A Novel, Simple Method to Salvage Stripped Lateral Mass Screws in the Subaxial Cervical Spine Using the Screw Sock™

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Lateral mass screws are the gold standard for achieving spinal fixation in the subaxial posterior cervical spine (C3-C7) for spinal fusion constructs. In the setting of a failed or stripped lateral mass screw, the limited amount of local host bone often precludes redirecting the screw using an alternate trajectory in order to gain satisfactory screw purchase. Further, the use of a larger “salvage” screw, a technique commonly employed in stripped thoracic and lumbar pedicle screws, is of limited utility in the posterior cervical spine as a result of loss of local bone during the initial attempt at screw insertion. Therefore, the search continues for optimal lateral mass screw salvage strategies that do not require use of a larger screw. The objective of this study was to evaluate the biomechanical performance profile of the Screw Sock™, a combination mono- and multifilament polyethylene terephthalate (PET) device that is placed between the screw and the stripped hole in an attempt to increase the interference fit and screw pullout forces.

Six female cadaveric spines (ages: 46-60; BMI: 23.9-32.3) were procured and imaged with quantitative CT to assess bone density (range: 314-433mg/cm³). C3-C7 lateral mass screw holes were prepared using the Magerl technique by a fellowship-trained spinal surgeon. Test A compared the pullout force of a stripped 3.5mm screw and a stripped 3.5mm screw augmented with Screw Sock™. Test B compared a 4.0mm screw and stripped 3.5mm screw augmented with Screw Sock™. Test C compared an intact 3.5mm screw and a 3.5mm screw augmented with Screw Sock™. Using a servohydraulic load frame, each screw was removed at a rate of 5mm/min per ASTM F543-07 and the maximum axial force was reported.

A total of 56 fixation points were available for evaluation. For Test A, the Screw Sock™ increased pullout strength compared with the stripped screw by 49.5%(102.3N vs. 152.9N, Figure 1). For Test B, Screw Sock™ achieved 84% of the pullout force of a larger 4.0mm rescue screw (86.6N vs 103.3N). When the data from Test A and B were pooled, however, Screw Sock™ increased pullout forces compared with the rescue screw by 15.8%(119.8N vs. 103.3N). In Test C, Screw Sock™ increased pullout forces compared with the intact 3.5mm screw by 14.7%(229.0N vs 199.6N, Figure 2). This simple, efficient device warrants further study as a cost-effective and highly versatile means to salvage stripped screws in the spine without needing to convert to a larger screw, or potentially as a primary screw augmentation device in patients with compromised bone quality (i.e. osteoporosis).
Figure 1. Average pullout strength for Test A

Figure 2. Average pullout strength for Test C