



Adult spinal deformity: Past, present & future

The awareness of adult spinal deformity (ASD) and its impact on patient well-being was recognized as early as 2005–2010. As the population seeking ASD treatment continues to grow, reflecting longer life expectancies and a commitment to active aging, addressing this condition has become a paramount concern.

ESSG (European Spine Study Group) research has revealed the global homogeneity of ASD in various regions, underscoring its profound health implications, surpassing those of other chronic diseases such as heart and lung conditions, as well as limitations in the use of limbs.

Our approach to addressing the ASD epidemic has undergone significant transformations. Our understanding of spinal deformities has evolved from pediatric coronal plane analysis to a focus on sagittal plane issues in adult patients. Furthermore, the adoption of Patient-Reported Outcome Measures (PROMs) has enhanced our comprehension of the health-related impacts of ASD. Consequently, treatment strategies have shifted from non-operative support to more direct surgical intervention.

Recognizing the imperative need for a deeper understanding of ASD, four ASD classifications have been published in just seven years, paralleling a dramatic increase in ASD-related PubMed citations. Our comprehension of deformities has expanded from complex coronal and sagittal deformities to simpler degenerative conditions. This shift has led us to view all degenerative conditions as potential pain generating deformity cases due to excessive use of compensatory paraspinal and pelvic muscles resulting with muscle fatigue pain.

While no ideal classification yet exists to unravel the heterogeneity of clinical presentations and treatment options for adult spinal deformity, the SRS (Scoliosis Research Society)-Schwab classification is commonly employed. Recent AI (Artificial Intelligence)-based studies, such as the collaborative ISSG (International Spine Study Group)-ESSG effort, have identified optimal patient types, facilitating treatment optimization and risk mitigation, promising to be invaluable classification tools.

Non-operative treatments lack standardized application, with recent studies indicating limited efficacy. Surgical intervention, despite its inherent complications, has emerged as a promising option for improving pain and disability in ASD patients. However, we remain hopeful about non-operative treatments and anticipate more standardized, interdisciplinary approaches in the future. Advancements in central pain control and innovative electro-stimulation devices offer additional avenues for exploration.

Despite our progress, the high rate of complications necessitates improvements in patient selection, optimization, and personalized surgical planning to enhance patient safety. Efforts to assess patient quality of life and refine outcome assessment protocols continue to drive our research.

In surgical planning, prioritizing patient-specific treatment selection,

counseling, and aligning expectations are paramount. Evidence suggests that elderly patients with the poorest PROMs derive the most significant benefit from surgical interventions.

The future of treatment selection and counseling will likely involve objective measures of invasiveness, ASD-specific frailty indices, and prediction tools. Collaborative work by ISSG and ESSG, employing machine learning technologies, has already laid the foundation for these advancements.

Patient optimization, including the management of comorbidities that contribute to complications, is crucial. Cultural adaptation of protocols, such as SSP, and the development of more effective drugs and rehab modalities hold promise for improving patient optimization.

In the realm of ASD, rapid developments in sagittal plane analysis and planning tools are reshaping clinical practice. Although the literature may be contentious, embracing these tools remains beneficial, and future advances will likely incorporate AI-based radiographic analysis with functional assessments, including soft tissues, senescence, and bone quality.

The ongoing challenge of high mechanical complication rates has spurred strategies for better planning, the use of multiple rod configurations, BMPs (Bone Morphogenetic Proteins), and preoperative osteoporosis optimization. PJK (Proximal Junctional Kyphosis) and soft landing remain controversial topics, necessitating further exploration.

Mild to moderate ASD patients may benefit from less aggressive surgeries, while robotics and navigation technologies are poised to revolutionize surgical precision and automation.

Despite these advancements, complications remain a significant concern, underscoring the need for ongoing research on strategies to mitigate risks.

Outcome evaluation is another challenge, requiring the development of multilingual and multicultural outcome questionnaires. Functional limitations, often overlooked, are now being addressed through wearable devices, promising more accessible and reproducible assessments.

Lastly, governmental policies to advance spinal health and prevent adult spinal deformities should be considered, as prevention remains the best medicine.

In summary, the journey to address adult spinal deformity has been marked by significant advancements, but there is much ground left to cover. Collaboration, innovation, and a commitment to improving patient outcomes will continue to drive our efforts in this critical field. Brain and Spine, the official journal of EUROSPINE and EANS, offers you a platform to publish your research about all these aspects of Adult Spinal Deformity research.

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Ahmet Alanay*

*Department of Orthopedics and Traumatology, Acibadem Mehmet Ali
Aydinlar University School of Medicine, Istanbul, Turkey
Comprehensive Spine Center, Acibadem Maslak Hospital, Istanbul, Turkey
President, Eurospine, Zurich, Switzerland*

* Eurospine, Zurich, Switzerland.
E-mail address: aaalanay@gmail.com.