CHARACTERISTICS OF UNICORTICAL AND BICORTICAL LATERAL MASS SCREWS IN THE CERVICAL SPINE
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INTRODUCTION: Lateral mass plating for posterior cervical spine fusion is an effective method for the treatment of traumatic and degenerative instability. The stability of the cervical spine plating system is dependent on a number of factors. One of these factors is the strength that the screw has in terms of bony purchase. The initial description of the technique utilized bicortical screw purchase. The challenge to the surgeon is balancing what is safe versus what is biomechanically sound. The added benefit of bicortical purchase must be weighted against the increased risk of injury to nerve roots and the vertebral artery. The purpose of this study was to analyze the safety, pullout strength and radiographic characteristics of unicortical and bicortical screws within cadaveric specimens and to evaluate the influence of level of training on the positioning of these screws.

METHODS: Twenty-one cadavers, mean age 78.9 yrs, underwent bilateral placement of 3.5mm AO lateral mass screws from C3-C6 (n=168) using a modification of the Magerl technique. Intra-operative imaging was not used. The right side (unicortical) utilized only 14mm screws (effective length of 11mm) while on the left side bicortical purchase was obtained. Three Orthopedic surgeons (attending, fellow, chief resident) with varying levels of spine training performed the procedure. All spines were harvested and the screws were evaluated clinically and radiographically for their safety and zone placement (1, 2, 3). Screws were assigned “satisfactory”, “at risk” and “direct injury” with respect to the spinal cord, facet joint, nerve root and vertebral artery. Pull-out force was determined for all screws using a material testing machine. Results: The majority of screws (92.8%) were satisfactory. There were no injuries to the spinal cord. On the right side (14mm) 98.9% of the screws were “satisfactory” and on the left side (bicortical) 68.1% were “satisfactory”. There was a 5.8% incidence of direct artery injury and a 17.4% incidence of direct nerve root injury with the bicortical screws. There were no “direct injuries” with the unicortical screws. The majority of “direct injury” bicortical screws were placed by the surgeon with the least experience. There was no relationship between the safety of a screw and its zone placement. The mean pull-out force for all screws was 542.9+/−296.6N. There was no statistically significant difference between the pull-out force for unicortical (519.9+/−286.9N) and bicortical (565.2+/−306N) screws (p<0.05). There was no
significant difference in pull-out strengths with respect to zone placement.

DISCUSSION: This study addressed the issues of safety and efficacy of unicortical versus bicortical screws in the cervical spine lateral masses. It is apparent, that 14mm lateral mass screws (effective length of 11 mm) placed in a supero-lateral trajectory in the adult cervical spine, provide an equivalent strength with a much lower risk of injury than the longer bicortical screws placed in a similar orientation. Additionally, when intra-operative imaging is not utilized, the accurate and safe placement of these screws is significantly improved with experience and focused educational training in the technique.