

## **INDUCTION AND MAINTENANCE OF LORDOSIS IN MULTILEVEL ACDF USING ALLOGRAFT**

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**Purpose:** Restoration of segmental lordosis is infrequently mentioned in the literature as an important outcome of multilevel ACDF. Cervical kyphosis is a yet undermined factor in adjacent segment degeneration. A consecutive series of multilevel ACDF in which large cortical ring allografts were seated on intact bony endplates after intervertebral distraction were retrospectively reviewed to determine if restored lordosis using this technique could be maintained at followup. The series was evaluated at last followup for segmental lordosis, clinical outcome, and fusion rate, and then compared to the current literature.

**Methods:** Between 1998 and 2000, 89 patients underwent ACD for radiculopathy only. Of these 89, 40 patients (19 males and 21 females) were identified who required multilevel ACDF (with average age 52 (range 36-72)) (32 2-level, 6 3-level, 2 4-level) Oversize allograft cortical rings ((Cornerstone) (8 average graft size, range 7-10) filled with autogenous bone removed from uncovertebral osteophyctomy and/or anterior osteophyctomy were placed on intact bony endplates. Caspar pin distraction aided by an intervertebral spreader was used to induce lordosis and enable the insertion of large grafts. Distraction was released on the producing graft compression and immediate increased intervertebral segmental stiffness prior to neutralization plating. Average follow-up 24 months (range 10-44). All patients discontinued soft collars at 1 week postop. Using previously published criteria, fusion was defined as no movement of the surgically treated level on dynamic radiographs and complete trabecular bridging across both graft-vertebral body interfaces. Thus, a pseudarthrosis was present when any lucency was observed at the graft-vertebral body interface. A patient who received grafts at multiple levels and developed a pseudarthrosis at any single interface was categorized as not fused for statistical analysis. Graft collapse and subsidence were documented. Plain x-rays were evaluated for improvement and maintenance of post-op lordosis, hardware position changes, and gross graft settling. Odom's classification was used to evaluate clinical outcome.

**Results:** No patient had residual radiculopathy. All patients were rated as Excellent and Good using Odom's criteria. Lordosis improved on average 14.3 degrees (range 5 to 35) degrees post-op and was maintained at followup. Single graft-vertebral body interface lucency was found in 5 patients and therefore, by radiographic criteria, 35 of 40 fused (87%). No patient with lucency had recurrent symptoms. No adjacent segment degeneration was noted. Symptomatic relief did not depend on the presence of radiographic fusion at followup. Initial posterior cervical pain ceased within average of 3 days postop. Complications included mild, transient dysphagia and hoarseness, which resolved within a week of surgery. One patient experienced dysphagia lasting 2 months. One patient had Horner's Syndrome ipsilateral to the approach, which resolved 3 months postop. There were no infections or implant removals.

**Conclusions:** This study demonstrates that large cortical ring allografts placed on intact bony endplates facilitate the induction and maintenance of lordosis in multiple level ACDF. Although fusion rate and clinical outcome are similar to previously published studies, postoperative lordosis was improved in this series of patients. Most current ACDF studies focus on fusion rate and clinical outcome with surgical technique as the primary study variable. Restoration of cervical lordosis lost through the disc degenerative process is uncommonly mentioned as an important goal of ACDF surgery. One recent study concedes that after multiple level ACDF with autograft, the average segmental sagittal measurement was 0.4 degrees of kyphosis<sup>1</sup>. Normal cervical lordosis from C2-C7 has been mathematically estimated at 34°<sup>2</sup>.

The use of cortical allografts in ACDF avoids autogenous bone graft harvesting complications and facilitates the supply of large grafts to induce lordosis. The use of cortical Allograft is key to the success of this procedure in that it allows the utilization of large grafts to induce lordosis. Allografts have sufficient compressive strength and coupled with their seating on intact endplates, settling and collapse of the lordosed interspace during graft incorporation is eliminated. Clinical outcome was independent of radiographic fusion-a finding observed in previous studies. Recreation of cervical lordosis after multilevel ACDF has the theoretical benefit of reducing adjacent segment shear forces and possibly degeneration. Moreover, lordosis makes possible future posterior decompression for multilevel stenosis.

The determinates of spinal adjacent segment degeneration have been widely argued. Proponents of disc replacement speculate that the stress riser effect of fusion is causative. The clinical model of degenerative spondylolisthesis at L4-5 above a stiff L5-S1 supports that claim. An equally causative factor though, is that the L4-5 disc is in shear, which accelerates the process of degeneration and slip. The same process, it can be argued, occurs in the cervical spine. Until it is determined through studies of sufficiently long followup which factors are important in accelerating adjacent segment degeneration after fusion, every effort should be made to restore lordosis during ACDF.

1. Wang J, McDonough P, Endow K, et al. Increased fusion rates with cervical plating for two-level anterior cervical discectomy and fusion. Spine 2000;25:41-45

2. Harrison, D, Tadeusz J. et al Comparisons of Lordotic Cervical Spine Curvatures to a theoretical ideal model of the static sagittal cervical spine. Spine 1996 March;21(6):667-675
3. Gore, Donald R. The Arthrodesis Rate in Multilevel Anterior Cervical Fusions Using Autogenous Fibula. Spine 2001;26:1259-1263