REVIEW DERLEME

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Classification of Spinal Deformities: Systematic Review (Without Meta-Analysis)

Spinal Deformitelerin Sınıflandırılması: Sistematik Derlemeler (Metaanaliz İçermeyen)

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ABSTRACT Understandably describe historical and current spinal deformity classifications. Spinal deformities can be divided into three main categories: congenital, idiopathic, and secondary spinal deformities. Secondary is by far the largest group. Congenital spinal deformities are generally seen in very early ages and may be accompanied by neural with systemic organ pathologies. Different classification systems are based on clinical and radiological symptoms since the etiology of adolescent spinal deformities is not known. On the other hand, different classification systems are based on clinical and radiological symptoms since the etiology of adolescent spinal deformities is not known. In addition to these two groups, degenerative spinal deformities in elder patients should be also considered. There is scoliosis, kyphosis, degenerative deformity, iatrogenic deformity and post traumatic deformity. Spondylolisthesis can be considered a deformity. King and Lenke are classifications for adolescent idiopathic scoliosis (AIS) and are designed to guide fusion levels for the treatment of AIS. The Lenke classification arose to address 2 issues. One was sagittal deformity and second was that with newer instrumentation techniques there were more treatment options. Schwab and Scoliosis Research Society classifications are classifications of adult spinal deformity. The key addition in these systems is the introduction of lumbar lordosis and pelvic parameters. This includes adult sequelae of AIS but also degenerative deformity.

Keywords: King classification; Lenke classification; Schwab classification; Scoliosis Research Society classification; spinal deformity

ÖZET Tarihsel ve güncel omurga deformite sınıflandırmalarını anlaşılabilir şekilde tanımlamak. Omurga deformiteleri 3 ana kategoriye ayrılabilir; konjenital, idiyopatik ve sekonder spinal deformiteler. Sekonder açık farkla en büyük gruptur. Konjenital spinal deformiteler genellikle çok erken yaşlarda görülür ve nöral ile sistemik organ patolojileri eşlik edebilir. Adölesan spinal deformitelerin etiyolojisi bilinmediği için klinik ve radyolojik semptomlara göre farklı sınıflandırma sistemleri oluşturulmuştur. Öte yandan adölesan spinal deformitelerin etiyolojisi bilinmediği için klinik ve radyolojik semptomlara göre farklı sınıflandırma sistemleri oluşturulmuştur. Bu 2 gruba ek olarak yaşlı hastalarda dejeneratif omurga deformiteleri de düşünülmelidir. King ve Lenke, adölesan idiyopatik skolyoz için yaptıkları sınıflandırmayı, tedavide füzyon seviyelerine rehberlik etmek üzere tasarlanmışlardır. Lenke sınıflandırması sagittal deformiteyi ve daha yeni enstrümantasyon teknikleri ile daha fazla tedavi seçeneğini ele aldı. Schwab ve Skolyoz Araştırma Derneği sınıflandırmaları, erişkin omurga deformitesinin sınıflandırılmasıdır. Bu sistemlere anahtar ekleme lomber lordoz ve pelvik parametrelerin tanıtılmasıdır. Bu, AİS'nin erişkin sekellerini ve aynı zamanda dejeneratif deformiteyi içerir. Skolyoz, kifoz, dejeneratif deformite, iyatrojenik deformite ve travma sonrası deformite vardır. Spondilolistezis bir deformite olarak kabul edilebilir.

Anahtar Kelimeler: King sınıflaması; Lenke sınıflaması; Schwab sınıflaması; Skolyoz Araştırma Derneği sınıflaması; spinal deformite

The classification of spinal deformities has four main objectives:

1. To achieve systemic categorization of diseases,

2. To provide prognosis for natural course and outcomes of care,

3. To identify correlations with health performance or severity of deformity,

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TABLE 1: Etiological classification of spinal deformities.

Idiopatic	Early-onset	Congenital	Vertebra anomalies
	Late-onset		Formation anomalies
	Adult		Hemivertebra
Neuromuscular	Neuropathic disease		Abnormal segmentation
	Upper motor neuron diseases		Unilateral bar
	Spinocerebellar degeneration		Rib fusion
	Cerebral palsy		Spinal dysraphism
	Lower motor neuron disease		Tethered cord syndrome
	Poliomyelitis		Chiari malformation
	Myopathic		Syringomyelia
	Congenital hypotonia		Diastematomyelia
	Duchenne muscular dystrophy		Meningocele-meningomye locele
Developmental syndromes	Skeletal system dysostosis (e.g. neurofibromatosis)	Tumor-related	Osteoblastoma
	Skeletal system dysplasia (e.g. osteogenesis imperfecta)		Osteid osteoma
			Intraspinal-intramedullary tumors
			Extramedullary tumors

4. To serve as a guide for treatment decisions.

When we look at the literature, it is seen that many spinal deformity classifications have been published in the last century. The pioneering study in this field dates to 1905, when Schulthess developed a classification that uses curve patterns as reference.[1] In 1950, Ponseti and Friedmann carried out a more comprehensive study on curve patterns (Table 1).[2]

Spinal deformities can be divided into 2 main categories: congenital spinal deformities and idiopathic spinal deformities. Classification of congenital spinal deformities is made by considering their etiology. On the other hand, different classification systems are based on clinical and radiological symptoms since the etiology of adolescent spinal deformities is not known. In addition to these 2 groups, degenerative spinal deformities in elder patients should be also considered.

DISCUSSION

To qualify as early onset scoliosis (EOS), the Scoliosis Research Society (SRS) states that lateral curvature of the spine must be diagnosed before the age of 10. EOS can be subclassified: congenital, idiopathic infantile and juvenile scoliosis. Apart from these, neuromuscular and syndromic scoliosis occurring before the age of 10 are also evaluated in the EOS category.[3]

Congenital spinal deformities: Congenital scoliosis occurs with disruption of normal vertebral development at the 4th to 6th week of pregnancy. Thus, it is often associated with other disorders, such as thoracic, intraspinal, cardiac and urogenital abnormalities. Approximately 10-15% of patients have congenital heart problems (such as ventricular septal defects, tetralogy of Fallot, or transposition of the great vessels). If large curvature is present, pulmonary function is severely restricted and these patients may develop hypoplastic lung. Congenital spinal deformities such as scoliosis, kyphosis, lordosis, kyphoscoliosis and lordoscoliosis are due to abnormal vertebral development, and the anomaly is present at birth. No reason associated with this situation. It has bad effects on spinal growth (Figure 1).[3,4]

McMaster and Singh were classified into 4 categories:[5]

Type I: spinal formation defects

Type II: spinal segmentation defects

Type III: both formation and segmentation defects

Type IV: unclassified

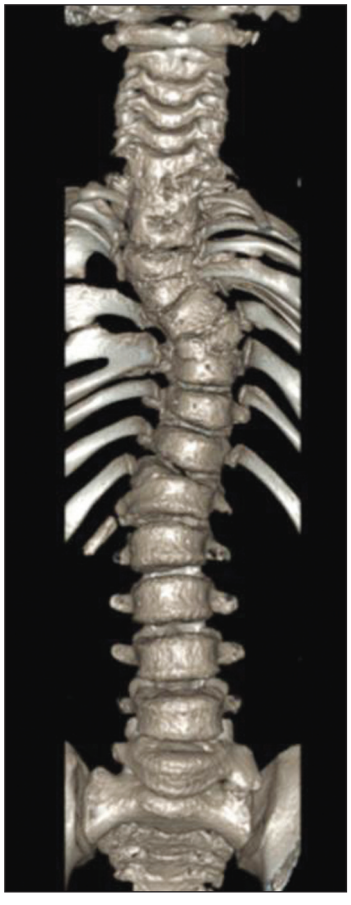


FIGURE 1: Patient with congenital spinal deformity.

Type I. formation defects:

These deformities develop as a result of deficiencies during formation of embryological materials required for normal vertebra development. It can contain many anomalies from spina bifida occulta to multiple hemivertebrae. Formation defects can be completely occult depending on the extent, location, and shape of the defect, or a complex, severe deformity with neurological. The most common type is unsegmented bar. These defects involve a single vertebra unilaterally or involve different regions on multiple segments. The thoracic region is the most common localization for an unsegmented bar and is often associated with clinical problems of lung capacity.[6,7]

- Fully segmented hemivertebra (includes normal disc tissue above and below the hemivertebrae).
- Semisegmented hemivertebra (while there is normal disc tissue on one side, hemivertebra fusion occurs on the other side).
- Unsegmented hemivertebra (the upper and lower distances of the hemivertebrae are fused).
- Incarcerated hemivertebra (found within lateral margins of vertebra above and below).
- Unincarcerated hemivertebra (laterally positioned).
- Wedge vertebra.

Type II. segmentation defects:

- Block vertebra (includes bilateral bony bars).
- Bar body (unilateral unsegmented bar is a common and rapidly progressing condition).

Type III. mixed:

- Unilateral unsegmented bar with contralateral hemivertebra (it is the most rapidly progressive defect type).

Deformities may progress slowly or fast or may even be stable without progression. Statistically, half of the curves show rapid deterioration and need treatment. The anatomical localization and type of the anomaly are among the points that determine the natural course and the risk of worsening of the deformity. Type III-kyphosis/kyphoscoliosis is the most severely progressive type. Type I follows type III. Lumbar or lumbosacral hemivertebrae cause more serious deformity than other localization.[3] The goal of treatment is to allow spinal growth, stop the progression of the deformity, and maintain a stable and balanced spine.[8] Although there are case series about conservative treatment for formation failure in the literature, the indications for conservative treatment are not clear. Many authors recommend surgery before puberty to prevent cor pulmonale in patients with segmentation failures, even without long-term results.[4] Severe kyphosis is observed in 15% of newborns with meningomyelocele in the lumbar and thoracolumbar regions. The degree of the kyphotic curve is usually large initially and increases by from 4° and 12° per year. In meningomyelocele, kyphectomy performed simultaneously with closure of the dural sac is a safe surgery that adds effective correction. Primary wound healing is better than without kyphectomy. Primary surgical wound healing is earlier and better in newborns who have undergone kyphectomy. Even if recurrent deformity occurs, it is better toler-

ated, and revision surgery is easier than in older child.[8]

Idiopathic spinal deformities: Deformities are usually seen during adolescence. This group consists of several subtypes, and the most common types are: infantile, juvenile, adolescent, adult scoliosis.

Congenital anomalies, neuromuscular diseases, neurofibromatosis, connective tissue diseases and skeletal dysplasia can lead to pediatric scoliosis. The idiopathic form is most common and generalized syndromes, congenital or inflammatory causes must be excluded for diagnosis. Idiopathic scoliosis can show familial inheritance and bimodal distribution scoliosis. Adolescent and adult types differ in terms of clinic, radiology, treatment, and prognosis. As a result, it is seen that many different classification types have been developed for adolescent idiopathic scoliosis (AIS).

Classification of AIS: In 1983, King et al. developed a classification system that aims treatment of adolescent thoracic deformity.[9] In 2001, Lenke developed a classification system which, along with the King classification, focusing on AIS.[10] Surgical approach towards patients with AIS was limited during the period when spinal instrumentation was underdeveloped. Thus, classification systems for scoliosis patients have not developed sufficiently. Spinal instrumentation and surgical advances have allowed surgeons to perform corrective surgeries on these patients. Therefore, it has become necessary to organize more detailed classification systems for these pathologies. Schwab system and SRS classification have been added to King and Lenke classifications recently (Figure 2).[11,12]

King Classification: It is the classification developed to determine the thoracic region fusion level in AIS. It is predicted that if the thoracic region fusion segment is defined correctly, lumbar, and sacral pathologies will be corrected. This classification was developed to determine the shortest and most accurate thoracic fusion segment (Table 2a). Thoracolumbar, lumbar double major and triple major curves are not available in this system. The classification did include lumbar (Type I) and double major curves (Type IIa). King was designed for the use of first-generation instrumentation. In addition, this classification system is criticized as *i)* it evaluates coronal system, but not sagittal plane, and *ii)* the number of study observers is limited.[10,13,14]

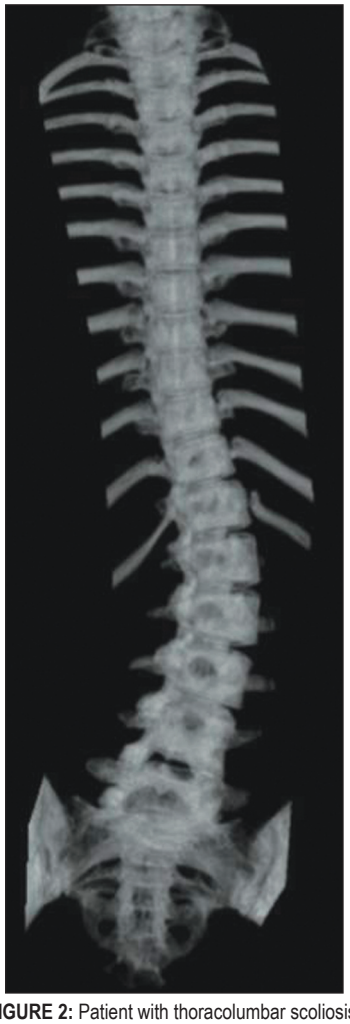


FIGURE 2: Patient with thoracolumbar scoliosis.

***Lenke Classification*:** Lenke et al. created the Lenke classification together with SRS.[10] This classification system was designed to include all curves in the sagittal and coronal planes. Changes in the chest and waist area were considered and 6 basic and 2 additional groups were formed. This classification system aimed to *i)* encompass all curves of AIS, *ii)* enable evaluation on both planes, *iii)* suggest fusion segment, and *iv*) to indicate segments to avoid fusion. The Lenke classification arose to address 2 issues. One was sagittal deformity and second was that with newer instrumentation techniques there were more treatment options (Table 2b).

TABLE 2a: King Moe classification system of AIS.

Type	Features
Type I	Lumbar curve ≥ thoracic curve thoracic flexibility > lumbar flexibility
Type II	Lumbar flexibility > thoracic flexibility thoracic curve > lumbar curve
Type III	Thoracic curve, lumbar curve does not cross midline, lumbar flexibility > thoracic flexibility
Type IV	L4 tilts into long thoracic curve, L5 at center
Type V	Double thoracic curve joined to the concavity of T1 curve

AIS: Adolescent idiopathic scoliosis.

TABLE 2b: Lenke classification system of AIS.

Curve type	Proximal thoracic	Main thoracic	Thoracolumbar/lumbar	Description
1	Non-structural	Structural	Non-structural	Main thoracic
2	Structural	Structural	Non-structural	Double thoracic
3	Non-structural	Structural	Structural	Double major
4	Structural	Structural	Structural	Triple major
5	Non-structural	Non-structural	Structural	Thoracolumbar/lumbar
6	Non-structural	Structural	Structural	Thoracolumbar/lumbar Main thoracic
Structural Criteria for Minor curves				
Proximal thoracic			Side bending Cobb>25°	
			T2-T5 kyphosis>+20°	
Main thoracic			Side bending Cobb>25°	
			T10-L2 kyphosis>+20°	
Thoracolumbar/lumbar			Side bending Cobb>25°	
			T10-L2 kyphosis>+20°	
Location of Apex				
Curve			Apex	
Thoracic			T2 to T11-12 disc	
Thoracolumbar			T12-L1	
Lumbar			L1-2 disc to L4	
*Major curve: Largest Cobb angle, always structural; Minor curve: Remaining structural curves.				
Modifiers				
Lumbar spine modifier			CSVL* to Lumbar Apex	
A			Between pedicles	
B			Touches apical corpus	
C			Completely medial	
*CSVL: Central sacral vertical line.				
Thoracic Sagittal Profile T5-T12				
Modifier			Cobb Angle	
- (Hypo)			<10°	
N (Normal)			10-40°	
+ (Hyper)			>40°	
*Evaluation: Type of curve-Lumbar modifier-Thoracic sagittal profile; e.g: 2B+.				

AIS: Adolescent idiopathic scoliosis.

Classification of Adult Spinal Deformities: Its classification and standard surgical treatment for adult spinal deformity (ASD) are still poorly defined. There is no widely accepted classification system for ASD. It is known that the prevalence in elderly volunteers is over 60% (Figure 3).

Simmons Classification: Two types of deformities seen in ASD were defined by Simmons in 2001 (Table 3a).[15] This classification is perhaps the first attempt in adult patients with scoliosis, considering the critical stages in surgery. Shorter instrumentation is used for Type I deformity. For Type II deformity, longer instrumentation is used with sagittal plane reconstruction.

Aebi Classification: Aebi et al. published his adult scoliosis classification based on etiology and spinal abnormality in 2005 (Table 3b).[16-18] While deformity curve location, model and size are included as descriptors; curve flexibility, pelvic alignment, and spinal global alignment are not included. It is an easy and practical classification. It is good at predicting natural progression. However, it cannot convey certain features of individual deformities. Aebi's classification does not provide guidance for surgeons to determine the surgical boundaries.[17]

Faldini Classification: It is a classification system designed to help plan the most appropriate surgery for ADS patients.[18,19] This classification is basically divided into 2 types, stable (Type A) and instable (Type B) curves (Table 3c). Type A curves have degeneration involving the facet joint, disc, and lamina as the body tries to stabilize the motion of the spine. The arc of motion of the spinal motion unit is reduced, and a fixe lateral deformity is maintained. These are the main determinants of the stability of the

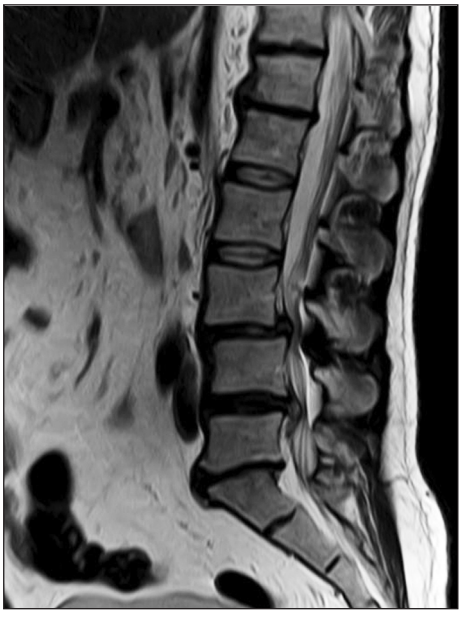


FIGURE 3: Adult Spine Deformity is shown in the picture.

TABLE 3a: Simmons classification system of ASD.

Type I	Degenerative lumbar scoliosis with no or minimal rotational deformity
Type II	Degenerative scoliosis often superimposed on a preexisting scoliosis with greater rotational deformity and greater loss of lordosis

ASD: Adult spinal deformity.

TABLE 3b: Aebi classification system of ASD.

Type	Description	Etiology
I	Primary degenerative scoliosis ("de novo" scoliosis)	Asymmetric disc and facet joint degeneration
II	Progressive idiopathic scoliosis of the lumbar and/or thoracolumbar spine	Idiopathic scoliosis present since adolescence, progression due to mechanical reasons or bony and/or degenerative changes
III (a)	Secondary adult scoliosis mostly thoracolumbar or lumbosacral	Secondary to an adjacent thoracic or thoracolumbar curve of idiopathic, neuromuscular or congenital origin. Obliquity of pelvis due to leg length discrepancy orhip pathology with secondary spinal curve Lumbosacral transitional anomaly
III (b)	Deformity progressing mostly due to bone weakness, for example, osteoporotic fracture with secondary deformity	Metabolic bone disease, osteoporosis

TABLE 3c: Faldini classification system of ASD.

Curve type	Classification	Decompression	Fusion
A (stable)	A1 Facet hypertrophy with foraminal stenosis	Hemilaminectomy+unilateral foraminotomy	
		Laminectomy+bilateral foraminotomy	Posterolateral fusion with or without instrumentation
	A2 Facet hypertrophy with cental stenosis	Hemilaminectomy	
		Hemilaminectomy+unilateral foraminotomy	
		Laminectomy+bilateral foraminotomy	Posterolateral fusion with or without instrumentation
	A3 Intervertebral disc degeneration	Hemilaminectomy+unilateral foraminotomy	Posterolateral fusion with or without instrumentation
		Hemilaminectomy+unilateral foraminotomy+ discectomy and restoration of disc height	Interbody plus posterolateral fusion with or without instrumentation
	A4 Mixed	Hemilaminectomy+unilateral foraminotomy	
		Laminectomy+bilateral foraminotomy	Posterolateral fusion with or without instrumentation
			Interbody plus posterolateral fusion with or without instrumentation
B (instable)	B1 Hypermobility due to facet joint degeneration	No decompression	Posterolateral fusion with or without instrumentation
		Hemilaminectomy+unilateral foraminotomy	
		Laminectomy+bilateral foraminotomy	
	B2 Disc degeneration	Unilateral foraminotomy	Posterolateral fusion with or without instrumentation or
		Bilateral foraminotomy	interbody plus posterolateral fusion with or without instrumentation
	B3 Mixed	Unilateral foraminotomy	Posterolateral fusion with or without instrumentation
		Bilateral foraminotomy	Interbody plus posterolateral fusion with B4 or without instrumentation
	B4 Unstable with sagittal imbalance	Unilateral foraminotomy	
		Bilateral foraminotomy	

ASD: Adult spinal deformity.

curve that determines the segmental and foraminal stenosis with nerve root compression. In Type B curves, the degeneration cannot stabilize the spine. The resulting degenerative changes lead to instability. Considering the decompression and fusion strategies, a surgical treatment algorithm is recommended for each curve type. This classification system defines of ADS while also aiming to provide a surgical algorithm. The validity of surgeries to be performed is questionable since it relies on the experience and competence of the surgeon. Also, most of the cases for which Faldini et al. suggested a bilateral foraminotomy and optional instrumentation can be operated today without a need for instrumentation at all.[20]

SRS Classification: The aims of all scoliosis classification systems are to standardize the communication between healthcare personnel and to make diagnosis and treatment approaches easier. SRS reported a classification system using radiographic features in 2006 (Table 4a).[11] In this classification system, sagittal and lumbar modifiers as well as global "balance" modifiers were considered. The authors stated that the classification they developed was insufficient to describe the surgical boundaries, and thus this system could further be improved through future studies. In addition, they did not take the symptoms, age, and comorbidities of the patients into account either.

Schwab Classification: This system was advanced as a result of a prospective clinical study, where Schwab et al. evaluated 947 adult patients with spinal deformities.[12] It provides radiological evaluation of intervertebral subluxation, apex of deformity, lumbar lordosis, and frontal Cobb angle. This classification system was based on three main criteria (Table 4b). It is a system that focuses on the relationship between radiographic and clinical evaluation. Emphasizes assessing the apex of the curve, lumbar lordosis, and vertebral subluxation. It is the first classification to report that a lower apex with loss of lumbar lordosis results in lower health-related quality of life (HRQOL) scores. The most important point of this classification is that it classifies each patient according to his/her clinical condition. Patients with higher

TABLE 4a: SRS classification system of ASD.

Primary curve types
● Single thoracic
● Double thoracic
● Double major
● Triple major
● Thoracolumbar
● Lumbar " de novo"/idiopathic
● Primary sagittal plane deformity
Adult spinal deformity modifiers
● Proximal thoracic (T2-T5): ≥+20°
● Main thoracic (T5-T12): ≥+50°
● Thoracolumbar (T10-L2): ≥+20°
● Lumbar (T12-S1): ≥-40°
Lumbar degenerative modifier
● Decrease in disc height and facet atrophy between L1 and S1
●Listhesis ≥3 mm between L1 and L5
● Junctional L5-S1 curve ≥10°
Global balance modifier
● Sagittal C7 plumb ≥5 cm anterior or posterior to sacral promontory
● Coronal C7 plumb ≥3 cm right or left of CSVL
SRS definition of regions
● Thoracic from the T2 apex, T11-T12 disc, thoracolumbar T12-L1
● Lumbar from the L1 apex, L1-L2 disc, L4
Criteria for specific major curve types
1. Thoracic curve
● Curve ≥40°
● T1 rib or clavicle angle ≥10° upper thoracic curves
2. Thoracolumbar and lumbar curve
● Curve ≥30°
● Apical vertebral body lateral to CSVL
3. Primary sagittal plane deformity
● No major coronal curve

SRS: Scoliosis Research Society; ASD: Adult spinal deformity; CSVL: Central sacral vertical line

degrees of subluxation and lordosis have greater pain and are less likely to perform daily activities, thus requiring surgery. The limitation of the Schwab's classification, however, is that the number of patients studied was limited when developing the classification. Furthermore, criticisms include not indicating the Cobb angle and the lower level in addition to not covering some of the subtypes. Schwab et al. stated that there was a need for a more comprehensive classification that covered the spinopelvic parameters, thoracolumbar alignment, and lumbosacral junction.[12]

SRS-Schwab Classification: ASD is a pathology with clinical problems ranging from asymptomatic to severe disability. There is a significant relationship between standard HRQOL scores and radiographic pelvic parameters. The SRS-Schwab classification provided the clinician with an approach to categorize radiographic elements through the sagittal vertical axis, pelvic tilt, and mismatch between pelvic incidence and lumbar lordosis (Table 4c).[21] The classification includes three sagittal spinopelvic parameters (a curve type descriptor and intrinsic components of sagittal deformity and compensatory mechanisms associated with the deformity). Curve type descriptor and sagittal spinopelvic parameters correlated with HRQOL. Classification modifiers were also associated with the decision to pursue surgery or conservative treatment. It also reflected significant differences in surgical strategy (major osteotomy, pelvic fixation, and decompression).[21] It is a widely accepted and applied classification because it describes the nature of the curve, reflects the severity of the curve and the HRQOL correlation.

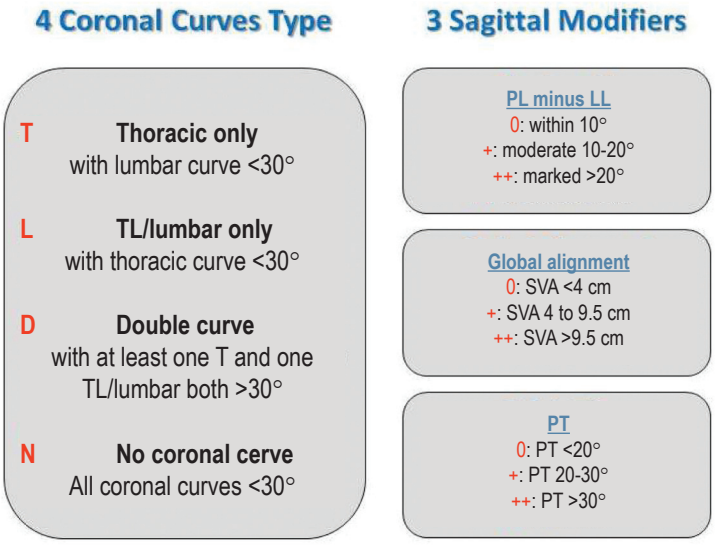
Many ASD patients may have multiple problems including low back pain, radiculopathy, neurological claudication, osteoporosis, functional disability, severe obesity, and comorbidities such as diabetes mellitus, hypertension, or coronary artery disease. Patients have different clinics and require different treatment strategies. All current classifications are

TABLE 4b: Schwab classification system of ASD.

Type	Radiological Criteria
I	Thoracic curve only
II	Major upper thoracic, apex T4-T8
III	Major lower thoracic, apex T9-T10
IV	Major thoracolumbar, apex T11-L1
V	Major lumbar curve, apex L2-L4
Lumbar lordosis changes	
A	Severe lumbar lordosis; (≥40°)
B	Moderate lordosis (0-40°)
C	No sing of lordosis (Cobb >0°)
Subluxation changes	
0	No intervertebral subluxation at any level
+	Maximum subluxation of 1-6 mm
++	Subluxation >7 mm

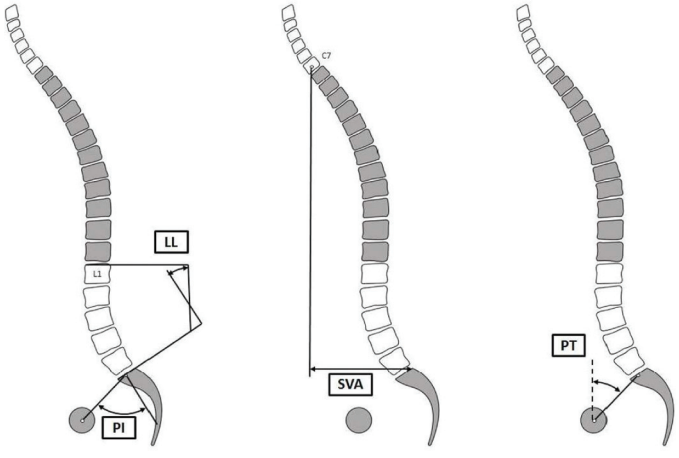
ASD: Adult spinal deformity.

TABLE 4c: SRS-Schwap classification of ASD.



SRS-Schwap Classification-graphical representati on wirh theresholds

● Sagittal parameters- schematic representation of the 3 modifiers



● Sagittal parameters- schematic representation of the 3 modifiers

SRS: Scoliosis Research Society; ASD: Adult spinal deformity; TL: Thoracolumbar; PI: Pelvic incidence; LL: Lumbar lordosis; SVA: Sagittal vertical axis; PT: Pelvic tilt.

based on radiology and do not include clinical markers and conditions in patients. It is obvious that classifications based on radiological parameters alone will not be sufficient to determine the treatment parameters of patients.[22] The Lenke classification is the most widely used AIS classification. For patients with adult scoliosis, SRS classification stands out due to rich content, Schwab classification due to clinical consistence, and the Aebi classification due to ease of use.

CONCLUSION

King and Lenke are classifications for AIS and are designed to guide fusion levels for the treatment of AIS. King was designed for the use of first-generation instrumentation. The classification did include lumbar (Type I) and double major curves (Type II). The Lenke classification arose to address two issues. One was sagittal deformity and second was that with newer instrumentation techniques there were more treatment options. The Schwab and SRS classifications are used to describe a completely different problem. They are classification of ASD. The key addition in these systems is the introduction of lumbar lordosis and pelvic parameters. This includes adult sequelae of AIS but also degenerative deformity. In adult the coronal deformity is almost insignificant to indication for treatment and outcomes.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Özgür Akşan;* ***Design:*** *Özgür Akşan;* ***Control/Supervision:*** *Nail Özdemir;* ***Data Collection and/or Processing:*** *Nail Özdemir;* ***Analysis and/or Interpretation:*** *Özgür Akşan;* ***Literature Review:*** *Özgür Akşan;* ***Writing the Article:*** *Özgür Akşan;* ***Critical Review:*** *Nail Özdemir;* ***References and Fundings:*** *Nail Özdemir;* ***Materials:*** *Nail Özdemir.*

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