

# Health-Related Quality of Life of Patients with Postural Kyphosis Compared to Spinal Deformities in Adolescence: A Cross-Sectional Study

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## ABSTRACT

**AIM:** To evaluate the quality of life of patients with postural kyphosis (PK) compared with those adolescent idiopathic scoliosis (AIS) and Scheuermann Kyphosis (SK).

**MATERIAL and METHODS:** Health-related quality of life (HRQoL) of adolescents with PK who were admitted to our clinic between January 2020 and June 2022 was compared with that of patients with AIS and SK who were admitted during the same period by using the Scoliosis Research Society-22 (SRS-22) questionnaire. All patients were asked to complete the SRS-22 questionnaire before the radiological evaluation. In the radiological evaluation, the sagittal and coronal deformities of the patients were measured.

**RESULTS:** In total, 126 patients with PK were compared with age and sex-matched AIS patients and 42 SK patients. The mean SRS-22 function score of the PK group was  $4.72 \pm 0.3$  while it was  $4.38 \pm 0.6$  ( $p=0.015$ ) in SK patients and it was  $4.34 \pm 0.6$  ( $p<0.001$ ) in AIS patients. The mean SRS-22 pain scores of PK patients was  $4.18 \pm 0.7$ . The mean pain score was  $3.68 \pm 0.8$  ( $p=0.033$ ) in the SK group and  $3.6 \pm 0.8$  ( $p=0.010$ ) in the AIS group. Adolescents with PK perceived less pain than those with AIS or SK. The scores for the other domains of SRS-22 revealed no differences.

**CONCLUSION:** HRQoL of patients with PK is reduced, similar to that of patients with common structural spine deformities. Recognizing the effects of PK on the HRQoL in adolescents can help physicians to treat these patients.

**KEYWORDS:** Thoracic kyphosis, Hyperkyphosis, Health-related quality of life, Postural, SRS-22

**ABBREVIATIONS:** HRQoL: Health-related quality of life, AIS: Adolescent idiopathic scoliosis, SK: Scheuermann Kyphosis, PK: Postural Kyphosis, SRS-22: Scoliosis Research Society-22 questionnaire

## INTRODUCTION


Spinal balance can be defined as the equality of muscle strength, which opposes the forces acting on the body, especially gravity, and allows us to stand in an upright position. Spinal balance in adolescents can be affected by skeletal growth and maturation of the postural control center

(2). Digital devices that have become more common in our lives now make adolescents prone to kyphotic posture. In addition, online classes and increased smartphone usage during the COVID-19 pandemic have caused more frequent complaints of postural disorders, and physicians now face postural disturbances more often in their daily routine (8,10,19).


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Postural kyphosis (PK) is a poor postural habit in which the patient's back looks abnormally rounded, and this sagittal plane deformity exceeds the physiological limit of over  $40^\circ$  (1,11,12). Increased kyphosis in the thoracic region can cause pain, breathing difficulties, and cosmetic problems (11,12,24). In addition, PK is associated with back pain and a poor cosmetic appearance. Furthermore, health-related quality of life (HRQoL) is lower in patients with kyphosis than in the healthy controls (14,20,24). It has been shown that there is a negative correlation between an increase in the thoracic kyphosis angle and HRQoL scores, although the quality of life of PK patients has not been studied separately (20). Although many adolescents with PK visit spine specialists, HRQoL in PK has rarely been studied.

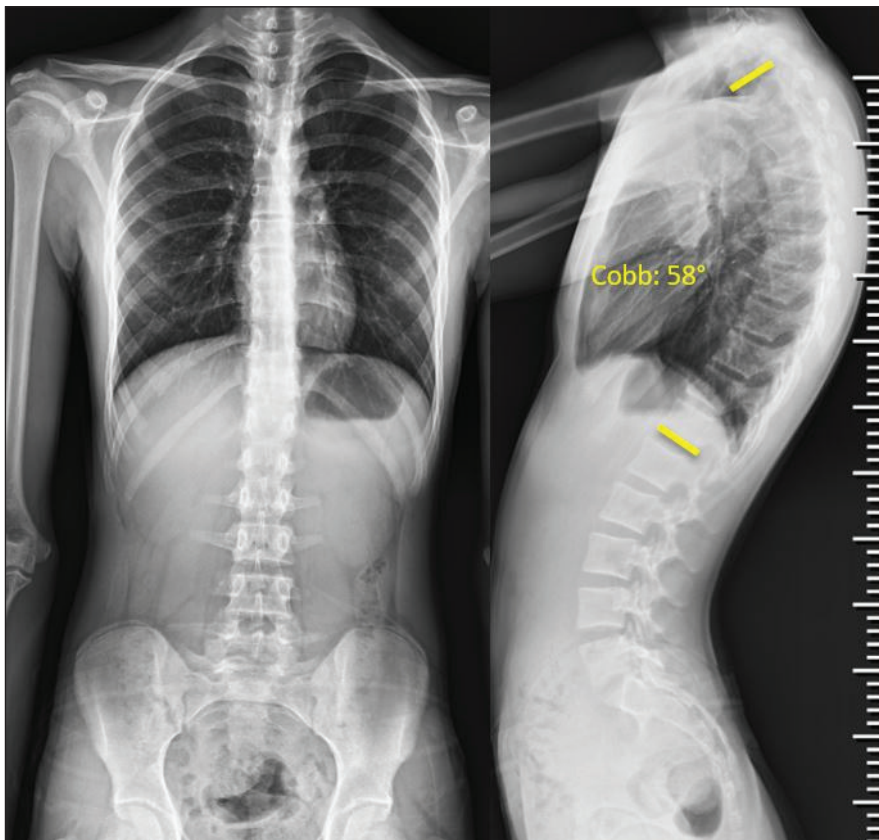
As PK is not usually perceived as a real deformity most of the time, there may be delays and omissions in its diagnosis and treatment. This study aimed to evaluate the HRQoL in PK compared to that in adolescent idiopathic scoliosis (AIS) and Scheuermann kyphosis (SK) patients.

## ■ MATERIAL and METHODS

Our institutional review board reviewed and approved this single-center cross-sectional study (Ethical committee of Gulhane Education and Research Hospital, Health Sciences University, Date: 11.05.2022; No: 2022/57). Adolescent patients with PK who were admitted to our clinic between January 2020 and June 2022 were included in this study (Figure

1). Thoracic hyperkyphosis patients who did not meet the SK diagnostic Sorenson's criteria had a thoracic kyphosis of  $45^\circ$  with three or more adjacent wedged vertebrae angled by at least  $5^\circ$ , disc space narrowing, irregular endplates associated with the single-wedged vertebra, or the presence of Schmorl's nodes in the PK group (21). Patients with congenital, neuromuscular, or other secondary spinal deformities were excluded from the study. Patients with SK and AIS admitted during the same period were selected as separate control groups. All patients were asked to complete the Scoliosis Research Society-22 (SRS-22) questionnaire before the radiological evaluation. The SRS-22 is the most widely used disease-specific questionnaire, and the reliability and validity of the Turkish version have been demonstrated (3). The SRS-22 assesses the self-reported pain, the patient's functional capacity, self-image perception, and mental health. Cervical lordosis, thoracic kyphosis, lumbar lordosis, and coronal deformities were assessed radiologically using the Cobb angle method. The T1-pelvic angles were also measured to evaluate global sagittal balance. As the number of patients with SK was fewer than that of patients with PK, all patients with SK patients were included in the first control group. Age- and sex-matched patients with AIS who had lower than  $40^\circ$  thoracic scoliosis were selected as the second control group.

We used the SPSS software version 25.0 package (Chicago, IL) and expressed categorical variables as percentages and continuous variables as mean  $\pm$  standard deviation (SD) or median (quartiles). We used the Kolmogorov-Smirnov test to



**Figure 1:** Anteroposterior and lateral spinal X-rays of 15-year-old boy with postural kyphosis.

evaluate whether the distribution of continuous variables was normal. For parameters that showed normal distribution, we used the paired sample t-test, and for parameters that did not show normal distribution we used the Mann-Whitney U test. Statistical significance was set at  $p < 0.05$ .

### RESULTS

The PK and AIS groups comprised of 126 patients (66 females and 60 males), while the SK group included 42 patients (16 females and 26 males). The average age was  $15.1 \pm 1.8$  in the PK group and  $15.5 \pm 1.5$  years in the SK group ( $p = 0.580$ ). When cervical lordosis, thoracic kyphosis, and lumbar lordosis were compared, the SK group showed higher Cobb angles than that of the PK group in the sagittal plane. In addition, the SK group had more coronal plane deformities than that of the PK group. T1-pelvic angles were similar between the groups ( $p = 0.328$ ). SRS-22 function and pain scores of the PK group were  $4.72 \pm 0.3$  and  $4.18 \pm 0.7$  respectively while SRS-22 function and pain scores of the SK group were  $4.38 \pm 0.6$  and  $3.68 \pm 0.8$  respectively ( $p = 0.015$  and  $p = 0.033$  respectively). There were no statistically significant differences between self-image, mental health, and SRS-22 total scores (Table I).

When the PK group was compared with the age- and sex-matched AIS group, thoracic kyphosis in the PK group was higher, whereas cervical lordosis and lumbar lordosis were similar ( $p < 0.001$ ,  $p = 0.069$ , and  $p = 0.476$  respectively). The T1-pelvic angles were similar between the groups ( $p = 0.418$ ). The AIS group had  $20.5 \pm 8.3$  thoracic scoliosis and  $4.9 \pm 5.9$  lumbar scoliosis while the PK group had significantly less deformity in the coronal plane ( $p < 0.001$ ). The SRS function score of the AIS group was  $4.34 \pm 0.6$  and the SRS pain score of the AIS group was  $3.75 \pm 0.7$ . These scores were lower than the PK group's function score of  $4.72 \pm 0.3$ , and pain score of  $4.18 \pm 0.7$  ( $p < 0.001$  and  $p = 0.010$  respectively). The other domain scores of the groups were similar (Table I).

### DISCUSSION

Postural disturbances are common in adolescence and are associated with the speed of puberty, slouching, and poor postural habits related to digital device usage (10,12,17). The effect of PK on the quality of life of adolescents can be underestimated compared to that of AIS or SK. Although the HRQoL of patients with AIS and SK compared to healthy adolescents has been widely studied, there has been little interest in the quality of life specifically in patients with postural kyphosis (3,5,7,14,17,20,21,24). The SRS outcome scores were developed to measure the quality of life in AIS and can also be used in SK (5,7,9,18,20,22). In this study, we evaluated the HRQoL of adolescent patients with PK and compared it with those with AIS and SK by using the SRS-22 questionnaire. In most previous studies, adolescents without deformities who were referred for school screenings were included in the control group. In this study, the HRQoL of adolescents with PK was compared with patients with spinal deformities instead of a control group.

Table I: Comparison of Radiological Parameters and SRS-22 Scores of Patients

	Age	Cervical lordosis (°)	Thoracic kyphosis (°)	Lumbar lordosis (°)	T1-pelvic angle (°)	Thoracic Scoliosis (°)	Lumbar scoliosis (°)	SRS Function	SRS Pain	SRS Self-image	SRS Mental health	SRS Total
Postural Kyphosis	$15.1 \pm 1.8$ (12-17)	$14.1 \pm 5.1$ (4-24)	$42.8 \pm 4.27$ (38-52)	$40.4 \pm 6.17$ (28-50)	$10.3 \pm 7.4$ (-7.2-14.6)	$1.7 \pm 2.7$ (0-9)	$1.3 \pm 2$ (0-7)	$4.72 \pm 0.3$ (3.4-5)	$4.18 \pm 0.7$ (2.4-5)	$3.34 \pm 0.6$ (2.2-5)	$3.3 \pm 0.7$ (2.2-5)	$3.84 \pm 0.4$ (2.9-4.7)
Scheuermann Kyphosis	$15.5 \pm 1.5$ (12-17)	$22.7 \pm 7.3$ (8-36)	$65.3 \pm 7.71$ (56-80)	$49.7 \pm 12.3$ (22-68)	$9.8 \pm 7.3$ (-7.8-15.2)	$4.5 \pm 5.5$ (0-21)	$4.2 \pm 4$ (0-12)	$4.38 \pm 0.6$ (2.2-5)	$3.68 \pm 0.8$ (2.2-5)	$3.12 \pm 0.9$ (1.6-4.6)	$3.44 \pm 0.9$ (2.2-5)	$3.66 \pm 0.7$ (2.3-4.8)
Postural kyphosis versus Scheuermann kyphosis												
p	0.580	<0.001	<0.001	<0.001	0.328	0.018	0.001	0.015	0.033	0.342	0.608	0.281
Adolescent Idiopathic Scoliosis												
	$15.1 \pm 1.8$ (12-17)	$15.8 \pm 3.4$	$28.5 \pm 4.8$	$39.6 \pm 3.4$	$10.2 \pm 7.4$ (-7.9-14.4)	$20.5 \pm 8.3$	$4.9 \pm 5.9$	$4.34 \pm 0.6$	$3.75 \pm 0.7$	$3.28 \pm 0.7$	$3.33 \pm 0.7$	$3.66 \pm 0.5$
Postural kyphosis versus Adolescent idiopathic scoliosis												
p	1	0.695	<0.001	0.476	0.418	<0.001	<0.001	<0.001	0.010	0.690	0.861	0.107

Age- and sex-matched groups could not be formed in this study because the incidence of SK was lower than that of PK and AIS (14,16). Petcharaporn et al. investigated the relationship between thoracic hyperkyphosis and the SRS outcome instrument; they found that the magnitude of the kyphosis negatively correlated with SRS scores in all domains (20). They did not compare SK and PK as different deformities and compared all hyperkyphosis cases with a normal control group that had been referred for a scoliosis screening program. In contrast, we compared patients with PK with those with SK and found that the SRS-22 function and pain scores of patients with PK were higher than those of patients with SK. Although both the coronal and sagittal plane deformities in these groups were significantly different, the SRS-22 self-image, mental health, and total scores were similar between these groups. Lonner et al. demonstrated that patients with SK experience more pain and have decreased self-image perception compared to their normal counterparts and that patients with SK had a greater clinical impact on SRS-22 outcomes (10). In addition, the total SRS-22 scores of the patients with SK were worse than those in the control group. The results of the present study demonstrated that patients with PK had similar self-image perceptions as patients with SK and had similar mental health and total SRS-22 scores. These results show that the underestimation of PK as a deformity may affect the HRQoL of adolescents with PK.

Because AIS is the most common spinal deformity in adolescents, age- and sex-matched groups were formed using PK in our study (4,13,15). In addition, we only included patients with AIS and thoracic deformities to make an ideal comparison. Comparison of the SRS-22 scores of the matched PK and AIS groups revealed that patients with PK had better scores in SRS-22 function and pain scores. Although the PK group had a significantly smaller coronal plane deformity, the SRS-22 self-image, mental health, and total scores were similar between these groups. Previous studies demonstrated a relationship between Cobb angle magnitude and SRS-22 scores (5,6,23). In our study, although the coronal plane deformities in patients with PK were smaller than those in patients with AIS, we can associate similar SRS-22 scores with the sagittal plane deformities in patients with PK.

The results of our study revealed that postural kyphosis may negatively affect the HRQoL in adolescents, although to a lesser extent than AIS or SK. According to the SRS-22 results, patients with PK experienced less pain and were more active than patients with SK and AIS, but the scores of the other domains were similar. This indicates that the effect of PK on HRQoL should not be underestimated in adolescents.

Our study had several limitations. First, we did not evaluate the progression of deformities at the time we measured HRQoL which could affect the answers of the patients owing to its cross-sectional design. Second, because this was a single-center study, some sociocultural or socioeconomic differences may have affected the results of our study. In our opinion, because our hospital is easily accessible in the country's capital and serves different socio-cultural groups, this limitation may have only minimally affected our results.

## CONCLUSION

PK is a spinal problem frequently encountered in adolescents. The HRQoL of patients with PK is reduced, similar to that of patients with common structural spinal deformities. Recognizing PK as a serious spinal condition will help physicians to improve the quality of life of these patients.

### AUTHORSHIP CONTRIBUTION

Study conception and design: OE, TE

Data collection: OE, OLK

Analysis and interpretation of results: UY, AMB

Draft manuscript preparation: OE, OLK

Critical revision of the article: OE, TE

Other (study supervision, fundings, materials, etc...): UY, AMB

All authors (OE, UY, OLK, AMB, TE) reviewed the results and approved the final version of the manuscript.

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