Biomechanical comparison between cortical screw–rod construct versus pedicle screw–rod construct in transforaminal lumbar interbody fusion: A porcine animal study model

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Abstract

Objective: To compare construct stiffness of cortical screw (CS)-rod transforaminal lumbar interbody fusion (TLIF) construct (G2) versus pedicle screw (PS)-rod TLIF construct (G1) in the standardized porcine lumbar spine. Methods: Six porcine lumbar spines (L2-LS) were separated into 12 functional spine units. Bilateral total facetectomies and intertransverse decompression were performed for all specimens. Non-destructive loading to assess stiffness in lateral bending, flexion and extension as well as axial rotation was performed using a universal material testing machine. Results: PS and CS constructs were significantly stiffer than the intact spine except in axial rotation. Using the normalized ratio to the intact spine, there is no significant difference between the stiffness of PS and CS flexion (1.41 ± 0.27, 1.55 ± 0.32), extension (1.98 ± 0.49, 2.25 ± 0.44), right lateral flexion (1.93 ± 0.37, 1.55 ± 0.30), left lateral flexion (2.00 ± 0.73, 3.16 ± 0.29), right axial rotation (0.99 ± 0.21, 0.83 ± 0.26) and left axial rotation (0.94 ± 0.22, 0.92 ± 0.15). Conclusion: The CS-rod TLIF construct provided comparable construct stiffness to a traditional PS-rod TLIF construct in a standardized porcine lumbar spine model.

Keywords
biomechanical, cortical screw, pedicle screw, TLIF, transforaminal lumbar interbody fusion

Introduction

The merits of minimally invasive spine surgery had led to its popularity in recent times. Its advantages include preservation of the multifidus muscle integrity,12 faster immediate post-operative recovery, less post-operative pain as well as less blood loss.3 It has also been shown to have less tissue destruction with lower blood levels of inflammatory markers such as IL-6 and IL-8.4 However, the placement of the minimally invasive percutaneous pedicle screw (PS) carries a significant risk of screw malposition, neural structure injury and revision surgeries.5 Insertion of percutaneous screw in this manner is also dependant on fluoroscopy, and the deleterious effects of radiation on surgeons have been shown.6,7 Minimally invasive decompression is also reliant on a variety of bone graft substitutes, which would increase the cost of surgery. The efficacy of stand-alone bone graft substitutes for fusion remains debatable.8-10

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