Neurosurgical Forum
LETTERS TO THE EDITOR**Correction of thoracic hypokyphosis in the treatment of scoliosis**

TO THE EDITOR: We have read with great interest the article about simultaneous translation on two rods (ST2R) by Sakai et al.¹ (Sakai D, Schol J, Hiyama A, et al. Simultaneous translation on two rods improves the correction and apex translocation in adolescent patients with hypokyphotic scoliosis. *J Neurosurg Spine*. 2021;34[4]:597–607). We congratulate the authors for re-emphasizing the correction of thoracic hypokyphosis in the treatment of adolescent idiopathic scoliosis (AIS).

We are pleased to see that Sakai et al. confirm the potential of the ST2R technique to increase thoracic kyphosis (TK) in significant proportions.¹ They also highlight the ability to change the position of the apex of TK. Indeed, bending the rods according to the desired sagittal profile allows, on the one hand, the ability to restore TK in accordance with the sagittal contour of the rods and, on the other hand, the ability to place the apex at the level determined by the rods.^{2,3} However, two issues remain unresolved concerning sagittal targets: where to locate the TK apex, and what angular values should we aim for?

Regarding the apex, we can expect regular TK between T2 and T12 with an apex in the middle at T7 and a proximal kyphosis equal to the distal kyphosis.³ Elsewhere, we can provide two unequal arches with, for example, an apex around T8 or T9 depending on the spinal morphotype according to the Roussouly classification.⁴ As Sakai et al. reported, this issue is not resolved.¹ Personally, for adolescents we prefer a regular kyphosis between T2 and T12 with an apex at T7.^{2,3}

Regarding the TK target value, recent literature is available about normal TK, which is related to pelvic parameters and lumbar lordosis in healthy adolescents.⁵ The TK is not the same for all patients, but everyone has a specific TK depending on each individual's lumbopelvic parameters. Therefore, it seems important to give the scoliotic patients the kyphosis they need for a good sagittal alignment. Thus, it is necessary to calculate the target TK preoperatively and to bend the rods to the desired shape either preoperatively² or intraoperatively.

We strongly encourage the authors to continue their ap-

proach in this direction with the aim of further improving sagittal alignment.

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Disclosures

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Response

We sincerely appreciate the letter from Dr. Clément and his colleagues on our recent paper examining the po-

tential of the ST2R technique for curvature corrections in hypokyphotic AIS patients. We are particularly grateful for the response as Dr. Clément is the original surgeon to describe the ST2R technique.¹

An interesting point is raised by Clément et al. as to the desired correctional outcome, particularly considering the TK and TK apex. We concur that this largely remains an unresolved aspect of spinal corrections. As suggested by Clément and coworkers, an optimal TK and apex are likely dependent on the “natural” profile tendency of the patient’s specific spine. This is emphasized by the discrepancies reported in sagittal plane parameters in relation to age, sex, and ethnicity;^{2,3} for example, one study found that Japanese females tend to have fewer pelvic inclinations and lower lordotic angles than those of European ethnicity.⁴ These aspects should similarly be taken into consideration when comparing study cohorts from across the world. Future investigations examining the effects of apex translocation likely require careful deliberation on the spinal types, relation to pelvic tilts, etc., as proposed by Clément et al.

Alternatively, current reports generally evaluate sagittal parameters only in a static standing position. We strongly believe advancements in dynamic spinal alignment assessment, such as through gait analysis, will become critical tools to further assess functionality and compensation strategies of AIS patients before and following surgery, thereby potentially providing better insights to optimize surgical correction targets.

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Cervical deformities

TO THE EDITOR: I read the article by Protopsaltis et al.¹ with interest (Protopsaltis TS, Stekas N, Smith JS, et al. Surgical outcomes in rigid versus flexible cervical deformities. *J Neurosurg Spine*. 2021;34[5]:716–724). The authors have divided cervical deformities into rigid and flexible varieties. Essentially all patients underwent multi-level spinal fixation and osteotomies. Considering the average age of the patients being around 63 years, it can be presumed that in the majority of the patients reported in the study the deformity was related to spinal degeneration.

We have earlier discussed the role of weakness of muscles of the spine that are involved in the human standing position as the nodal point of pathogenesis of spinal degeneration. It has been demonstrated that intervertebral ligament buckling that includes the posterior longitudinal ligament and ligamentum flavum, disc space reduction, disc bulges, and osteophyte formation are not primary events but are secondary to vertical spinal instability and facetar retrolisthesis as a result of muscle weakness.^{2,3} Facetal instability, being subtle, lateral, and away from the neural structures, is difficult or impossible to diagnose even with modern computer-based imaging.³ Our study revealed that cervical spinal kyphosis in degenerative spinal disease is not a primary event but is secondary to multisegmental spinal instability that includes atlantoaxial instability in a majority of cases.⁴ Irrespective of the abnormal mobility on dynamic radiographs, the presence of cervical kyphosis by itself is evidence of multisegmental spinal instability. Essentially, kyphosis in spinal degeneration is not fixed but is flexible and abnormally or pathologically mobile. We argued that in such cases, “only fixation” is the most appropriate treatment and osteotomies of any kind are unnecessary.

Identification of the unstable spinal segments constitutes a critical basis of surgical treatment. Depending on the nature and site of cervical spinal kyphosis, we divided spinal degeneration–related kyphosis into three groups and based our surgical treatment accordingly.⁴ The extent of the curve and the location of its apex had defining roles in the selection of the surgical levels that require fixation. The atlantoaxial instability is more often of a “central” or “axial” variety in a significant number of cases of cervical spinal kyphosis. We are convinced that ignoring the atlantoaxial joint in the fixation construct can be a cause of surgical outcome failure.⁵

Considering the fact that Protopsaltis et al. have identified surgical complications in more than 60% of cases, out of which more than 20% were “major,” it is prudent to review the existing literature in which alternative concepts related to cervical deformity are discussed and 100% positive clinical outcome has been reported.^{4,6,7}

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Disclosures

The author reports no conflict of interest.

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Response

No response was received from the authors of the original article.

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