



S2 alar-iliac screws versus iliac screws for pelvic fixation

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Achieving a sacropelvic fusion continues to be a challenge due to complex anatomy biomechanics and morbidity associated with invasive procedures. Initially, the Galveston technique was utilized until the introduction of iliac screws (IS) in the early 2000s, which showed improved fusion rates and decreased complications (1-3). However, drawbacks to the IS technique include extensive dissection of paraspinal muscles, screw prominence given its high profile, and the requirement of offset connector use (4,5). Tsuchiya reported a 34% rate of IS screw removal at 5 years in patients treated for spinal deformity (6). In an effort to overcome such challenges, the S2 alar-iliac (S2AI) screw technique was developed (5). This technique allows for biomechanically stable fixation with less dissection and does not require offset connector use. Technically, the S2AI screw has a starting point that is 15 mm deeper than ISs and allows in line rod placement. However, a possible disadvantage is that a reported 60% of S2AI screws violate the sacroiliac (SI) joint, as reported by a single cadaveric study (5). The significance of SI joint violation has not been examined by clinical studies although it remains a concern for some surgeons.

A recent case series titled “Use of S2-alar-iliac screws associated with less complications than iliac screws in adult lumbosacropelvic fixation” was published in *Spine* as a retrospective comparison between the S2AI and the traditional IS technique. Strengths of the study included the relatively large patient population evaluated from a single center, and surgeons well-versed in S2AI screw technique. This study reported lower rates of reoperation, surgical site infection, wound dehiscence, and symptomatic screw prominence when comparing S2AI to IS fixation.

Rates of pseudarthrosis, proximal junctional kyphosis, and sacroiliac pain were similar in both groups. Additionally, there was no difference reported in pain relief achieved between the two groups. Although the S2AI technique had no advantage in terms of preventing pseudarthrosis relative to the traditional IS technique, it did reduce infection, re-operation, and symptomatic hardware rates. The authors suggested that the high infection rate in the IS group was related to prominence especially where breakdown and dehiscence were present. This finding supports the purpose of the S2AI technique, which was developed to decrease screw prominence and reduce the need for extensive tissue dissection and muscle stripping.

However, there were several limitations. First, the study was retrospective, which lends itself to selection bias especially when incorporating new techniques utilized by a variety of surgeons on a case by case basis. Patients were only included if they had a postoperative CT scan. In our experience, postoperative CT scans are ordered in patients who present with a clinical problem. In fact, this excluded 71 patients who did not have CT scans, which may skew the data to representing more patients with complications. Additionally, only 25 patients received the IS technique compared to 65 who received the S2AI technique. In future studies, a more balanced comparison would be appreciated when allocating patients for both groups. Also, the patients only had minimum 1-year follow-up, which may not be adequate to assess pseudarthrosis. Longer follow-up is necessary to assess post-operative SI joint pain, as the study mentions it was difficult to assess cartilage violation of the S2AI screws post-operatively and the diagnostic accuracy of assessing SI joint pain is often suboptimal without long-

term follow-up. Additionally, there were certain trends in the data which were not statistically significant but could become so if the study size was increased: the IS group had more patients treated for neoplasms which present much more complex anatomy, pathology, and a higher risk for complications; S2AI cases trended toward receiving more interbody support at L5–S1 and frequency and amount of use of BMP-2. Nevertheless, fusion rates were similar. The surgeons who performed the S2AI technique were well versed with the procedure, which may have contributed to decreased operative time and therefore decreased complication rates. Those who are learning the procedure may initially experience longer operative times and increased resulting complications compared to those proficient with S2AI placement.

Given its improved biomechanical profile and decreased skin to screw distance, S2AI fixation can reduce re-operation and infection. This study affirms the work done previously by Mazur *et al.* and Ilyas *et al.* who demonstrated decreased post-operative complications and re-operation rates with the S2AI technique compared to the IS technique (7,8). However, what is of concern is the ability of the S2 screw to violate the joint space. An anatomic study by O'Brien *et al.* demonstrated violation of the articular cartilage in 60% of cases (5). This warrants further study with long-term post-operative outcomes. The long-term data concerning cartilage violation was not adequately reported in this study with only 1-year follow-up and lack of radiographically adequate assessment of this occurrence. Nevertheless, the strength of the construct and its ability to withstand the physiologic forces at the spinopelvic junction has been established in prior biomechanical studies (9).

Overall, the S2AI technique, once it is mastered, is a superior technique in terms of decreasing the risk of surgical site infection and revision surgery given its biomechanical advantages. However, the long-term clinical assessment of pain and function given its potential to violate the articular cartilage within the joint warrants further prospective studies with longer follow-up.

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References

1. Saer EH 3rd, Winter RB, Lonstein JE. Long scoliosis fusion to the sacrum in adults with nonparalytic scoliosis. An improved method. *Spine (Phila Pa 1976)* 1990;15:650-3.
2. Allen BL Jr, Ferguson RL. The Galveston experience with L-rod instrumentation for adolescent idiopathic scoliosis. *Clin Orthop Relat Res* 1988;(229):59-69.
3. Emami A, Deviren V, Berven S, et al. Outcome and complications of long fusions to the sacrum in adult spine deformity: luque-galveston, combined iliac and sacral screws, and sacral fixation. *Spine (Phila Pa 1976)* 2002;27:776-86.
4. O'Shaughnessy BA, Lenke LG, Bridwell KH, et al. Should symptomatic iliac screws be electively removed in adult spinal deformity patients fused to the sacrum? *Spine (Phila Pa 1976)* 2012;37:1175-81.
5. O'Brien JR, Yu WD, Bhatnagar R, et al. An anatomic study of the S2 iliac technique for lumbopelvic screw placement. *Spine (Phila Pa 1976)* 2009;34:E439-42.
6. Tsuchiya K, Bridwell KH, Kuklo TR, et al. Minimum 5-year analysis of L5-S1 fusion using sacropelvic fixation

- (bilateral S1 and iliac screws) for spinal deformity. *Spine (Phila Pa 1976)* 2006;31:303-8.
7. Mazur MD, Ravindra VM, Schmidt MH, et al. Unplanned reoperation after lumbopelvic fixation with S-2 alar-iliac screws or iliac bolts. *J Neurosurg Spine* 2015;23:67-76.
 8. Ilyas H, Place H, Puryear A. A Comparison of Early Clinical and Radiographic Complications of Iliac Screw Fixation Versus S2 Alar Iliac (S2AI) Fixation in the Adult and Pediatric Populations. *J Spinal Disord Tech* 2015;28:E199-205.
 9. O'Brien JR, Yu W, Kaufman BE, et al. Biomechanical evaluation of S2 alar-iliac screws: effect of length and quad-cortical purchase as compared with iliac fixation. *Spine (Phila Pa 1976)* 2013;38:E1250-5.

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