

Investigation of post-surgical rod deflection using instrumentation with manufactured curvature in scoliosis corrective surgery

Category: Surgery & Surgical Specialties, Oral Presentation

Disclosure: The authors did not report any financial relationships or conflicts of interest

[Supplemental Video](#)

Presenting Author: Kevin James Littrell, MPH, Third Year Medical Student, Tulane University, School of Medicine, Tulane University, New Orleans, LA

Coauthors: Margaret Higgins, Bachelor of Science in Neuroscience and Anthropology, Third-Year Medical Student, Tulane University, School of Medicine, Tulane University, New Orleans, LA

Introduction

Adolescent idiopathic scoliosis (AIS) is a three-dimensional spinal deformity without a known cause¹. Ideally, most scoliosis can be managed nonoperatively². Yet with spinal curvatures beyond 45-50°, surgical treatment is considered. In order to surgically correct spinal deformities a multi-level spinal fusion, stabilized with rod implants, is the standard approach³. During surgery, the rods are bent in the sagittal plane to achieve a natural lordosis/kyphosis profile, which introduces imperfections within the implant and can decrease stiffness^{4,5}. When the rods are loaded as part of the correction maneuver, they tend to lose their sagittal curvature resulting in a reduction of the deformity correction. This process is known as post-surgical rod deflection⁶.

Traditionally, the implants are manufactured as straight rods and post-surgical rod deflection can be controlled by changing other aspects about the implant, such as the stiffness or rod diameter. However increasing implant stiffness or rod diameter can lead adverse consequences, such as osteonecrosis. A newer alternative is a rod with a patient-specific, pre-manufactured sagittal curvature. While there are various structural characteristics that influence rod stability, a pre-manufactured sagittal curvature is hypothesized to provide additional stability to the implant and help prevent post-surgical rod deflection⁷.

Goals

Using a retrospective chart review, the authors will measure the implant curvature from pre-surgical imaging with intra-operative and post-operative imaging. Using a case-control study, our ultimate goal is to track deflection in three dimensions by using tangent lines. The authors will match subjects and controls on various factors, such as age and sex.

Through this project we aim to compare the amount of rod deflection between the newer, alternative to the traditional, straight rod implant. Although most research that explores rod stability focuses on rod diameter and composition, the authors see this as an opportunity to increase awareness of patient-specific implants and hope that the results of this study can help highlight novel characteristics that can provide additional stability to orthopaedic implants.

References

1. Edgar M: The natural history of unfused scoliosis. *Orthopedics* 1987, 10(6):931-939.
2. Weinstein SL, Dolan LA, Spratt KF, Peterson KK, Spoonamore MJ, Ponseti IV: Health and function of patients with untreated idiopathic scoliosis. *JAMA* 2003, 289:559-567.

3. Harrington PR: Treatment of scoliosis. Correction and internal fixation by spine instrumentation. *J Bone Joint Surg Am* 1962, 44:591-610.
4. Picetti GD III, Pang D, Bueff HU: Thoracoscopic techniques for the treatment of scoliosis: early results in procedure development. *Neurosurgery* 2002, 51:978-984.
5. Winter RB, Lonstein JE, Denis F: How much correction is enough? *Spine* 2007, 32:2641-2643.
6. Sia U, Tan BB, Teo YY, Wong CC. Post-implantation Deformation of Titanium Rod and Cobalt Chrome Rod in Adolescent Idiopathic Scoliosis. *Malays Orthop J.* 2019;13(1):14-19. doi:10.5704/MOJ.1903.002
7. Ohrt-Nissen S, Dahl B, Gehrchen M (2018) Choice of rods in surgical treatment of adolescent idiopathic scoliosis: what are the clinical implications of biomechanical properties?—a review of the literature. *Neurospine* 15(2):123–130

Learning Objectives

1. Evaluate the differences in post-operative stability and rod deflection among patients treated for scoliosis using straight rods versus curved rods
2. Expand awareness of patient-specific, pre-manufactured rods used for scoliosis correction surgery
3. Expand awareness of various characteristics that affect implant stability in orthopaedic surgery