Decompressive laminectomy for degenerative spinal canal stenosis has been a popular form of surgery and is still considered by many as gold standard in the treatment. While anterior multilevel decompression surgery with or without corpectomy has seen its ups and downs, decompressive laminectomy has continued to occupy pride of place in the treatment of degenerative spinal canal stenosis. Decompressive laminectomy involves wide removal of laminae up to the facets in the cervical spine while, in the lumbar spine, some suggest resection of at least medial half of facets to achieve adequate decompression of the neural structures. Some authors recommended opening up of the dura and sectioning of the dentate ligament, but this form of treatment did not achieve popularity and universal acceptance. Laminectomy for spinal tumors is a commonly performed surgical procedure. As this operation led to instability of the spine and deformities in a percentage of patients, several authors recommend laminotomy or replacement and fixation of the laminae. Although deformities are uncommon, laminoplasty has also been a popular form of treatment for degenerative spinal canal stenosis. In this study, the aim of treatment is to widen the spinal canal and retain stability by fixation of the laminae using a variety of implants.

The principle of treatment by laminectomy is based on the premise that degenerative spondylosis leads to secondary stenosis of the spinal canal; that is a result of osteophyte formation anteriorly and hypertrophy of the ligamentum flavum posteriorly to the spinal cord in the cervical and dorsal spine and dural sac in the lumbar spine. The primary pathogenesis of spondylosis is generally focused to disc space reduction, disc degeneration, or reduction in the water content of the disc. Computerized tomography scan and magnetic resonance imaging show the degenerative changes and cord affection and its circumferential "squeeze" vividly. The stenosis of the canal and the compression of the neural structures are clearly obvious on imaging. Decompressive laminectomy and widening of space for the cord to "pulsate" or "breathe" freely is an accepted aim of surgery. Most crucial is the conventional understanding that degeneration of the spine and its neurological consequences are secondary to unwanted intrusions in the spinal canal that result in reduction in the space available to the neural structures. While laminectomy forms a relatively easy and effective solution, several authors believe that the primary disease process namely the degenerated disc and the osteophytes are anterior to the cord, and hence anterior decompressive surgery is more effective and lasting. Anterior decompression by multiple level discectomy and osteophyte removal has been identified to be an effective surgical modality and has
been employed world over. Some authors find usefulness of single or multiple level corpectomy to achieve wide decompression of the cord. The issue of instability has been traditionally considered to thwart the immediate postoperative or long-term destabilizing effects of bone removal, either by anterior or by the posterior surgical routes. In general, degenerative spondylotic disease is considered to be a “stable” disease. Some authors believe that the osteophytes and the ligamentum flavum hypertrophy naturally increase the stability of the spine and the stability of the spine is more than normal or is a nonissue in the management. As the disease is stable, decompression of the neural structures by removal of bone and soft tissues either from the front or behind forms the “backbone” of all treatment. A variety of implants has been employed during surgery by both anterior and posterior routes to maintain the stability of the spinal column.

An emerging concept in the management of degenerative spinal disease is the understanding that instability of the spine could be a major and primary initiating factor or the nodal point of pathogenesis of the entire process of spinal degeneration. The instability occurs at the most mobile point of the spinal segment, namely the facets. The muscles of the nape of the neck and back or the extensor muscles support the spine, affect the movements, maintain an erect standing posture and also assist in keeping the spinal elements apart. Age-related or disuse or misuse-related weakness of the muscles leads to “vertical” spinal instability that results in telescoping of the spinal segments. The instability occurs at the facet joints and considering their oblique profile it is difficult if not impossible to decipher the facetal overriding on imaging. Vertical instability results in buckling of the ligamentum flavum, buckling of the posterior longitudinal ligament that ultimately results in osteophyte formation and reduction in the disc space height. Apart from these named ligaments, buckling occurs circumferentially in all the ligaments that cross from one vertebra to the other across the disc, facets, and laminae. Reduction in the root canal and spinal canal height are direct consequences of the vertical instability of spinal segment. Essentially, the features of cord compression by osteophyte and ligamentum flavum seen on imaging are secondary effects of a less obvious, but the primary pathology that is located laterally in the facets. In our earlier publications on the subject, we mentioned that the secondary responses of osteophyte formation, ligamental buckling, and disc space reduction might be protective in nature, rather than pathological in effect.

The spinal cord has remarkable resilience and elasticity. In a chronic or longstanding situation, it can tolerate significant distortion, deformation, and destruction. Such spinal neural capabilities are obvious in situations of large benign tumors that grow over several years and flatten the spinal cord into a thin filament without significantly affecting its function. Similarly, in longstanding or chronic situations with syringomyelia, the cord substance can be reduced to a membrane, and the person may have only marginal clinical consequence. More than the compression or deformation, it is repeated micro-injuries or abnormal, excessive movements that result in neurological deterioration. Essentially, it means that deformation that is, obvious on imaging in cases with degenerative spondylitis is neither the primary pathological event nor it is the cause of symptoms. Instability of the spine that primarily occurs at its main and most mobile spot at the facets results in abnormally excessive movements that cause symptoms by repeated microtrauma. Essentially, it means that the aim of surgery may not be restoration of the cord bulk by its decompression but blocking the abnormal movements and aim for stabilization.

We had earlier identified that distraction of the spinal segments by placement of spacers within the facetal articulation results in or have the potential for reversal of all the known and visible consequences of spinal degeneration. Facetal distraction resulted in an immediate widening of the spinal and root canal and unbuckling of the ligamentum flavum and has the potential for reduction in the sizes of the osteophyte by introducing stretch over the posterior longitudinal ligaments. We also identified an increase in the disc space height following facetal distraction and an increase in its “water” content in the immediate postoperative phase. Facetal distraction restored the anatomical distortions and stabilized the facets.

The operation ultimately aimed for arthrodesis of the spinal segment. In essence, stabilization and decompression could be simultaneously achieved without resorting to removal of any part of the bone, ligament, or disc. Moreover, the operation is remarkably straightforward, simple, and easy to perform and is safe for the cord, vertebral artery, and the roots.

As we mature in our understanding of spinal degeneration, we realize further that instability is the key or the only pathological factor. Our current policy is treating multilevel spinal degeneration by only stabilization without any attempt at decompression or even distraction. Transarticular facetal screw stabilizes the spine at the site of pathology and the fulcrum of its movements, and moreover, the screw is implanted in the strongest part of the bone. The operation is safe and simple and provides remarkable stability. Our remarkable clinical results suggest that the policy of treatment of spinal degeneration by stabilization and not by decompression is the most rational and effective way of treatment. Although there can be a reasonable postoperative outcome following decompressive laminectomy, the operation is wrought with a potential of complications and delayed neurological worsening. We are convinced that the normally present and divinely designed anatomical structures of bone and ligaments and the disc should be preserved. Restoration of muscle strength and keeping them healthy and young are the most effective ways to avoid spinal degeneration.

REFERENCES

1. Fager CA. Results of adequate posterior decompression in the relief of spondylotic cervical myelopathy. J Neurosurg 1973;38:684-92.
2. Kurokawa R, Kim P. Cervical laminoplasty: The history and the future. Neurol Med Chir (Tokyo) 2015; 55: 529-39.
3. Goel A, Deogunkar M. Thoracic laminoplasty using spinous processes. Neurol Med-Chir (Tokyo) 1996; 36: 9: 659-661.
4. Goel A. Vascularised pedicled laminoplasty. Surg Neurol 1997; 48: 442-445.
5. Mummaneni PV, Kaiser MG, Matz PG, Anderson PA, Groff MW, Heary RF, et al. Cervical surgical techniques for the treatment of cervical spondylotic myelopathy. J Neurosurg Spine 2009; 11: 30: 1-11.
6. Cloward RB. The anterior approach for removal of ruptured cervical disks. J Neurosurg 1958; 15: 602-17.
7. Faldini C, Leonetti D, Nanni M, Di Martino A, Denaro L, Denaro V, et al. Cervical disc herniation and cervical spondylosis surgically treated by Cloward procedure: A 10-year minimum follow-up study. J Orthop Traumatol 2010; 11: 99-103.
8. Goel A. Vertical facetal instability: Is it the point of genesis of spinal spondylotic disease? J Craniovertebr Junction Spine 2015; 6: 65-7.
9. Goel A. Facet distraction-arthrodesis technique: Can it revolutionize spinal stabilization methods? J Craniovertebr Junction Spine 2011; 2: 1-2.
10. Goel A. Facet distraction spacers for treatment of degenerative disease of the spine: Rationale and an alternative hypothesis of spinal degeneration. J Craniovertebr Junction Spine 2010; 1: 65-6.
11. Goel A. Not neural deformation or compression but instability is the cause of symptoms in degenerative spinal disease. J Craniovertebr Junction Spine 2014; 5: 141-2.
12. Goel A, Shah A. Facet distraction as treatment for single- and multilevel cervical spondylotic radiculopathy and myelopathy: A preliminary report. J Neurosurg Spine 2011; 14: 689-96.
13. Goel A, Shah A, Jadhav M, Nama S. Distraction of facets with intraarticular spacers as treatment for lumbar canal stenosis: Report on a preliminary experience with 21 cases. J Neurosurg Spine 2013; 19: 672-7.
14. Goel A. Is it necessary to resect osteophytes in degenerative spondylotic myelopathy? J Craniovertebr Junction Spine 2013; 4: 1-2.
15. Goel A. ‘Only fixation’ as rationale treatment for spinal canal stenosis. J Craniovertebr Junction Spine 2011; 2: 55-6.
16. Goel A, Nadkarni T, Shah A, Rai S, Rangarajan V, Kulkarni A. Is only stabilization the ideal treatment for ossified posterior longitudinal ligament? Report of early results with a preliminary experience in 14 patients. World Neurosurg 2015; 84: 813-9.
17. Goel A, Shah A. Reversal of longstanding musculoskeletal changes in basilar invagination after surgical decompression and stabilization. J Neurosurg Spine 2009; 10: 220-7.
18. Tan LA, Gerard CS, Anderson PA, Traynelis VC. Effect of machined interfacet allograft spacers on cervical foraminal height and area. J Neurosurg Spine 2014; 20: 178-82.
19. Shah A. Morphometric analysis of the cervical facets and the feasibility, safety, and effectiveness of Goel inter-facet spacer distraction technique. J Craniovertebr Junction Spine 2014; 5: 9-14.
20. Satoskar SR, Goel AA, Mehta PH, Goel A. Quantitative morphometric analysis of the lumbar vertebral facets and evaluation of feasibility of lumbar spinal nerve root and spinal canal decompression using the Goel intraarticular facet spacer distraction technique: A lumbar/cervical facet comparison. J Craniovertebr Junction Spine 2014; 5: 157-62.
21. Goel A. Alternative technique of cervical spinal stabilization employing lateral mass plate and screw and intra-articular spacer fixation. J Craniovertebr Junction Spine 2013; 4: 56-8.
22. Goel A, Goel AA, Satoskar SR, Mehta PH. Double insurance transfacetal screws for lumbar spinal stabilization. J Craniovertebr Junction Spine 2014; 5: 85-7.