliosis version (BIDQ-S), in a population with adolescent idiopathic scoliosis. We hypothesized that the BIDQ-S would demonstrate internal consistency and validity in these patients. We also aimed to evaluate its discriminant validity, or ability to differentiate among various degrees of disease severity.

Methods

Study Subjects

Initial Validation Phase

In the initial validation phase, forty-nine consecutive subjects (thirty-seven female) with adolescent idiopathic scoliosis requiring surgery were enrolled at four sites and completed the BIDQ-S and other questionnaires. Patients with previous scoliosis surgery were excluded. The study was approved by the institutional review board at each site.

Nineteen (39%) of the subjects had previously undergone brace treatment. The mean age of the subjects was fourteen years (range, eleven to twenty years). The mean curve magnitude at the time of surgery was 53.5° (range, 40° to 82°) (see Appendix).

Discriminant Validity Phase

The second, cross-sectional, phase of the study utilized prospectively collected data from the site of one of the authors (B.S.L.). Separate institutional review board approval was received for this phase of the study, in which the BIDQ-S was administered to patients with adolescent idiopathic scoliosis and to normal adolescent controls. Demographics including sex, weight, height, household status (single or dual-parent), parental education, estimated annual household income level, and race were collected (see Appendix). Verma et al. reported that these parameters may impact health-related quality-of-life scores in healthy populations[25].

Two primary study groups were compared, the clinical group containing the patients with scoliosis and the control group. The clinical group was further subdivided into the operative subgroup for whom surgery was recommended and the nonoperative subgroup. The clinical group included eighteen patients from the original validation study who had the required demographic data. The nonoperative subgroup consisted of patients whose curves were not in the surgical treatment range (which was a Cobb angle of >40°). A total of 157 patients, sixty-six in the operative subgroup and ninety-one in the nonoperative subgroup, completed the BIDQ-S.

The control group consisted of individuals without an important medical illness or history of scoliosis. BIDQ-S and demographic questionnaires (see Appendix) were distributed to three physical education classes at a Manhattan public high school. The 300 students were asked to complete the anonymous questionnaire only if they had no history of any spinal curvature. In addition, 100 questionnaires were sent to the parents of patients with the request that they be completed by nonscoliotic and otherwise healthy siblings. A total of 217 questionnaires were completed (response rate, 54%).

The initial data collection resulted in two unmatched groups. The clinical group contained 157 patients with adolescent idiopathic scoliosis (mean age, 14.1 years; 83% female), and the control group contained 217 healthy adolescents (mean age, 16.1 years; 52% female). To control for potentially confounding variables, the two groups were matched for age (within one year) and sex. Ninety-eight patients in the clinical group (mean age, 15.7 years; seventy-five female) were matched with ninety-eight patients in the control group (mean age, 15.3 years; seventy-five female) (Table I).

Outcome Measures

Participants in the initial validation phase of the study completed the BIDQ-S, SRS-22, CDI (Children's Depression Index), and BESAA (Body Esteem Scale for Adolescents and Adults) questionnaires. Patients in the subsequent phase completed only the BIDQ-S.

BIDQ and BIDQ-S

The BIDQ is a valid, psychometrically sound, self-reported, seven-item instrument that measures body image disturbance. It assesses (1) concern about body part(s) felt to be unattractive; (2) preoccupation with the concern(s); (3) experiences of emotional distress about appearance; (4) impairment in social, occupational, or other areas of functioning; (5) interference with social life, school, job, or role functioning; (6) avoidance of activities because of appearance; and (7) behavioral avoidance[10,26]. Using a rating scale from 1 to 5 (with 1 = not at all concerned, and 5 = extremely concerned) to measure each of these items and a mean score for the seven items, the BIDQ allows for continuous, quantitative measurement. Higher scores reflect more severe body image disturbance[10].

The BIDQ-S represents a modification of the BIDQ (see Appendix). Whereas the original BIDQ inquires about distress and impairment related to "physical defects," the BIDQ-S modifies these questions by asking that participants keep in mind their "back shape" when answering the questions. The modifications of each BIDQ question are detailed in the Appendix.

Like the BIDQ, the BIDQ-S includes seven items that are scored on a scale of 1 to 5, with 5 being the highest level of body image disturbance. For these questions, which have a subheading of "A," the number that corresponds to each answer choice indicates the score. The BIDQ-S score is derived by averaging the scores of these questions—1A, 2A, 3, 4, 5A, 6A, and 7A. In addition, the BIDQ-S includes qualitative questions inviting free text responses

TABLE I Demographics and BIDQ-S Scores for the Discriminant Validity Testing Phase (Total N = 196)

Parameter	Control Group, N = 98	Clinical Group, N = 98	P Value
BIDQ-S score*†	1.06 ± 0.14	1.50 ± 0.49	<0.005
Female	1.06 ± 0.13	1.53 ± 0.50	<0.005
Male	1.07 ± 0.17	1.41 ± 0.44	<0.005
Age* *(yr)*	15.3 ± 1.61	15.7 ± 1.68	0.338
Sex *(no.)*			1.00
Male	23	23	
Female	75	75	
BMI* *(kg/m^2)*	22.5 ± 3.54	20.5 ± 3.33	<0.005
Race *(%)*			<0.005
White	18.4	44.9	
Black	10.2	11.3	
Hispanic	34.7	5.1	
Asian	4.1	6.1	
Mixed race	12.2	8.2	
Other	2	2	
No answer	18.4	22.4	
Household income range *(%)*			0.06
<$15,000	13.3	5.1	
$15,000-30,000	7.1	6.1	
$30,000-$50,000	6.1	8.2	
$50,000-$75,000	6.1	13.3	
$75,000-$125,000	13.3	15.3	
$125,000-$200,000	3.1	10.2	
>$200,000	6.1	10.2	
No answer	44.9	31.6	
Maternal education level‡ *(%)*			0.30
High school	22.4	21.4	
Technical	6.1	4.1	
Bachelors	14.3	15.3	
Masters	10.2	17.3	
Doctorate	0.0	3.1	
No answer	46.9	38.8	
Paternal education level‡ *(%)*			0.13
High school	22.4	15.3	
Technical	3.1	6.1	
Bachelors	8.2	19.4	
Masters	10.2	9.2	
Doctorate	1.0	3.1	
No answer	55.1	46.9	
Household status *(%)*			0.02
Single parent	31.6	15.3	
Dual parent	40.8	56.1	
No answer	27.6	28.6	

*The values are given as the mean and the standard deviation. †There was no significant difference according to sex in either group (p = 0.284).
‡High school = high school degree or equivalent, technical = technical school/vocational degree, and doctorate = MD, JD, or PhD.

TABLE II Questionnaire Scores for the Initial Validation Phase (N = 49)

	Mean	95% CI*	Std. Dev.	Range
BIDQ-S	1.67	1.5-1.8	0.51	1.00-3.14
SRS-22				
Overall mean	4.03	3.9-4.2	0.47	3.17-4.83
Activity	4.18	4.0-4.3	0.48	3.00-4.80
Pain	4.26	4.0-4.5	0.73	2.20-5.00
Image	3.61	3.4-3.8	0.62	2.17-5.00
Mental	4.09	3.9-4.3	0.66	2.20-5.00
CDI				
Total	5.18	3.5-6.8	4.82	0-18
Negative mood	1.35	0.8-1.7	1.51	0-6
Interpersonal difficulties	0.33	0.2-0.5	0.55	0-2
Negative self-esteem	0.86	0.4-1.4	1.37	0-6
Ineffectiveness	1.98	1.2-2.6	1.98	0-8
Anhedonia	0.67	0.4-1.1	1.01	0-4
BESAA				
Overall mean	2.88	2.41-3.42	0.26	2.79-2.97
Appearance	2.8	2.7-3.0	0.39	2.00-4.00
Weight	2.9	2.8-3.1	0.43	1.75-3.75
Attribution	3.2	3.0-3.4	0.71	1.60-4.75

*CI = confidence interval.

so that specific concerns and their impact on daily functioning can be assessed (see Appendix).

SRS-22

The SRS-22 is the most commonly utilized health-related quality-of-life measure for adolescent idiopathic scoliosis, and the BIDQ-S results were compared with those of the SRS-22 to assess convergent validity and the relationship between health-related quality of life and body image disturbance.

BESAA

The BESAA is a twenty-three-item self-reported questionnaire to assess overall body image. It contains three subdomains that assess (1) general feelings about appearance, (2) satisfaction with body weight, and (3) evaluations attributed to others regarding one's body and appearance. Respondents are asked to indicate the extent to which they agree with each statement (e.g., "I like what I look like in pictures") with use of a 5-point Likert scale (1 = never, 5 = always)[27]. The BESAA measure was used to help evaluate construct validity (the extent to which a measure, in this case the BIDQ-S, reflects the construct of interest) as well as convergent validity (the extent to which two measures assess similar or related constructs)[28].

CDI

The CDI is a twenty-seven-item measure of depressive symptoms in children and adolescents[29]. This measure yields a total score as well as subscores for negative mood, interpersonal problems (e.g., trouble getting along with others, social avoidance, and isolation), ineffectiveness (e.g., negative evaluation of one's abilities and school performance), anhedonia (e.g., inability to experience pleasure, loss of energy, and problems with sleep and appetite), and negative self-esteem (e.g., self-dislike and feeling unloved). The CDI was used to assess convergent validity of the BIDQ-S with a measure of depressive symptoms.

Demographic Questionnaire

The demographic questionnaire used in this study was created on the basis of commonly utilized U.S. Census Bureau demographic categories for household status, family income, educational status, and race/ethnicity (see Appendix).

Radiographic Measurements

The major Cobb angle was measured on standing radiographs, and the trunk rotation angle was evaluated with use of a scoliometer during physical examination[30]. In both cases, the largest value measured in the patient at any time point was used in the analysis.

Statistical Analysis

Initial Validation Phase

In the initial phase, the internal consistency of the BIDQ-S was assessed with use of the Cronbach alpha value. The convergent validity of the BIDQ-S was assessed by comparing its results with those of the already validated measures with use of the Pearson correlation coefficient. A p value of ≤ 0.05 was considered significant.

Discriminant Validity Phase

Differences in demographic characteristics between the two primary study groups in the second phase were analyzed with use of independent-sample t tests for continuous variables and chi-square analysis for categorical variables (sex, race, household income range, household status, and parental education). Variations in mean BIDQ-S scores between the control and clinical groups as well as between the nonoperative and operative subgroups were analyzed with use of independent-sample t tests. Bonferroni post hoc tests were performed for all comparisons. Pearson correlation coefficients were calculated to determine variations in BIDQ-S scores with respect to (1) age and body mass index (BMI) in the control and clinical groups, and (2) major Cobb angle and trunk rotation angle in the nonoperative and operative subgroups.

TABLE III Correlations Among Questionnaires

	BIDQ-S		SRS-22	
	R Value	P Value	R Value	P Value
SRS-22				
Total	−0.72	≤0.001		
Activity	−0.53	≤0.001		
Pain	−0.53	≤0.001		
Image	−0.60	≤0.001		
Mental	−0.50	≤0.001		
CDI				
Total	0.31	0.03	−0.59	≤0.001
Negative mood	0.14	0.33	−0.47	≤0.001
Interpersonal difficulties	−0.42	≤0.001	−0.36	0.02
Negative self-esteem	0.13	0.39	−0.26	0.11
Ineffectiveness	0.32	0.02	−0.56	≤0.001
Anhedonia	0.24	0.09	−0.48	≤0.001
BESAA				
Total	0.60	<0.001		
Appearance	−0.13	0.37	0.15	0.35
Weight	−0.60	≤0.001	0.65	≤0.001
Attribution	0.001	0.99	0.19	0.24

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Results

Initial Validation Phase

The mean BIDQ-S score (and standard deviation) in the initial phase of the study was 1.67 ± 0.51 (Table II). Six patients (12%) reported being very or extremely worried about the appearance resulting from their back shape (a score of 4 or 5). Only one patient (2%) reported being very preoccupied with worry over back shape (a score of 4). Two patients (4%) reported severe or disturbing emotions related to their back appearance. Examples of open-ended free text responses are given in the Appendix.

Internal Consistency (Reliability)

The BIDQ-S had a Cronbach alpha value of 0.82, indicating this instrument to be reliable, with good internal consistency. The corrected item total (Pearson product-moment correlation coefficient between a particular item and the total test score excluding that item) ranged from 0.47 to 0.67. Thus, no individual item diminished the overall reliability of the instrument, indicating that no question was inconsistent with its intent.

Construct and Convergent Validity

The BIDQ-S score was significantly correlated with those of the SRS-22, the CDI, and the BESAA. Construct validity was examined by determining the correlation of the BIDQ-S with the SRS-22 image subdomain and with the BESAA general appearance domain.

The BIDQ-S was significantly correlated with each subdomain of the SRS-22 ($p \leq 0.001$), indicating that greater body image disturbance correlated with poorer SRS-22 subdomain and total scores (Table III).

The BIDQ-S was also significantly correlated with the total CDI score and with the interpersonal difficulties and ineffectiveness subdomains ($p = 0.03$, $p \leq 0.001$, and $p = 0.02$, respectively); there was also a trend toward a significant correlation with the anhedonia subdomain ($p = 0.09$). These results suggest that greater body image disturbance was associated with more social difficulties, feelings of ineptitude, and unhappiness.

The BIDQ-S was also significantly correlated with the BESAA weight subdomain ($p \leq 0.001$), suggesting that lower satisfaction with weight was associated with greater body image disturbance. Correlations between the BIDQ-S and the BESAA appearance and attribution subdomains were not significant ($p > 0.05$).

The SRS-22 score demonstrated significant correlations with the total CDI score and subdomains A (negative mood), B (interpersonal difficulties), D (ineffectiveness), and E (anhedonia) ($p \leq 0.02$). The SRS-22 was also correlated with the BESAA weight subdomain ($p \leq 0.001$) but not with the BESAA appearance or attribution subdomains ($p > 0.05$) (Table III).

Discriminant Validity Phase

Descriptive Statistics

Table I summarizes the demographic characteristics of the matched groups. The control group had a slightly higher mean BMI and a greater number of Hispanic patients compared with the clinical group; the clinical group contained more white patients. Mean household income ranges and parental education levels did not differ significantly. The proportion of dual-parent households was higher in the clinical group than in the control group. There were no significant differences in demographic characteristics between the operative and nonoperative subgroups ($p > 0.05$).

Differences in BIDQ-S Scores and Clinical Measurements Between Groups

The clinical group had a significantly higher (poorer) mean BIDQ-S score (1.50) compared with the control group (1.06, $p < 0.001$) (Table I). This result persisted when only female ($p < 0.005$) and only male ($p < 0.005$) subjects were compared between these groups, and no sex differences were noted within the clinical groups ($p = 0.203$; see Appendix). Scores differed significantly ($p < 0.005$) among the operative subgroup (1.57), nonoperative subgroup (1.45), and control group (1.06) (see Appendix). The mean score in the operative subgroup was not significantly higher than that in the nonoperative subgroup ($p = 0.195$). Compared with the nonoperative subgroup, patients in the operative subgroup had larger curves as measured by the major Cobb angle (50.7° compared with 23.2°, $p < 0.005$) and more pronounced trunk rotation angles (12.1° compared with 7.8°, $p < 0.005$) (see Appendix). The two patients with the highest BIDQ-S scores were in the clinical group; one patient

(female, seventeen years old, white, 50° Cobb angle, 14° trunk rotation) scored 3.71, and the other patient (female, sixteen years old, white, 38° Cobb angle, 16° trunk rotation) scored 2.71.

BIDQ-S Scores within Groups (See Appendix)

Correlation analysis revealed no significant effect of age or BMI on the overall mean BIDQ-S score in the control or clinical group subjects and no significant effect of the major Cobb angle or trunk rotation angle on the score in the clinical group. There was no significant effect of race, sex, household status, or parental education on the BIDQ-S score in either group.

Household income level had an impact on scores in the control group ($p = 0.002$) but not in the clinical group ($p = 0.153$). Subjects whose annual household income level was >$200,000 had significantly better mean BIDQ-S scores compared with the three groups whose income ranged from $15,000 to $75,000 ($p \leq 0.027$). However, mean scores were still worse (higher) in the clinical group than in the control group at these income levels.

Discussion

Appearance concerns in patients with adolescent idiopathic scoliosis can lead to psychological distress and impairment in daily functioning, otherwise known as body image disturbance. Body image can be defined as perceptions, thoughts, and feelings about the body and bodily experience or as an internal representation of the individual's own outer appearance[31,32]. As the field of body image study has grown rapidly in recent years, so has our understanding of the potential for body image disturbance, especially in appearance-related medical conditions[26,33-36]. Although numerous validated outcome measures exist to characterize body image and appearance, to our knowledge there are currently no validated outcomes instruments to assess body image disturbance, which is a distinct psychological entity in the adolescent idiopathic scoliosis population[31]. For example, the SRS-22 outcomes instrument includes items such as "Do you feel attractive with your current back condition?" but these questions do not measure mental preoccupation or behavior modification, which represent scoliosis-related body image disturbance. The present study aimed to address this void by creating and validating the BIDQ-S.

The experience of having a substantial spinal deformity can leave adolescents vulnerable to teasing and feelings of self-consciousness that contribute to the development of body image disturbance, which has been associated with depression, low self-esteem, social anxiety, and poor quality of life[16]. Body image disturbance can therefore cause problems with social interactions, such as dating, making friends, and joining a peer group, that are critical developmental milestones.

It is often assumed that the severity of an appearance difference will predict the degree of psychosocial problems. However, the individual's subjective perception of the severity of the disfigurement can be the most predictive of psychosocial distress and impairment in functioning[37]. Thus, body image is a critical construct to assess and understand in relation to adjustment in youth with appearance differences.

Adolescent idiopathic scoliosis is a well-known risk factor for psychological impairment[1]. At the time of diagnosis, approximately 40% of patients experience isolation, denial, distress, and depression[38,39]. Danielsson et al. observed that 49% of patients treated operatively and 34% of patients treated with a brace, compared with 15% of controls, reported limitations of social activities related to their back and self-consciousness about their appearance[40]. Poor body image associated with this condition and with bracing leads to preoccupation with appearance, guardedness, and depression[2,41,42]. Andersen et al. demonstrated that approximately one-half of patients surveyed felt "bothered" being with their friends during brace treatment and reserved in their relations with the opposite sex after treatment[43]. Freidel et al. found that female patients showed a less positive point of view toward life and were more likely to experience depressive moods[44]. Consistent with these findings and others regarding the detrimental psychological impact of adolescent idiopathic scoliosis, the present study revealed that patients with this condition experience body image disturbance[1,2,45-48].

The BIDQ-S is a simple, user-friendly, now-validated, reliable instrument that enables measurement of body image in patients with adolescent idiopathic scoliosis. Our results demonstrate that the BIDQ-S was correlated in the expected direction with established measures of depression, body image, and scoliosis-related quality of life. We therefore conclude that the BIDQ-S has construct validity, in that it measured what it is intended to measure, and it is internally consistent, suggesting acceptable reliability.

This study has several limitations. Although we had expected the BIDQ-S to be correlated with the BESAA subdomains, the only correlation that proved significant was with the weight subdomain, perhaps because of the small sample size. However, the nonsignificant correlation for the general appearance subdomain was in the expected direction. We had also expected the BIDQ-S to correlate better with the CDI and BESAA than with the SRS-22, whereas the opposite was observed. This could be because the SRS, CDI, and BESAA, unlike the BIDQ-S, are all capable of measuring general mental health.

Our results confirmed that the mean BIDQ-S scores discriminated between scoliotic and nonscoliotic subjects. As hypothesized, the BIDQ-S scores for the patients were higher than those for the nonscoliotic subjects, demonstrating greater back deformity-related body image disturbance. However, we did not find a significant correlation between larger major Cobb angles and higher BIDQ-S scores in the clinical group, and we did not find significantly higher BIDQ-S scores in the operative compared with the nonoperative subgroup. Asher et al. found that the SRS-22 self-image domain successfully discriminated between operatively and nonoperatively treated patients[49]. Likewise, Berliner et al. found significantly lower self-image scores in operatively treated patients[50]. However, neither study demonstrated a relationship between body image and intervals of curve magnitude, suggesting the limited discriminative capacity of the SRS-22 with respect to the self-image domain[49]. In the discriminant validity phase of the present study, the mean curve magnitude was 53.5°, with a range of 40° to 82°. Despite the lack of correlation between increasing curve magnitude or

operative status and BIDQ-S scores, the questionnaire still discriminated between affected and unaffected individuals. The study is strengthened by matching for body image disturbance-related variables of age and sex, with few significant demographic differences between groups and no effect of demographic variables on BIDQ-S scores. Lower BMI in the adolescent idiopathic scoliosis population compared with controls, consistent with our findings, has been documented previously[51-54]. Stratification of the control group by income level did reveal intragroup differences in BIDQ-S scores, but the clinical group still had lower scores when the control and clinical groups in a single income level were compared.

In contrast to studies that have shown sex differences with respect to body image disturbance in the general population and in patients with adolescent idiopathic scoliosis[1,25,46,55,56], we found no such differences in BIDQ-S scores, likely because of the small sample of male patients. The next step in the validation process will be to evaluate the responsiveness of the BIDQ-S to change after surgical treatment. Future work should establish the minimum clinically important difference, or the threshold of improvement on the BIDQ-S that is "the smallest improvement considered worthwhile by a patient."[57]

In conclusion, the present study validated the BIDQ-S in a population with adolescent idiopathic scoliosis. It is internally consistent and valid, measuring the relevant indices of body image disturbance and discriminating between patients with scoliosis and normal individuals. The BIDQ-S can also be used to identify patients who are experiencing distress and impairment related to their appearance concerns and who may be at risk for psychosocial problems; such patients can then be referred for further mental health assessment and intervention, and their spinal deformity treatment strategy can be adjusted appropriately.

Appendix

(eA) Tables showing the demographics of the subjects in the two study phases, the BIDQ-S, its derivation, the demographic questionnaire, examples of open text responses, and the correlations between demographic parameters and BIDQ-S scores in each group are available with the online version of this article as a data supplement at jbjs.org. ■

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