Lag screws placed across adjacent vertebral bodies stabilize the segment similar to traditional pedicle screws

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INTRODUCTION: In spine surgery, fusion using pedicle screws is among the most commonly used techniques. A new technique involving lag screws inserted through a lateral trajectory in to the adjoing vertebral bodies and the disc in between, figure 1, was developed in order to fix the lumbar segment. The screws pass through the intervertebral disc, compresses the two vertebral bodies, and provides stabilization. This can be done with or without the inter-body cages. The surgery involves creating the entry point which is the superolateral point of the intersecting line of vertebral body and pedicle of the superior vertebra. The trajectory for screw insertion involves 30 degrees in sagittal plane and 45 degrees in coronal plane. The combination of these angles allow the screw to insert at an angle that passes through the entire body of the superior vertebra, the intervertebral disc and the upper half of the inferior vertebra. This new surgical approach might be a good alternative to traditional fusion using pedicle screws. The objective of this project was to evaluate the stability provided by the new bilateral system. Our hypothesis was that the new bilateral system significantly decreases the motion compared to intact and similar to pedicle screw system.

METHODS: In this study 6 human cadaveric spines from L2-sacrum were tested to evaluate the range of motion (ROM) across each segment using Optotrak motion capture system (NDI, Waterloo, ON, Canada). The DEXA T scores for these specimens ranged from -2.8 to -5.6. The L2 and sacrum of each specimen were potted using bondo. Potted sacrum was fixed on the testing apparatus. LED plates were attached to potted L2, L3, L4, L5 and potted sacrum. Moments were applied on potted L2 up to 10 Nm in extension, flexion, left and right lateral bending and left and right axial rotations. The position of each vertebra was recorded using Optotrak motion capture system. Following the testing of intact specimen, L4-5 was fused using pedicle screw system (PSS) and tested for ROM. In the third step, the pedicle screws were removed and the lag screws (LS) were inserted bilaterally using new technique and tested for ROM. In the fourth step TLIF cages were inserted bilaterally in conjunction with lag screws (LS+TLIF cages) and tested for ROM. Finally, the lag screws were removed and pedicle screws of bigger size were inserted and fixed keeping the cages (PSS+TLIF Cages) and tested for ROM. Statistical analysis was performed using paired t-test.

RESULTS: The mean ROM data for 6 specimens at 10 Nm across L4-L5 segment is shown in figure 2. The instrumented cases reduced the motion across the segment compared to intact. The percentage of reduction in motion was more for flex, ext, lateral bending cases but less for left and right rotations. The motion was significantly reduced in all instrumented cases for flexion, extension, left and right bending compared to intact. The reduced motion for all instrumented cases was not significant in left and right rotations (Table 1). P Values. There is no significant difference between bilateral approach and traditional pedicle screw system in stabilizing the segment.

DISCUSSION: The bilateral approach using lag screw significantly decreased the motion compared to intact and similar to pedicle screw system. The limitations of the study include, all the specimens were osteoporotic and this could be the contributing factor for the increased motion in instrumented cases. The data of two specimens was found to be out of trend.

SIGNIFICANCE: The proposed new technique is an easy and safe procedure which allows the screws to be inserted away from the spinal cord. This procedure can be minimally invasive with less hardware and it can be cost effective compared to traditional pedicle screw system.

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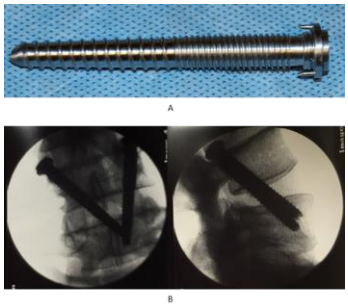

Figure 1: A) Lag Screw B) Lateral trajectory

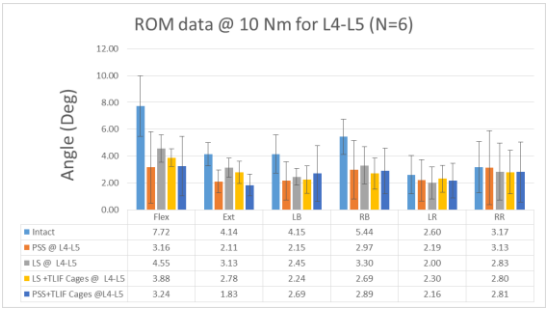

Figure 2: Mean ROM

P Values						
Compared to Intact	Flex	Ext	LB	RB	LR	RR
PSS @ L4-L5	0.022	0.009	0.002	0.009	0.039	0.925
LS @ L4-L5	0.018	0.05	0.011	0	0.073	0.321
LS +TLIF Cages @ L4-L5	0.006	0.05	0.028	0.001	0.225	0.37
PSS+TLIF Cages @L4-L5	0.022	0.005	0.05	0.002	0.449	0.286
Compared to PSS @ L4-L5	Flex	Ext	LB	RB	LR	RR
NT @ L4-L5	0.15	0.05	0.47	0.64	0.49	0.45
Compared to NT +TLIF Cages @ L4-L5	Flex	Ext	LB	RB	LR	RR
PSS+TLIF Cages @L4-L5	0.44	0.09	0.64	0.77	0.72	0.98

Table 1. P values