Introduction: Prior clinical studies have reported the benefits and potential complications of anterior cervical plate stabilization, but have only to a limited extent described the changes in sagittal geometry following arthrodesis and plating. High fusion success rates have been reported for discectomy and fusion across one disc space; in contrast, long-segment (three- and four-level) arthrodesis and plating procedures have demonstrated lower clinical success rates, increased rates of hardware failure and increased pseudarthrosis rates. Using a new computer-aided measurement technique, a consecutive case retrospective analysis was undertaken to investigate the time evolution of the geometry of anterior cervical discectomy and fusion.

Methods: Sagittal alignment data were collected from lateral radiographs of 51 patients with 52 operations for single- or multiple-level anterior cervical discectomy and fusion (ACDF), both with and without anterior cervical plate stabilization. Intervertebral angulation and separation at the operated segments preoperatively, immediately postoperatively, and at long-term follow-up were measured using a computer-aided technique and the changes over time were computed.

Results: Single-level ACDF with plate stabilization lost 0.9° of the operatively-obtained lordosis postoperatively compared to 7.5° for single-level fusions with bone alone (p=0.0001). There were no significant differences in the initial geometric parameters of the surgeries (intraoperative lordosis and distraction obtained) between the two groups. In multilevel ACDF, the bottommost level of the ACDF construct was much more prone to collapse than the remaining levels (mean loss of 4.0° at the bottom level vs. a mean 0.2° increase in lordosis at the remaining levels, p<0.0001) and contained the majority of lost angulation for the entire construct.

Conclusions: The measurement method was used effectively in the presence of surgical bony decompression, degenerative disease, and cervical hardware, and allowed measurement. The results reveal increased collapse at the bottom level of multilevel ACDF constructs, where hardware failure and pseudarthrosis have been observed most often by others, and where in vitro biomechanical testing has shown early weakening and failure of plate-screw constructs. In single-level procedures and in the upper segments of multilevel procedures, anterior cervical plate stabilization helps maintain operatively
obtained segmental distraction and lordosis following ACDF. In multilevel procedures, postoperative collapse is almost entirely localized to the bottommost level.