Transcranial Electrical Motor Evoked Potentials (tceMEP) in Anterior Cervical Discectomy and Fusion Surgery: A Comparison Study between Automated and Non-Automated Technologies

INTRODUCTION
Spinal cord injury resulting in postoperative motor deficits is a serious complication of major spine surgery. Intraoperative electrophysiologic monitoring is performed to assess the functional integrity of the spinal cord in order to recognize and avoid injury. Motor pathways have been successfully monitored using transcranial electrical motor evoked potentials (tceMEP or MEP). A novel system offers automated intraoperative monitoring capabilities that utilize the “threshold-level” alert criteria method which provides more detailed myotome-specific responses, contrasted with the conventional “presence-or-absence” technique which uses a single supramaximal stimulus to obtain responses from one or all myotomes. The automated system then displays this feedback to the end user in a simplified form. The purpose of this study was to compare the automated system to that of conventional, non-automated technology.

METHODS
This was a prospective, IRB-approved, multi-center study of subjects undergoing anterior cervical discectomy and fusion (ACDF) with MEP monitoring. The same stimulating and recording electrodes were used to ensure consistency and allow the recording to be read simultaneously from the two systems. Subjects underwent pre- and postoperative neurological exams to identify the incidence of new neurologic deficits. These findings were correlated with intraoperative changes in MEP recordings from both systems.

RESULTS
A total of 60 subjects, 28 females and 32 males averaging 50 years of age (26-71 range), underwent ACDF from November 2007 to April 2009; one at C3-4, 16 at C4-5, 38 at C5-6, 33 at C6-7, and one at C7-T1 for a total of 89 levels treated with an average OR time of 1:32 per level. There were no intraoperative complications and no new motor deficits were reported. False positives were defined as a significant increase in threshold or complete loss of all myotomes on a given extremity. A 10% false positive rate was identified for the automated system and 3% false positive rate was noted for the non-automated system; a difference perhaps due to additional myotome-specific information that is provided by the automated system. The conventional “presence-or-absence” approach may mask changes in lower-responding channels which was evident
by threshold improvements noted in 20% of automated cases and only 7% in the non-automated cases.

DISCUSSION/CONCLUSION
Though both systems delivered results that were consistent with the clinical findings, the results suggest that the automated system using the “threshold-level” alert method provides more detailed, myotome-specific information than the conventional “presence-or-absence” approach. The automated system allows for greater sensitivity and visibility not only to threshold improvements but also to an increased incidence of false positives. This study is a first step in the quantification and refinement of alarm criteria for the more sensitive “threshold-level” method of MEP monitoring.