



ARE DISTAL FUSION LEVEL AND QUALITY OF LIFE RELATED IN ADOLESCENT SCOLIOSIS?

ADÖLESAN İDİOPATİK SKOLYOZDA DİSTAL FÜZYON SEVİYESİ İLE HAYAT KALİTESİ İLİŞKİLİ MİDİR?

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SUMMARY

The most common treatment method used for adolescent idiopathic scoliosis (AIS) is posterior instrumentation and fusion. Curvature correction does not always coincide with the life quality of the patient. There are several surveys used to evaluate the life quality of scoliosis patients. The most commonly used survey, approved in terms of reliability and validity, is the SRS-22 survey, which is available in Turkish. In this study, the effect of distal fusion levels on life quality was evaluated for patients who received posterior fusion. The patients, who had previously received scoliosis surgery, were requested to complete the Turkish version of the SRS-22 survey when they came for a follow-up appointment between April 2009 and November 2012. Patients with at least two years of follow-up after surgery were included in the study. After completing the survey, the patients were evaluated radiologically for lumbar residual deformation. The patients were grouped by distal fusion level, as L1, L2, L3 or L4.

The distal fusion level was L1 in ten patients, L2 in 17 patients, L3 in 14 patients and L4 in seven patients. The mean patient age was 17.3 ± 2.4 years and the mean follow-up period was 37.2 ± 18.2 months. There were no statistically significant differences between the patients' residual deformations. While the scores for pain were the lowest in the L4 group, the scores for personal appearance were highest. The function-activity score was highest for the L1 group and lowest for the L4 group. No statistically significant differences were detected between the groups in terms of mental health and satisfaction from treatment.

In conclusion, this suggests that there is a relationship between fusion level and life quality, based on the results of the SRS-22 survey.

Key words: Adolescent idiopathic scoliosis, SRS-22, spinal fusion, life quality

Level of evidence: Retrospective clinical study, Level III

ÖZET

Adölesan idiopatik skolyozda en sık kullanılan tedavi yöntemi posterior enstrümantasyon ve füzyondur. Bununla birlikte eğriliğin düzeltilmesi her zaman hastanın hayat kalitesi ile örtüşmemektedir. Skolyoz hastalarında hayat kalitesini değerlendiren pek çok anket mevcuttur. Bunlardan en sık kullanılan geçerliliği ve güvenilirliği kanıtlanmış olan SRS-22 anketinin Türkçe formudur. Bu çalışmada posterior füzyon uygulanmış hastalarda füzyonun distal seviyesinin hayat kalitesine etkisi SRS-22 anketi kullanılarak araştırılmaktadır. Nisan 2009-Kasım 2012 tarihleri arasında daha önce skolyoz ameliyatı uygulanmış hastalardan kontrole gelenlere SRS-22 anketinin Türkçe formunu doldurması istendi. Çalışmaya ameliyatından sonra en az 2 yıl ameliyat sonrası takibi olan hastalar dâhil edildi. Hastalar anketi doldurduktan sonra radyolojik olarak lomber kalıntı deformite değerlendirildi. Distal füzyon seviyelerine göre hastalar L1, L2, L3, L4 olarak dört gruba ayrıldı.

Distal füzyon seviyesi 10 hastada L1, 17 hastada L2, 14 hastada L3 ve 7 hastada L4 idi. ortalama hasta yaşı $17,3 \pm 2,4$ ve ortalama takip süresi $37,2 \pm 18,2$ aydı. Hastaların kalıntı deformiteleri arasında istatistiksel olarak fark yoktu. L4 grubunda ağrı alt başlığındaki skorlar en düşükken, kişisel görünüm alt başlığında skorlar en yüksekti. Fonksiyon-aktivite skorları en yüksek L1 grubundayken en düşük L4 grubunda bulundu. Ruh sağlığı ve tedaviden tatmin skorları arasında gruplar arasında anlamlı fark tespit edilmedi. Sonuç olarak adölesan idiopatik skolyoz hastalarında SRS-22 anketine göre füzyon seviyeleri ile hayat kalitesi arasında bir ilişki olduğu düşünülmüştür.

Anahtar kelimeler: Adölesan idiopatik skolyoz, SRS-22, spinal füzyon, hayat kalitesi

Kant düzeyi: Retrospektif klinik çalışma, Düzey III

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INTRODUCTION

Adolescent idiopathic scoliosis (AIS) is defined as the three-dimensional deformation of the spine, and is seen at a rate of 2–3% in the population. As well as the use of conservative treatment choices such as observation, physiotherapy, and brace treatment, the most effective and frequently used treatment method is posterior instrumentation and fusion^{20,23}. The Cobb angle is decreased and correction of the curvature is provided by posterior fusion. Although this correction results in patient satisfaction most of the time, that only takes into account the correction of the curvature^{7,10,17}. Various surveys have been developed to evaluate the life quality of scoliosis patients, and the survey which is most frequently used and whose validity and reliability have been shown is the SRS-22 survey^{5,9,12,13,19,21,25,26}. This survey has been translated into Turkish and the validity and reliability of the Turkish version have also been shown¹.

The SRS-22 survey has been used in a number of studies to evaluate the treatment success for adolescent idiopathic scoliosis^{2-5,9,10,12,13,19,21,25,26}. In those studies, generally, evaluations before and after surgery for the same patient group are compared^{3,10,21}. The relationship between the distal fusion level and the life quality of the patients who received posterior fusion has not yet been analyzed.

The aim of this study is to evaluate the relationship between life quality and distal lumbar fusion level in patients who received posterior fusion due to AIS, using the SRS-22 survey.

MATERIALS AND METHODS

62 patients, who had previously received posterior instrumentation and fusion due to adolescent idiopathic scoliosis between April 2009 and May 2012, were requested to complete the Turkish version of the SRS-22 survey during their follow up.

48 patients (5 males, 43 females), who had at least two years of postoperative follow-up after surgery and who had no major or minor complications postoperatively, were included in this study. 11 patients with a follow-up period of less than two years, one patient who had a washing debridement surgery for deep infection one month after surgery, and two patients who took intravenous antibiotic treatment for postoperative superficial infections, were excluded from the study.

After completing the survey, the patients' deformations were measured radiologically and their gibbosities were measured clinically using a scoliometer. The patients were grouped into four groups, L1, L2, L3 and L4, according to their distal fusion levels. The distal fusion level was L1 in ten patients, L2 in 17 patients, L3 in 14 patients and L4 in seven patients.

Data were analyzed using the SPSS 15.0 statistical program. The fit of the data to a normal distribution was analyzed with the One Sample Kolmogorov Smirnow compatibility test. A Paired Sample t-test was used for the comparison of variables fitting a normal distribution, and the Mann-Whitney U test was used for comparison of the variables. The Chi-square test was used for the comparison of categorical data.

When the alpha degree of freedom was 0.5 and the confidence interval was 95%, p-values less than 0.05 were accepted as statistically significant.

RESULTS

The mean age of the patients was 17.3 ± 2.4 years and the mean follow-up period was 37.2 ± 18.2 months. The mean Cobb angles were measured as $6.1 \pm 3.4^\circ$ in the thoracic area and $4.5 \pm 2.7^\circ$ in the lumbar area in an AP scoliosis X-ray taken in a standing position on the same day the survey was completed. The mean gibbosity was found to be 3.6 ± 0.6 in the measurements made with a scoliometer. There were no statistically significant differences

between the groups in terms of patient age, gender, thoracic and lumbar residual deformation, mean follow-up period or gibbosity (Table-1).

In the SRS-22 surveys, when the questions in the function-activity subgroup were analyzed, it was detected that the lowest scores were in the L4 group and the highest scores were in the L1 group. The mean score of the L4 group was found to be 4.68 and the mean score of the L1 group was found to be 4.13 ($p=0.0403$ and $p=0.0367$, respectively). There were no differences between the scores of the L2 and L3 groups and the mean score.

On analysis of the mental health and treatment satisfaction subgroups, there were no statistically significant differences between the groups (Table-2).

DISCUSSION

The SRS-22 survey is a survey developed in 2003 to evaluate treatment efficacy, and which is simple, disease-specific, practical, and provides patient-based measurement. The reliability of this survey has been evaluated in different treatment groups^{1,3,4,7}. Although a number of surveys, such as the Bad Sobernheim Stress Survey, Brace Survey, SRS-24, and SRS-30 can be used for the evaluation of scoliosis treatment efficacy, there are no Turkish versions of those surveys that have been tested for validity and reliability^{8,16,24}. In this study, SRS-22 was used, which was translated to Turkish by Alanay et al. in 2005 and has had its validity and reliability tested¹.

On analysis of the personal appearance subgroup, although there were no differences between the patients in terms of the measured Cobb angles and gibbosities when they completed the survey, the score for the L4 group was found to be statistically significantly higher than for the other groups ($p=0.0346$).

In the analysis of pain subgroup, the highest mean score was found to be 4.52 in group L1, and the lowest score was found to be 4.33 in group L4. No statistically significant difference was detected for the pain subgroup.

A statistically significant difference has been detected in various studies for all subgroups, when the life quality of adolescent idiopathic scoliosis patients was evaluated before and after surgical correction^{9,14}. In a study by

Carreon et al., a statistically significant difference was detected in all subgroups when comparing a survey taken at an evaluation conducted one year after surgery and one taken before surgery⁹. A relationship between the amount of curvature correction and life quality was detected in a study conducted by Gorzkowicz et al.¹⁴. Those studies might be considered to be relatively unassertive, as they compare the condition of the same patient at the time of completing the survey and prior to surgery. Bilgiç showed that surgical correction increases life quality using the SRS-22 survey in a study in which groups who either received surgery or did not were compared⁷.

Table-1. Deformations measured when the survey was conducted

	L1	L2	L3	L4	TOTAL
AGE	16.6	18.3	17	16.6	17.3
FOLLOW-UP PERIOD	33	41	35	36	37
GIBBOSITY	3.5	3.7	3.7	3.5	3.6
THORACIC DEFORMATION	6.1	5.9	6.3	6.3	6.1
LUMBAR DEFORMATION	4.7	4.4	4.5	4.6	4.5

Table-2. Distribution of SRS-22 results by group

	L1	L2	L3	L4	TOTAL
PAIN	4.52	4.42	4.48	4.33	4.45 ± 0.46
PERSONAL APPEARANCE	4.13	4.20	4.29	4.40	4.2 ± 0.46
FUNCTION-ACTIVITY	4.68	4.42	4.42	4.13	4.44 ± 0.47
MENTAL HEALTH	3.8	3.9	4.1	3.8	3.96 ± 0.35
SATISFACTION FROM THE TREATMENT	4.6	4.5	4.7	4.6	4.6 ± 0.5

Parent et al. compared patients grouped by observation, brace, and before and after surgery, in a study on adolescent idiopathic scoliosis patients using the SRS-22 survey, and found differences between the scores for pain, personal appearance and treatment satisfaction²¹. In the same study, a relationship was detected between the severity of the curvature and the SRS-22 scores. According to the SRS-22 survey, the lowest scores were detected in the preoperative group and the most significant differences were detected between the pre- and postoperative groups.

One of the key factors in AIS posterior fusion surgery is the choice of the lowest level vertebra to be instrumented. The choice of the vertebra to be included in the fusion is crucial, as this affects lumbar mobility¹⁸. Sanchez-Raya showed a relationship between the lowest level included in fusion and the lumbar mobility²². For this purpose, curvature X-rays, traction X-rays, fulcrum X-rays and the push-prone test are used^{11,15}, so that the patient has greater lumbar mobility after surgery. In the literature, there are no studies evaluating the relationship between the distal fusion level and life quality. In this study, patients were grouped according to their distal fusion levels, and the relationship of the distal fusion level to life quality was assessed.

In the study by Parent et al., the preoperative and postoperative periods were compared using the SRS-22 survey, and it was shown that there were differences in the pain, personal appearance and treatment satisfaction subgroups²¹. In a study conducted more recently that included 286 patients

with different curvatures, Berliner detected that there were differences in the results of the SRS-22 survey, particularly for the pain and personal appearance subgroups⁶. In this study, there was also a difference in the SRS-22 results in terms of personal appearance, and a significant difference in the function-activity scores, contrary to the literature. In the function-activity subgroup, the lowest scores were in the L4 group and the highest scores were in the L1 group, which shows the relationship of this subgroup of the SRS-22 survey to lumbar mobility.

Although, when evaluating the pain subgroup questions of the SRS-22 survey in this study, the highest mean scores were detected in group L1 and the lowest scores were detected in group L4, the difference was not significantly different from the other groups or the general mean.

Although there was no difference between the groups in terms of the gibbosity and residual curvatures in the personal appearance subsection, this was found to be significantly higher for group L4. Even though the deformities at the time of survey completion were similar, because the degree of correction of the size and curvature of patients' deformities were not analyzed, this may be due to better recoveries for the L4 group. The limitations of this study are small patient numbers and the lack of curvature analysis before surgery.

In conclusion, this study analyzes the effect of the distal fusion level on the life quality of patients after surgery for adolescent idiopathic scoliosis, which has not before been evaluated in the literature. With the addition of fewer lumbar vertebrae to the fusion,

the patients function better after surgery but are less happy about their appearance. Although it has been reported in the literature that the SRS-22 survey is more predictive for the pain subgroup of questions, in this study no difference was found between the groups in terms of pain^{12,26}.

REFERENCES

1. Alanay A, Cil A, Berk H, Acaroğlu E, Yazıcı M, Akcalı Ö, Kosay C, Genc Y, Surat A. Reliability And validity of adapted Turkish Version of Scoliosis Research Society-22 (SRS-22) Questionnaire. *Spine* 2005; 30: 2464–2468.
2. Asher M, Min LS, Burton D, Manna B. The Reliability and concurrent validity of the scoliosis Research society-22 patient questionnaire for idiopathic scoliosis. *Spine* 2003; 28: 63–69.
3. Asher MA, Min LS, Burton D, Manna B. Scoliosis Research Society-22 patient questionnaire: responsiveness to change associated with surgical treatment. *Spine* 2003; 28: 70–73.
4. Asher MA, Min LS, Burton DC. Further development and validation of the Scoliosis Research Society (SRS) outcomes instrument. *Spine* 2000; 25: 2381–2386.
5. Beausejour M, Joncas J, Goulet L, Roy-Beaudry M, Parent S, Grimard G, Forcier M, Lauriault S, Labelle H. Reliability and validity of adapted French Canadian version of Scoliosis Research Society Outcomes Questionnaire (SRS-22) in Quebec. *Spine* 2009; 34: 623–628.
6. Berliner JL, Verma K, Lonner BS, Penn PU, Bharucha NJ. Discriminative validity of the Scoliosis Research Society 22 questionnaire among five curve- severity subgroups of adolescents with idiopathic scoliosis. *Spine J* 2013; 13(2): 127-133.
7. Bilgiç S, Erşen Ö, Demiralp M, Şehirlioğlu A, Demiralp B, Oğuz E, Bilekli B. Adölesan idiopatik skolyoz posterior füzyon uygulanmış hastalarda yaşam kalitesi. *J Turkish Spinal Surg* 2011; 22 (3): 179-186.
8. Botens-Helmus C, Klein R, Stephan C. The reliability of the Bad Sobernheim Stress Questionnaire (BSSQbrace) in adolescents with scoliosis during brace treatment. *Scoliosis* 2006; 1: 1-22.
9. Carreon LY, Sanders JO, Diab M, Sucato DJ, Sturm PF, Glassman SD. The minimum clinically Important difference in Scoliosis Research Society-22 appearance, activity, and pain Domains after surgical correction of adolescent. İdiopathic scoliosis. *Spine* 2010; 35: 2079–2083.
10. DéAndrea LP, Betz RR, Lenke LG, Clemets DH, Lowe TG, Merola A, Haheer T, Harms J, Huss GK, Blanke K, mcglathlen S. Do radiographic Parameters correlate with clinical outcomes in Adolescent idiopathic scoliosis? *Spine* 2000; 25: 1795–1802.
11. Erickson MA, Baulesh DM. Lowest instrumented vertebra selection in AIS. *J Pediatr Orthop* 2011; 31(1Suppl): 69-76
12. Feise RJ, Donaldson S, Crowther ER, Menke JM, Wright JG. Construction and validation of The scoliosis quality of life index in adolescent İdiopathic scoliosis. *Spine* 2005; 30: 1310–1315.
13. Glattes RC, Burton DC, Lai SM, Frasier E, Asher MA. The reliability and concurrent validity Of the Scoliosis Research Society-22 patient Questionnaire compared with the Child Health Questionnaire-CF87 patient questionnaire for Adolescent spinal deformity. *Spine* 2007; 32: 1778–1784.
14. Gorzkowicz B, Kołban M, Szych Z. Assessment of quality of life in patients with idiopathic scoliosis treated operatively. *Ortop Traumatol Rehabil* 2009; 11(6): 530-541.

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15. Harfouch BF, Weinstein SL. Intra-operative push prone test: a useful technique to determine the lowest instrumented vertebra in adolescent idiopathic scoliosis. *J Spinal Disord Tech* 2012; DOI: 10.1097/ BSD.0b013e31825c36a9.
 16. Kinel E, Kotwicki T, Podolska A, Białek M, Stryła W. Quality of life and stress level in adolescents with idiopathic scoliosis subjected to conservative treatment. *Stud Health Technol Inform* 2012; 176: 419-422.
 17. Loder RT, Spiegel D, Gutknecht S, Kleist K, Ly T, Mehbod A. The assessment of intraobserver And interobserver error in the measurement of Noncongenital scoliosis in children less than or Equal to 10 years of age. *Spine* 2004; 29: 2548–2553.
 18. Marks M, Newton PO, Petcharaporn M, Bastrom TP, Shah S, Betz R, Lonner B, Miyanji F. Postoperative segmental motion of the unfused spine distal to the fusion in 100 patients with adolescent idiopathic scoliosis. *Spine* 2012; 37(10): 826-832.
 19. Merola AA, Haheer TR, Brkaric M, Panagopoulos G, Mahtur S, Kohani O, Lowe TG, Lenke LG, Wenger DR, Newton PO, Clements DH, Betz RR. A multicenter study of the outcomes of the Surgical treatment of adolescent idiopathic Scoliosis using the Scoliosis Research Society (SRS) outcome instrument. *Spine* 2002; 27: 2046–2051.
 20. National Scoliosis Foundation. *Information and Support*. Available at: <http://www.scoliosis.org/info.php>
 21. Parent EC, Hill D, Mhood J, Moreau M, Raso J, Lou E. Discriminative and predictive validity of the Scoliosis Research Society-22 questionnaire in Management and Curve-Severity Subgroups of Adolescents with Idiopathic Scoliosis. *Spine* 2009; 34: 2450–2457.
 22. Sanchez-Raya J, Bago J, Pellise F, Cuxart A, Villanueva C. Does the lower instrumented vertebra have an effect on lumbar mobility, subjective perception of trunk flexibility, and quality of life in patients with idiopathic scoliosis treated by spinal fusion? *J Spinal Disord Tech* 2012; 25(8): 437-442
 23. Trobisch P, Suess O, Schwab F. Idiopathic scoliosis. *Dtsch Arztebl Int* 2010; 107(49): 875-883.
 24. Vasiliadis E, Grivas TB, Gkoltsiou K. Development and preliminary validation of race Questionnaire (BrQ): a new instrument for measuring quality of life of brace treated scoliotics. *Scoliosis* 2006, 1: 1-7.
 25. White SF, Asher MA, Lai SM, Burton DJ. Patients' perceptions of overall function, pain, And appearance after primary posterior Instrumentation and fusion for idiopathic Scoliosis. *Spine* 1999; 24: 1693– 1699.
 26. Zhao L, Zhang Y, Sun X, Du Q, Shang L. The Scoliosis Research Society-22 questionnaire Adapted for adolescent idiopathic scoliosis Patients in China: reliability and validity analysis. *J Child Orthop* 2007; 1: 351–355.