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Article

Questionnaire of Physiotherapeutic Specific Exercises of Scoliosis – QPSSE

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Abstract: Study design: Creating and psychometric testing of a new QoL Questionnaire about Physiotherapeutic Specific Exercises of Scoliosis (Questionnaire of Physiotherapeutic Specific Exercises of Scoliosis -QPSSE). **Purpose:** The purpose of this study is to create a reliable and valid questionnaire for patients suffering mild and moderate adolescent idiopathic scoliosis (AIS) who have been treated with Physiotherapeutic Specific Exercises of Scoliosis (PSSE) in order to evaluate their quality of life. **Materials and Methods:** The developed questionnaire was based on a thorough literature review as well as on authors experience. It consists of 53 questions, of which 37 have a positive meaning, 15 have a negative meaning, and one is multiple choice question, additionally there are six "open" questions. Except for the multiple choice question, all other questions are answered on a Likert scale ranging from 1 to 5 scores. 5 represents a positive meaning or very much, whereas 1 stands for a negative meaning or not at all. Questions were developed by the authors who subsequently categorized the 53 questions into the following 8 domains: physical functioning, self-image, Physiotherapeutic Scoliosis-Specific Exercises (PSSEs), psychosocial functioning, cognitive functioning, compliance, motivation and pain. A pilot study was conducted so that we could calculate Cronbach's Alpha based on the outcome. Due to the COVID-19 pandemic, the authors worked through the Zoom online platform to structure the questionnaire. **Results:** Pearson's correlation coefficient was used for all correlations evaluated. P values of less than 0.05 were considered to be significant. Internal consistency was evaluated with Cronbach's alpha. Although there were very few missing values, accounting for 0.78% of the total values of the questionnaire, expectation maximization likelihood algorithm was used to impute data. IBM® SPSS® Statistics Software v.25 was used for the analysis. Cronbach's alpha coefficients for the overall score was 0.84. **Conclusion:** This original QPSSE was found to be a reliable and valid tool for AIS treated conservatively with PSSE and for their clinicians.

Keywords: adolescent idiopathic scoliosis; physiotherapeutic specific exercises; questionnaire; quality of life

1. Introduction

Idiopathic scoliosis (IS) is the most common type of scoliosis in people aged 10-18 years [1,2]. IS, is usually characterized as a 3-D deformity, as it affects the body in all the transverse, sagittal and coronal planes [3,4], but in reality it is a 4-D deformity, as the person having this condition suffers from this during the whole period of life, therefore the fourth dimension is time. It is reported that the incidence of adolescent idiopathic scoliosis (AIS) ranges from 0.93% to 12% [4].

Early diagnosis and regular monitoring of IS is therefore very important for the prevention and control of its progression. The first clinical diagnosis of the presence of scoliosis is made performing the forward bending test, called Adam's test, which examines for a height difference in one of the two hemithoraces i.e. the presence of a hump [5]. The radiological diagnosis of IS is made by measuring the Cobb angle, which according to the SRS must be equal to or greater than 10°, in the frontal plane and the presence of axial rotation in the horizontal plane. Also, distortion is observed in the oblique plane [6,7].

The term "idiopathic" means that the cause for the condition's development is unclear. Published research shows that IS may be associated with many genetic and epigenetic factors [4,8]. Although scoliosis is considered as a harmless condition, evidence suggests that people with scoliosis are more prone to experiencing back and low back pain [9,10]. Scoliosis causes multiple dysfunctions and appears to be a burden on healthcare, particularly when patients require extensive surgical treatment [11,12]. If scoliosis progresses to a form that is not amenable to conservative treatment, then surgical treatment is indicated. Surgical treatment of scoliosis places a significant burden on the healthcare system due to the relatively high cost and risk of complications involved. As the risks associated with mild and moderate scoliosis are not very high, conservative treatment is preferred to surgical treatment in order to stabilise the deformity, improve quality of life and significantly reduce rehabilitation costs.

The application of Physiotherapeutic Specific Exercises for Scoliosis (PSEE) alone or with bracing currently is one of the therapeutic modules for mild and moderate IS. SOSORT uses the term Physiotherapeutic Specific Exercises for Scoliosis (PSSE) for all approved schools and methods. Each method and school incorporate the SOSORT guidelines principles and shares a common goal, that of stabilization, arrest progression of IS and improving the quality of life of patients. The methodology of the PSSE must be based on scientific evidence and adjusted according to the type of the deformity of each patient [13,14]. Another protagonistic and high priority common goal during the implementation of PSSEs, as recommended by SOSORT, is "three-dimensional self-correction" [4,15]. Self-correction can be defined as the best possible trunk alignment that a patient with scoliosis can achieve in the three planes and axes [16].

The existing PSSE schools that have been created are as follows [14,17]:

- Schroth, Germany
- Lyon, France
- SEAS (Scientific Exercise Approach to Scoliosis), Italy
- BSPTS (Barcelona Scoliosis Physical Therapy School), Spain
- Side Shift, UK
- DoboMed, Poland
- FITS (Functional Individual Therapy of Scoliosis), Poland

In Greece, many of the above methods are applied for the rehabilitation of IS. To our knowledge a specific questionnaire for PSSEs was not yet published. In this report a questionnaire is presented which evaluates the quality of life of children and adolescents with diagnosed IS, who are undergoing treatment with one of the above PSSEs methods.

2. Materials and Methods

2.1. The questionnaire

For the development of the PSSEQ (Physiotherapeutic Scoliosis Specific Exercises Questionnaire) we followed the recommended guidelines [18] for designing a questionnaire. It is based on a thorough literature review of the field of scoliosis and Physiotherapeutic Scoliosis Specific Exercises (PSSEs), which are approved by the SOSORT organization [4], as well as on our experience regarding the needs of scoliotic children and adolescent patients in specialized physiotherapeutic centers, in our country. Permission and approval for conducting the research was requested and provided by the ethical committee of the Medical Association of Piraeus. In addition, because participants were minors, consent for using their children's data who participated in the study was provided by their parents.

The total number of the questions was chosen and categorized accordingly to the SOSORT guidelines and scientific articles of IS. The development of questions was carried out by the authors who subsequently divided the questionnaire into the following 8 domains: 1) physical functioning (questions number 1,5, 6, 20, 21, 23, 24, 25, 26, 34, 35, 40), 2) self-image (questions number 2, 47, 49, 50), 3) Physiotherapeutic Scoliosis-Specific Exercises (PSSEs) (questions number 3, 19, 27, 28, 32, 37, 38, 39), 4) psychosocial functioning (questions number 4, 7, 22, 29, 36, 41, 42, 44, 45, 46, 48, 51), 5) cognitive functioning (questions number 11,18, 30, 52,53), 6) compliance (questions number 8, 9, 10, 12, 13, 14, 15, 16), 7) motivation 17, 33) and 8) pain (questions number 31, 43).

The questionnaire consists of 53 questions. There are 37 with positive meaning and 15 with negative meaning and one multiple choice question. Furthermore, 6 open-ended questions were included related to the PSSEs and the questionnaire. In the scored items, a Likert scale of 1 -5 was used. More specifically, responses 1-5 correspond to 5 = Strongly agree and 1 = Strongly disagree. An additional edit was made to the wording of the questions so that they could correspond meaningfully to these responses.

The first sheet of the questionnaire includes questions about: date of data collection, demographic characteristics, first name and surname, father's and mother's names, gender, date of birth, address, contact details, height and weight in kilos to calculate BMI, right or left handedness, date of menarche for females, hair and eye color and type of scoliosis. Data to be filled in by the researcher include Scoliometer angle, Cobb Angle, Risser sign, (Formetric - scoliosis angle), type of treatment (exercise or both exercise and bracing).

A pre-final PSSE questionnaire was developed and pilot study was conducted, which was completed by 16 participants with AIS. We asked the 16 participants to complete this questionnaire so that we could calculate Cronbach's Alpha based on the results in their responses. The total sample responses to the questions were entered in SPSS and for each domain, the minimum and maximum effect (floor & ceiling effect), defined as the percentage of participants showing the minimum and maximum possible scores, respectively, were calculated. Results at the minimum and maximum effect exceeding 15% which were considered statistically significant. The floor effect was 53/265 and the ceiling effect was 265/265, respectively. Cronbach's Alpha was calculated >0.7 , which is considered a strong correlation-standard deviation result between responses. Internal consistency of the questionnaire was evaluated by calculating the Cronbach's Alpha. The initial number of questions was 64, thus, 11 were excluded from the study or combined with the existing just to because more specific and easier for the objects to understand them. Thus the final PSSE questionnaire consists of 53 questions, and 6 "open" questions, see Appendix. The original questionnaire for PSSEs was developed in Greek language and were coined QPSSE.

2.2. Study Population

The inclusion criteria for participating in this study are the following: 1) Patients should be from 10 to 18 years old, 2) Patients should have been diagnosed with mild or moderate AIS, 3) Patients should be able to speak and read in Greek and 4) Patients should be undergoing or have undergone in the past Physiotherapeutic Scoliosis Specific Exercises (PSSE) for a period of at least 2 months.

The exclusion criteria were mental health problems, low level of communication, congenital, neurological or other type of scoliosis, and/or having had surgery for scoliosis.

2.3. Psychometric evaluation

The PSSE questionnaire was evaluated for the following psychometrics: reliability, validity, floor and ceiling effects. Reliability was assessed by analyzing internal consistency and test-retest reliability. Internal consistency was determined by the Cronbach's Alpha. Intraclass Correlation Coefficient (ICC) was calculated to measure the test-retest reliability. The patients completed the questionnaire twice at an interval of 4-7 days for measuring of test-retest reliability. Convergent validity was compared against the critical value of Pearson's correlation. Divergent validity was evaluated by analyzing the answers of the patients of the PSSEQ and their characteristics (e.g. Risser sign, Formetric, Cobb angle, gender etc.) using Pearson's or Spearman correlation coefficient. The IBM SPSS software was used for the statistical analysis.

2.4. Materials

2.4.1. Scoliometer measurement (ATR)

Using a scoliometer the angle of trunk rotation (ATR) was assessed [15].

2.4.2. Formetric 4D-DIERS

The Formetric 4D DIERS is a scanning system with a light projector which scans the back of the patient. This system is connected with a computer that analyzes the data and provides information about the posture of the body, the spinal curves (frontal, lateral), pelvic position, vertebral rotation and muscle imbalance [16].

2.4.3. BMI

Body mass index (BMI) is a method that calculates body fat according to height and weight in females or males. A normal BMI range is between 18,5 to 24,9 [19].

2.4.4. Cobb angle

The Cobb angle measurement is used for calculating of spine curvatures in frontal plane. A radiograph is necessary in order for the Cobb angle to be measured. This method is used so as to determine the upper/lower end vertebrae (UEV/LEV) on the radiograph, then, a vertical line respectively at the upper/lower end vertebra endplate lines is necessary (UEVEL/LEVEL), and the included angle of the two vertical lines is the Cobb angle [20].

2.4.5. Risser sign

Risser sign is used by clinicians in order to assess the skeletal maturity of a human. Risser sign is determined by the iliac apophysis from radiographs and is classified in 6 stages (0-5 Risser). It is often used for the evaluation of adolescent idiopathic scoliosis and for the selection of their treatment [21].

2.4.6. Demographics

Demographics are characteristics of a population and are often evaluated for statistical analysis. Some of them are age, gender, ethnicity, education, geographic location etc. In this study, age, gender and colour of hair and eyes were used in statistical analysis.

3. Results

Time needed to complete the PSSEQ was about 10-11 minutes.

80 patients were included in the study and 21 tests- retests were completed in a period of 14months.

3.1. Descriptive statistics

Descriptive statistics			
		Mean	Standard Deviation
Age(yrs)		16.5	7.1
BMI (Kg/m ²)		19.89	2.75
Cobb Angle (degrees)		36.1	4.08
Risser sign		4.6	1.6
Age at menarche		12.1	1.1
		Count	Column N %
Menarche	No	12	18.2%
	Yes	54	81.8%
Sex	Male	11	13.8%
	Female	69	86.3%
Brace	No	19	25.0%
	Yes	57	75.0%
Dominant hand	Right	67	88.2%
	Left	9	11.8%
In general how would you describe the state of your physical health?	Not good at all	1	1.3%
	Somewhatgood	1	1.3%
	Moderately good	20	25.0%
	Quite good	41	51.3%
	Very good	17	21.3%
In general how would you rate your appearance?	Not good at all	0	0.0%
	Somewhatgood	2	2.5%
	Moderately good	17	21.3%
	Quite good	39	48.8%
	Very good	22	27.5%
In general how would you describe your experience with PSSE?	Not good at all	0	0.0%
	Somewhatgood	1	1.3%
	Moderately good	11	13.8%
	Quite good	42	52.5%
	Very good	26	32.5%
In general how would you describe your mental health?	Not good at all	0	0.0%
	Somewhatgood	3	3.8%
	Moderately good	11	13.8%
	Quite good	40	50.0%
	Very good	26	32.5%
In general how would you rate your posture during the day?	Not good at all	2	2.5%
	Somewhatgood	5	6.3%
	Moderately good	29	36.3%
	Quite good	36	45.0%
	Very good	8	10.0%
In general how would you rate your endurance?	Not good at all	3	3.8%
	Somewhatgood	6	7.5%
	Moderately good	13	16.3%
	Quite good	26	32.5%
	Very good	32	40.0%

In general how would you describe your relationship with the people close to you?	Not good at all	0	0.0%
	Somewhat good	0	0.0%
	Moderately good	5	6.3%
	Quite good	17	21.3%
	Very good	58	72.5%
This time period I do PSSE alone at home every day	Never	1	1.3%
	Almost never	5	6.3%
	Sometimes	28	35.0%
	Almost constantly	32	40.0%
	Constantly	14	17.5%
This time period I keep a PSSE diary	Never	51	63.8%
	Almost never	10	12.5%
	Sometimes	7	8.8%
	Almost constantly	5	6.3%
	Constantly	7	8.8%
This time period I do PSSE regularly and according to the physiotherapist's instructions	Never	3	3.8%
	Almost never	1	1.3%
	Sometimes	22	27.5%
	Almost constantly	26	32.5%
	Constantly	28	35.0%
This time period among my daily activities is trying to make sure that my body weight is better distributed on the right and left site	Never	2	2.5%
	Almost never	6	7.5%
	Sometimes	29	36.3%
	Almost constantly	39	48.8%
	Constantly	4	5.0%
I will do PSSE at home even if I'm tired	Not true at all	6	7.5%
	Somewhat true	16	20.0%
	Almost true	17	21.3%
	True enough	31	38.8%
	Absolutely true	10	12.5%
I will do PSSE at home even if I'm in a bad mood	Not true at all	10	12.5%
	Somewhat true	14	17.5%
	Almost true	19	23.8%
	True enough	22	27.5%
	Absolutely true	15	18.8%
I will do PSSE at home even if I don't have time	Not true at all	12	15.0%
	Somewhat true	26	32.5%
	Almost true	23	28.8%
	True enough	14	17.5%
	Absolutely true	5	6.3%
I will do PSSE at home even if I'm on vacation	Not true at all	27	33.8%
	Somewhat true	19	23.8%
	Almost true	16	20.0%
	True enough	11	13.8%
	Absolutely true	7	8.8%
I will do PSSE at home even if the physiotherapist is not with me	Not true at all	6	7.5%
	Somewhat true	8	10.0%
	Almost true	15	18.8%
	True enough	18	22.5%
	Absolutely true	33	41.3%

Motivation	I try to do the PSSE because if I don't I will feel guilty	4	5.0%
	I try to do PSSE because I don't want to upset some people who are very important to me.	16	20.0%
	PSSE are worth the effort and time I spend because of the positive effects on my body.	37	46.3%
	I do PSSE because I feel great satisfaction when I achieve the goals I set during each treatment.	14	17.5%
	I do PSSE because they really help me feel good about myself and my life.	9	11.3%
The PSSEs are important in treating scoliosis	Not true at all	0	0.0%
	Somewhat true	0	0.0%
	Almost true	6	7.5%
	True enough	29	36.3%
	Absolutely true	45	56.3%
The PSSEs are very useful for me	Not true at all	0	0.0%
	Somewhat true	0	0.0%
	Almost true	13	16.3%
	True enough	33	41.3%
	Absolutely true	34	42.5%
The PSSEs help me because I feel more energetic	Not true at all	10	12.5%
	Somewhat true	10	12.5%
	Almost true	26	32.5%
	True enough	21	26.3%
	Absolutely true	13	16.3%
The PSSEs help me breathing better	Not true at all	10	12.5%
	Somewhat true	12	15.0%
	Almost true	24	30.0%
	True enough	23	28.8%
	Absolutely true	11	13.8%
The PSSEs put me in a difficult position because I waste a lot of my free time	Absolutely true	12	15.0%
	True enough	27	33.8%
	Almost true	12	15.0%
	Somewhat true	16	20.0%
	Not true at all	13	16.3%
The PSSEs help me sleep better	Not true at all	18	22.5%
	Somewhat true	23	28.8%

	Almost true	29	36.3%
	True enough	7	8.8%
	Absolutely true	3	3.8%
The PSSEs help me feel my body stronger and more stabilized	Not true at all	5	6.3%
	Somewhat true	4	5.0%
	Almost true	17	21.3%
	True enough	36	45.0%
	Absolutely true	18	22.5%
The PSSEs are exhausting	Absolutely true	10	12.5%
	True enough	9	11.3%
	Almost true	21	26.3%
	Somewhat true	25	31.3%
	Not true at all	15	18.8%
The PSSEs help me have better endurance	Not true at all	5	6.3%
	Somewhat true	11	13.8%
	Almost true	30	37.5%
	True enough	26	32.5%
	Absolutely true	8	10.0%
The PSSEs are easier when I do them in front of the mirror because I can see if I'm doing them right	Not true at all	0	0.0%
	Somewhat true	1	1.3%
	Almost true	9	11.3%
	True enough	29	36.3%
	Absolutely true	41	51.3%
The PSSEs are very difficult	Absolutely true	10	12.5%
	True enough	9	11.3%
	Almost true	28	35.0%
	Somewhat true	16	20.0%
	Not true at all	17	21.3%
The PSSEs make me feel good about myself	Not true at all	3	3.8%
	Somewhat true	6	7.5%
	Almost true	22	27.5%
	True enough	35	43.8%
	Absolutely true	14	17.5%
The PSSEs help change my body for the better	Not true at all	0	0.0%
	Somewhat true	2	2.5%
	Almost true	7	8.8%
	True enough	29	36.3%
	Absolutely true	42	52.5%
The PSSEs help me feel less pain	Not true at all	13	16.3%
	Somewhat true	19	23.8%
	Almost true	15	18.8%
	True enough	13	16.3%
	Absolutely true	20	25.0%
The time I'm doing PSSEs I see my body becoming more straight	Not true at all	0	0.0%
	Somewhat true	0	0.0%
	Almost true	12	15.0%
	True enough	37	46.3%
	Absolutely true	31	38.8%
The time I'm doing PSSEs I try hard to do every exercise	Not true at all	2	2.5%
	Somewhat true	6	7.5%
	Almost true	16	20.0%
	True enough	31	38.8%
	Absolutely true	25	31.3%
The time I'm doing PSSEs I feel that I can't take a deep and satisfying breath	Absolutely true	19	23.8%
	True enough	22	27.5%
	Almost true	11	13.8%

	Somewhat true	11	13.8%
	Not true at all	17	21.3%
The time I'm doing PSSE my chest feels tight and can't "inflate" as much as it should	Absolutely true	25	31.3%
	True enough	14	17.5%
	Almost true	12	15.0%
	Somewhat true	13	16.3%
	Not true at all	16	20.0%
The time I'm doing PSSE I prefer not to be seen by anyone	Absolutely true	24	30.0%
	True enough	16	20.0%
	Almost true	9	11.3%
	Somewhat true	16	20.0%
	Not true at all	15	18.8%
The time I'm doing PSSE I can straighten my body from a sitting position	Not true at all	0	0.0%
	Somewhat true	6	7.5%
	Almost true	10	12.5%
	True enough	26	32.5%
	Absolutely true	38	47.5%
The time I'm doing PSSE I can straighten my body from a lying position	Not true at all	5	6.3%
	Somewhat true	8	10.0%
	Almost true	9	11.3%
	True enough	34	42.5%
	Absolutely true	24	30.0%
The time I'm doing PSSE I can straighten my body from a standing position	Not true at all	2	2.5%
	Somewhat true	10	12.5%
	Almost true	16	20.0%
	True enough	22	27.5%
	Absolutely true	30	37.5%
How often have you felt being out of breath lately ?	Always	26	32.5%
	Almost always	22	27.5%
	Sometimes	12	15.0%
	Almost never	6	7.5%
	Never	14	17.5%
How often have you lately felt bad about yourself?	Always	15	18.8%
	Almost always	22	27.5%
	Sometimes	26	32.5%
	Almost never	4	5.0%
	Never	13	16.3%
How often have you lately felt sad, down, or angry?	Always	5	6.3%
	Almost always	21	26.3%
	Sometimes	41	51.3%
	Almost never	7	8.8%
	Never	6	7.5%
How often have you lately felt pain in your body?	Always	15	18.8%
	Almost always	20	25.0%
	Sometimes	22	27.5%
	Almost never	14	17.5%
	Never	9	11.3%
How often have you lately felt that you have difficulties in making friends?	Always	25	31.3%
	Almost always	19	23.8%
	Sometimes	12	15.0%
	Almost never	5	6.3%
	Never	19	23.8%

How often have you lately felt uncomfortable when you're around people?	Always	15	18.8%
	Almost always	28	35.0%
	Sometimes	13	16.3%
	Almost never	13	16.3%
	Never	11	13.8%
It is true for me that I find it hard to open up to someone, especially as long as I've been dealing with PSSEs	Strongly agree	25	31.3%
	Agree	21	26.3%
	Neutral	12	15.0%
	Disagree	5	6.3%
	Strongly disagree	17	21.3%
It is true for me that I am not ashamed to do the PSSEs in front of people I consider close to me	Strongly disagree	3	3.8%
	Disagree	8	10.0%
	Neutral	9	11.3%
	Agree	16	20.0%
	Strongly agree	44	55.0%
It is true for me that my physical therapist is very friendly and supportive	Strongly disagree	0	0.0%
	Disagree	1	1.3%
	Neutral	2	2.5%
	Agree	17	21.3%
	Strongly agree	60	75.0%
It is true for me that my body's curve is too obvious to others	Strongly agree	12	15.0%
	Agree	9	11.3%
	Neutral	27	33.8%
	Disagree	20	25.0%
	Strongly disagree	12	15.0%
It is true that when I meet someone I worry about what they think about my appearance	Strongly agree	16	20.0%
	Agree	8	10.0%
	Neutral	27	33.8%
	Disagree	18	22.5%
	Strongly disagree	11	13.8%
It is true for me that it doesn't matter how someone looks like	Strongly disagree	5	6.3%
	Disagree	9	11.3%
	Neutral	12	15.0%
	Agree	32	40.0%
	Strongly agree	22	27.5%
In general how satisfied are you with the knowledge you gained through your experience with PSSE?	Not at all	0	0.0%
	A little	0	0.0%
	Modarately	10	12.5%
	Enough	46	57.5%
	Very much	24	30.0%
In general how satisfied are you with your physical therapist?	Not at all	1	1.3%
	A little	0	0.0%
	Modarately	3	3.8%
	Enough	16	20.0%
	Very much	60	75.0%

3.1. Statistical analysis

Based on Kolmogorov-Smirnov goodness-of-fit test and Shapiro-Wilk test for normality, data sis not follow the normal distribution; therefore, non-parametric tests were used for the statistical analysis. Pearson's correlation coefficient was used for all correlations evaluated. P values of less than 0.05 were considered to be significant. Internal consistency was evaluated by Cronbach's alpha

method. Although there were very few missing values, accounting for 0.78% of the total values of the questionnaire, expectation maximization likelihood algorithm was used to impute data. IBM® SPSS® Statistics Software v.25 was used for the analysis.

3.2. Factor analysis

The results of the content validity analysis demonstrated excellent reliability and content validity for the questionnaire, as summarized in Table 1.

3.3. Internal consistency reliability

Cronbach's alpha coefficients for the overall score was 0.84, exceeding the minimum recommended standard of 0.70 and indicating satisfactory internal consistency.

3.4. Item convergent validity

The criterion for item convergent validity was the correlation coefficient of each item of each domain with the domain scale variable. This value was compared against the critical value of Pearson's r equal to 0.219, taking into account 78 degrees of freedom for each comparison with a $p < 0.05$.

3.5. Item divergent validity

The criterion for item divergent validity was the correlation coefficient of each domain scale variable and the clinical continuous variables (age, BMI, Cobb angle). Except for the pain domain variable that was positively correlated with age, there was no other significant correlation found between the aforementioned variables, indicating the lack of relationship of the 53 measurements of the questionnaire with the clinical data.

3.6. Test-Retest Reliability

Test-retest reliability was assessed using Pearson's correlation coefficient r . 22 subjects were re-evaluated one week after the first interview. The results of the questionnaire were used for 53 discrete bivariate correlations, one for each variable of the questionnaire. The results showed that there was perfect test-retest reliability in terms of achieving r values equal to 1 in all correlations.

3.7. Floor and ceiling effects for the overall score

For the overall score, in the present study, 0 % of patients scored at floor and 0% scored at ceiling. Therefore, there were no floor or ceiling effects for the overall score. Floor and ceiling effects for each domain of the are shown in Table 1 Floor and ceiling effects for each item are shown in Table 2

Table 1. The questionnaire domains and the results of tests of item convergent validity, item consistency reliability and floor and ceiling effects.

Domain	Number of items	Cronbach's alpha	Item convergent validity*	Floor effects	Ceiling effects
Physical functioning	12	0.452	75.0%	0(0%)	0(0%)
Self Image	4	0.16	100.0%	0(0%)	0(0%)
PSSEs	8	0.514	87.5%	0(0%)	0(0%)
Psychosocial Functioning	12	0.75	75.0%	0(0%)	0(0%)
Cognitive functioning	5	0.641	100.0%	0(0%)	0(0%)
Compliance	8	0.822	100.0%	0(0%)	1(1.25%)
Motivation	2	0.156	100.0%	0(0%)	3(3.8%)
Pain	2	0.313	50.0%	4(5%)	2(2.5%)
Total	53	0.836	79.2%	0(0%)	0(0%)

* Percentage of item-scale correlations ≥ 0.219 .

Table 2. Floor and ceiling effects (percentage of respondents with minimum/maximum scale scores) for each item of the questionnaire.

No of Item	Floor effect	Ceiling effect
1	1 (1.3%)	17 (21.3%)
2	0 (0%)	22 (27.5%)
3	0 (0%)	26 (32.5%)
4	0 (0%)	26 (32.5%)
5	2 (2.5%)	8 (10%)
6	3 (3.8%)	32 (40%)
7	0 (0%)	58 (72.5%)
8	1 (1.3%)	14 (17.5%)
9	51 (63.8%)	7 (8.8%)
10	3 (3.8%)	28 (35%)
11	2 (2.5%)	4 (5%)
12	6 (7.5%)	10 (12.5%)
13	10 (12.5%)	15 (18.8%)
14	12 (15%)	5 (6.3%)
15	27 (33.8%)	7 (8.8%)
16	6 (7.5%)	33 (41.3%)
17	4 (5%)	9 (11.3%)
18	0 (0%)	45 (56.3%)
19	0 (0%)	34 (42.5%)
20	10 (12.5%)	13 (16.3%)
21	10 (12.5%)	11 (13.8%)
22	12 (15%)	13 (16.3%)
23	18 (22.5%)	3 (3.8%)
24	5 (6.3%)	18 (22.5%)
25	10 (12.5%)	15 (18.8%)
26	5 (6.3%)	8 (10%)
27	0 (0%)	41 (51.3%)
28	10 (12.5%)	17 (21.3%)
29	3 (3.8%)	14 (17.5%)
30	0 (0%)	42 (52.5%)
31	13 (16.3%)	20 (25%)
32	0 (0%)	31 (38.8%)
33	2 (2.5%)	25 (31.3%)
34	19 (23.8%)	17 (21.3%)
35	25 (31.3%)	16 (20%)
36	24 (30%)	15 (18.8%)
37	0 (0%)	38 (47.5%)
38	5 (6.3%)	24 (30%)
39	2 (2.5%)	30 (37.5%)
40	26 (32.5%)	14 (17.5%)
41	15 (18.8%)	13 (16.3%)
42	5 (6.3%)	6 (7.5%)
43	15 (18.8%)	9 (11.3%)
44	25 (31.3%)	19 (23.8%)
45	15 (18.8%)	11 (13.8%)
46	25 (31.3%)	17 (21.3%)
47	3 (3.8%)	44 (55%)
48	0 (0%)	60 (75%)
49	12 (15%)	12 (15%)

50	16 (20%)	11 (13.8%)
51	5 (6.3%)	22 (27.5%)
52	0 (0%)	24 (30%)
53	1 (1.3%)	60 (75%)

4. Discussion

The aim of this study is to develop a questionnaire that evaluates the quality of life in Greek population with idiopathic scoliosis, who are undergoing Physiotherapeutic Specific Exercises for Scoliosis (PSSE) and the evaluation of its psychometrics. To our knowledge, no questionnaire evaluating patients undergone PSSEs has been developed to date. The QPSSE was created in order to determine how various aspects of conservative treatment, PSSEs, influence patients with AIS. A final 53-item questionnaire was developed with 8 domains. The 8 domains of the final questionnaire were as follows: 1) physical functioning, 2) self-image, 3) Physiotherapeutic scoliosis-specific exercises (PSSEs), 4) psychosocial functioning, 5) cognitive functioning, 6) compliance, 7) motivation and 8) pain.

Previous studies have developed other questionnaires that evaluate similar aspects of patients with AIS after other treatments, either conservative or surgical. One questionnaire that evaluates the quality of life in AIS is the 22 revised questionnaire of SRS (SRS-22R) that evaluates quality of life in AIS, especially after surgery treatment [22]. Another one is the Brace questionnaire (BrQ) that evaluates quality of life in populations with IS treated with brace [23]. Also, Short-Form Health Survey 36 (SF-36) or Short-form Health Survey (SF-12) that evaluate the Health-Related Quality of Life (HRQoL) [24,25] and Spinal appearance questionnaire (SAQ) aim to assess self-image in patients with AIS [26].

SRS-22-R is one of the most frequently used questionnaires in patients with scoliosis and includes 22 items that are divided in five domains: Pain, Self-Image, Function, Mental Health and Satisfaction with Management [27]. QPSSE was divided into eight domains. Some of them were, also, pain, self-image and psychosocial functioning. As it was mentioned before, SRS-22R was mainly intended for patients with AIS treated with surgery. However, to date, no questionnaires have been developed to evaluate the quality of life in AIS patients, so SRS-22R was often used for evaluating general quality of life in these patients regardless of their treatment.

BrQ is a self-administrated questionnaire that evaluates the quality of life in patients with AIS who are treated with brace. There is a 34-item Likert scale that consists of eight domains such as QPSSE: general health perception, physical functioning (physical functioning, also, in QPSSE), emotional functioning (psychosocial functioning in QPSSE), self-esteem and aesthetics (self-image in QPSSE), vitality (motivation QPSSE), school activity, bodily pain (pain in QPSSE) and social functioning (psychosocial functioning in QPSSE) [23].

SF-36 is a 36-item self-reported and one of the most widely used Health Related Quality of Life questionnaire. It is divided into eight sections: 1) vitality or energy (motivation in QPSSE), 2) physical functioning (also in QPSSE), 3) bodily pain (also in QPSSE), 4) general health perceptions, 5) physical role functioning, 6) emotional role functioning, 7) social role functioning (psychosocial functioning in QPSSE), 8) mental health or emotional wellbeing (cognitive functioning in QPSSE). SF-12 is a smaller version of SF-36. These questionnaires have also been used in patients with AIS in order to evaluate their general quality of life [24,25].

The 32-item SAQ is a questionnaire based on Walter Reed Visual Assessment Scale (WRVAS) and it evaluates AIS patients' perception of spinal appearance. After validation, a 20-item SAQ was developed divided into 9 domains, and three textual items about the most distressing aspects of deformity. The items of SAQ are divided into the following domains: General (3 items), Curve (1), Prominence (2), Trunk shift (2), Waist (3), Shoulders (2), Kyphosis (1), Chest (2), Surgical Scar (1) and extra three textual questions as it was mentioned. The SAQ has been widely used and culturally adapted into many languages for the assessment of the appearance in patients with AIS. The original Greek- QPSSE (has) also includes a domain about AIS patients' self-image (4 items) [28,28].

The PSSEQ results showed that there was perfect test-retest reliability in terms of achieving r values equal to 1 in all correlations and an overall score for internal consistency on 0.84, exceeding the minimum recommended standard of 0.70 and indicating satisfactory internal consistency. The Greek version of SRS-22 was shown to have three domains with very satisfactory Cronbach's α (pain 0.85; mental health 0.87; self-image 0.83) and for two domains (function/activity 0.72 and satisfaction 0.67) were good. Intraclass correlation coefficient (ICC) was > 0.70 , demonstrating very satisfactory or excellent test/retest reliability [27]. The initial Greek BrQ was shown to have satisfactory internal consistency with Cronbach's alpha 0,82 [23]. The Greek version of SF-36 was found to have Cronbach's $\alpha > 0.70$ [29]. The original English SAQ had good to excellent reliability (Spearman's rho, 0.57–0.99) and high internal scale consistency (Cronbach's alpha > 0.7) [26].

Divergent validity in QPSSE was found with no other significant correlation between the aforementioned variables, indicating the lack of relationship of the 53 measurements of the questionnaire with the clinical data. Concurrent validity of SRS-22 was evaluated by its correlation with SF-36 domains analyzing Pearson Correlation Coefficients and all correlations were found to be statistically significant [27]. Other cultural adaptations of SAQ evaluated convergent validity by correlating SAQ with appearance domain of SRS-22R and divergent validity by correlating patients' answers in SAQ with their characteristics demonstrating good to excellent results [28,30–33] as in this study of the original Greek QPSSE.

The original Greek version of QPSSE showed similar results with the Greek versions or other studies of SRS-22, BrQ, SF-36 or SF-12 and SAQ. All these questionnaires evaluate the quality of life in AIS patients generally or after a treatment or assess in general Health Related Quality of Life. Our study assessed the intervention after Physiotherapeutic Scoliosis-Specific Exercises, BrQ after bracing and SRS-22 especially after surgery. However, further study of the QPSSE is needed in order to evaluate more psychometric properties, such as convergent validity or responsiveness. These tests would be necessary so as to develop if the PSSQ is responsive to changes. In order to assess convergent validity, it would be essential for other similar questionnaires or tools about the PSSEs and quality of life to be developed. Furthermore, a further study with a greater number of participants would potentially how better results in psychometrics in a questionnaire evaluating the quality of life in Greek population in AIS.

This questionnaire is a significant tool for the clinicians and physical therapists who work using PSSEs for adolescents with IS, in order to evaluate their patients' quality of life and interventions after exercises. This tool will provide clinicians with information about AIS Greek patients so as to improve or change something in their treatment or intervention. It would be essential for this questionnaire to be translated in other languages too, so that other countries could have a tool available for evaluation of quality of life in patients who undergo PSSEs.

Conclusions

In conclusion, the PSSE questionnaire was found to be reliable and valid for clinical use in patients with AIS treated conservatively with PSSEs or both PSSEs and brace for Greek population.

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Abbreviations

AIS = Adolescent Idiopathic Scoliosis; IS idiopathic scoliosis, ATR = Angle of Trunk Rotation; IIS = Infantile Idiopathic Scoliosis; IS = Idiopathic Scoliosis; JIS = Juvenile Idiopathic Scoliosis; PSSEs = Physiotherapeutic Scoliosis-Specific Exercises, TA = Truncal Asymmetry

Appendix A

QUESTIONNAIRE FOR PHYSIOTHERAPEUTIC SPECIFIC SCOLIOSIS EXERCISES (QPSSE)

(ATTENTION: this page is to be completed by the physiotherapist/health promoter and not by the child being examined)

Date of filling in the questionnaire: / /2022

Name:

Surname:

Father's Name:

Sex:

Date of Birth:

Address:

Contact phone number:

Email:

Height in cm:

Weight in kg: BMI:

Left-handed/Right-handed?

For girls: Exact date the menstruation cycle started:

Hair color:

Eye color:

Type of scoliosis:

Standing forward bend test- Scoliometer in degrees- Hump :

scoliometer right: thoracic..... thoracolumbar..... lumbar.....

scoliometer left: thoracic..... thoracolumbar lumbar.....

Seated forward bend test - Scoliometer in degrees- Hump :

scoliometer right: thoracic..... thoracolumbar..... lumbar

scoliometer left: thoracic..... thoracolumbar..... lumbar

Cobb Angle:

Risser Sign :

Formetric: (if there is any please attach it)

Treatment (wearing brace?)

Which method of Physiotherapeutic Specific Scoliosis Exercises is being used:

.....

TEST-VALIDITY:

RETEST:

RESPONSIVENESS

Clinic:

QUESTIONNAIRE FOR PHYSIOTHERAPEUTIC SPECIFIC SCOLIOSIS EXERCISES (PSSE)

Thank you for completing this questionnaire. In doing so please respond to the questions freely and truly for there are no right or wrong answers in the case of Physiotherapeutic Specific Scoliosis Exercises (PSSE).

example	Absolutely true	True enough	Almost true	A little true	Not true at all
1. PSSE are very useful for me		x			

In general		Not good at all	Somewhat good	Moderately good	Quite good	Very good
1.	..how would you describe the state of your physical health?					
2.	..how would you rate your appearance?					
3.	.. how would you describe your experience with PSSE?					
4.	..How would you describe your mental health?					
5.	.. How would you rate your posture during the day?					
6.	..how would you rate your endurance?					
7.	.. how would you describe your relationship with the people close to you?					

This time period		Never	Almost never	Sometimes	Almost constantly	Constantly
8.	.. I do PSSE alone at home every day					
9.	.. I keep a PSSE diary					
10.	.. I do PSSE regularly and according to the physiotherapist's instructions					
11.	.. among my daily activities is trying to make sure that my body weight is better distributed on the right and left site					

I will do PSSE at home even if..		Not true at all	Somewhat true	Almost true	True enough	Absolutely true
12.	.. I'm tired					
13.	.. I'm in a bad mood					
14.	.. don't have time					
15.	.. I'm on vacation					
16.	.. the physiotherapist is not with me					

17. Which one of the following sentences best fits your case? (Choose only one answer and check the corresponding box with x)	
<input type="checkbox"/>	a) I try to do the PSSE because if I don't I will feel guilty
<input type="checkbox"/>	b) I try to do PSSE because I don't want to upset some people who are very important to me.
<input type="checkbox"/>	c) PSSE are worth the effort and time I spend because of the positive effects on my body.

d)	I do PSSE because I feel great satisfaction when I achieve the goals I set during each treatment.
e)	I do PSSE because they really help me feel good about myself and my life.

The PSSEs		Not true at all	Somewhat true	Almost true	True enough	Absolutely true
18.	.. are important in treating scoliosis					
19.	.. are very useful for me					
20.	.. help me because I feel more energetic					
21.	.. help me breathing better					
22.	..they put me in a difficult position because I waste a lot of my free time					
23.	.. help me sleep better					
24.	.. help me feel my body stronger and more stabilized					
25.	.. are exhausting					
26.	.. help me have better endurance					
27.	.. are easier when I do them in front of the mirror because I can see if I'm doing them right					
28.	.. are very difficult					
29.	.. make me feel good about myself					
30.	.. help change my body for the better					
31.	.. help me feel less pain					

the time I'm doing PSSE		Not true at all	Somewhat true	Almost true	True enough	Absolutely true
32.	.. I see my body becoming more straight					
33.	.. I try hard to do every exercise					
34.	.. I feel that I can't take a deep and satisfying breath					
35.	.. my chest feels tight and can't "inflate" as much as it should					
36.	..I prefer not to be seen by anyone					
37.	.. I can straighten my body from a sitting position					
38.	.. I can straighten my body from a lying position					
39.	.. I can straighten my body from a standing position					

How often have you lately felt...		Never	Almost Never-Rarely	Sometimes	Almost Always	Always
40.	.. being out of breath?					
41.	.. bad about yourself?					
42.	.. sad, down, or angry?					
43.	.. pain in your body?					
44.	.. that you have difficulties in making friends?					
45.	.. uncomfortable when you're around people?					

It is true for me that..		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
46.	I find it hard to open up to someone, especially as long as I've been dealing with PSSE					
47.	I am not ashamed to do the PSSE in front of people I consider close to me					
48.	My physical therapist is very friendly and supportive					
49.	My body's curve is too obvious to others					
50.	When I meet someone I worry about what they think about my appearance					
51.	It doesn't matter how someone looks like					

In general		Not at all	A little	Moderately	Enough	Very much
52.	.. how satisfied are you with the knowledge you gained through your experience with PSSE?					
53.	.. how satisfied are you with your physical therapist?					

54. What would you like to have been different in the whole experience you have had so far with PSSE?

55. How would you feel if you been told that you must continue PSSE until you reach adulthood?

56. What changes do you think would improve this questionnaire?

57. Have you felt this questionnaire was tiresome? (Please explain)

58. Would you rather not answer some of the questions? which ones? (Please write down the numbers of the questions)

59. Would you like to comment on anything else?

Thank you very much for your participation!

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