Short Communication

International Journal of Neurology and Neurosurgery
Volume 8 Number 1, January - June 2016
DOI: http://dx.doi.org/10.21088/ijnns.0975.0223.8116.4

Spinal Degeneration: Evaluation of Role of Intra-Articular Interfacetal Spacers

Atul Goel

Abstract

Spinal degeneration has been conventionally attributed to disc space reduction related to disc degeneration. The author has recently speculated that the process of degeneration is an outcome of muscle weakness that results in facetal telescoping and overriding. All the events observed in cases with spinal degeneration are secondary to this event and are probably protective in nature. Facetal distraction using interfacetal or intra-articular spacers can result in reversal of the facetal over-riding and all other secondary spinal events in cases with spondylotic spinal degeneration.

Keywords: Interfacetal Spacers; Facet Distraction; Facetal Over-Riding; Goelfacetal Spacers.

Recent understanding of the fact that spinal degeneration or spondylosis is a result of spinal instability has the potential of changing the existing treatment protocol [1-5]. The focus of treatment has now shifted from decompression or removal of bone, disc, ligaments and osteophytic elements to stabilisation and aiming for arthrodesis of affected spinal segment [1-5]. This paradigm shift of basic conceptual understanding has a revolutionising effect on the treatment strategies adopted by spine surgeons throughout the world.

The understanding of the spinal mechanics and pathology has been 'disc-centric' for a long time. This is because of its large size and the possibility of its evaluation even by its non-visualisation on plain radiographs. The disc has been considered to be a major weight bearing 'joint' that over the years suffers the stresses and strains of weight and movement. Although the role of facets in the weight bearing and in movements has been evaluated, due to its relatively small size and the difficulties in its radiological assessment even by modern computer based imaging its overall role seems to be under-evaluated and under-valued. Location in the posterior spinal axis in relationship to the principle paraspinal muscles that form the bulk of muscles of spine make them the prime movers and initiators of spinal movements and activity. Muscles of the nape of the neck and paraspinal muscles have a role in maintaining erect standing human posture. Vertical spinal instability that is manifested by telescoping of the spine and listhesis or slipping of the superior facet over the inferior facet at the affected spinal level is a result of weakness of these muscles due to life long strain, abuse and disuse [1-5]. Although the non-compressible fluid contents of the intervertebral disc makes it a strong point in the spinal axis, lack of significant muscle bulk around its circumference suggests that the pull and push of muscles is not as significant in the intervertebral body zone as it is in the interfacetal zone. On the basis of our evaluation, it appears that the paraspinal muscle conduct the movements primarily at the interfacetal joint rather than at the intervertebral body joint. We had earlier speculated the role of odontoid process in conduct of movements at the atlantoaxial joint [6]. We observed that all the movements in the region are conducted at the large atlantoaxial facet joints and odontoid process acts to guide, direct and control these movements. On similar lines, we conclude that all spinal movements occur at the facets joints and are controlled and directed by the disc. Like the odontoid process in the craniovertebral junction, discs are the brain behind the spinal movements that occur in the facets. Essentially, it means that the facets are more prone to strain and stresses of longstanding

Author's Affiliation: Professor and Head, Department of Neurosurgery, K.E.M. Hospital and Seth G.S. Medical College, Parel, Mumbai-400012, India.

Reprint Request: Prof. Atul Goel, Professor and Head, Department of Neurosurgery, K.E.M. Hospital and Seth G.S. Medical College, Parel, Mumbai-400012, India.
E-mail: atulgoel62@hotmail.com

movements and weight bearing than the disc. The oblique profile of the facets makes them prone to telescoping when the muscles become weak with stresses and strain of age. The conventional and accepted theory is that spinal degeneration starts with reduction of the water content of the disc resulting in reduction in its height. However, it appears that vertical spinal instability results in over-riding of the facets and secondary reduction in the intervertebral height that includes disc space reduction. Facetal over-riding or listhesisis the primary event in spinal degeneration and all other events are secondary and possibly 'protective' in nature [5]. Retrolisthesis of the facet has been a recognised entity. However, it was considered to be a secondary effect to disc space reduction. Facetal hypertrophy has been identified for a long time and has been incriminated to be a part of degenerative changes secondary to disc space reduction. Facetal 'hypertrophy' is a result of facetal overriding and buckling of the intefacetal ligaments. Buckling of the circumferential interspinal ligaments initiate a 'periosteal reaction' and osteophytic bone formation in the entire intervertebral bone complex [7]. Osteophytes are formed in relationship with all intervertebral ligaments that include interfacetal ligaments, interspinous ligaments, ligamentum flavum and posterior longitudinal ligament. The osteophytes in relation to posterior longitudinal ligaments are most prominently observed on conventional plain radiographs and computer based imaging. The entire understanding of spinal degeneration was disc centric and posterior osteophyte based as both these events were more obvious on plain radiographs. The understanding existed and matured over decades and is engrained into the conventional teaching of the subject. It has been generally understood that osteophyte formation is secondary to reduction in the disc space height and separation of the posterior longitudinal ligament from the posterior surface of the vertebral body. The indentation of the osteophyte into the spinal cord has been generally recognised to be the primary pathological observation and presumed to be the cause of all symptoms. Ligamentum flavum buckling and thickening and hypertrophy are frequently associated with spinal degeneration. Buckling of these ligaments and their indentation into the posterior surface of the cord are other events that have guided the surgical decision making process. The nodal point of pathogenesis of spinal degeneration is significantly different from disc that is anterior, to facets that are posterior to the middle of spine.

Compression and distortion is generally well tolerated by the spinal neural structures particularly when the events are longstanding. Large benign intraspinal tumors and syringomyelia can be associated with remarkably minimal symptoms for a long time [8]. In spinal degeneration, the events of degeneration progress over several months and years and the neural distortions due to ostophytes and ligaments flavum thickening and the adjoining effects on spinal cord are clearly observed on magnetic resonance imaging. However it appears that instability of the spine and repeated micro-trauma to the neural structures are the principle cause of symptoms, rather than the distortions and compression observed on imaging [3].

We observed that restoration of facetal alignment and height by implanting inter-facet intra-articular spacers reverses the entire spectrum of changes that are observed in the cases with spinal degeneration [1,2,9-12]. The very fact that all changes of spinal spondylosis can be reversed by a single surgical step of facetal distraction essentially focusses the pathogenesis to this nodal point. The treatment that focussed on 'decompression' of the nerves and cord is now focussed on stabilisation and realignment. Neural indentation and compression was considered to be the primary cause of symptoms and removal of the indentation was the accepted form of solution. The process of decompression resulted in destabilizing effects of the spine and need for stabilisation was considered necessary. Essentially, stabilisation was not the primary treatment but was done as the surgical process of decompression resulted in instability. Our concept suggests that instability is the issue in degenerative spinal degeneration and stabilisation is the treatment.

As we mature further in the understanding of issues related to spinal degeneration, we have observed that spinal stabilisation more than spinal realignment is the prime aim of surgery. Interfacetal spacers have the potential of both realignment of the spine and firm stabilisation and provides a solid ground for arthrodesis, and is arguably the best form of treatment for spinal degeneration. However, only stabilisation of the spine can also be a rational and philosophical method of treatment [13-17].

Atlantoaxial joint is the most mobile and active joints of the body. However its structural formation that allows circumferential movements also subjects it to the possibility of instability. The instability at the atlantoaxial joint is less under-recognised, under-evaluated and under-treated. In cervical spinal degeneration, the general evaluation and treatment begins at C6-7 and C5-6 levels and ends superiorly at C2-3 levels. On the basis of our evaluation we have concluded that atlantaoxial instability is frequently associated with multi-level cervical spinal

degeneration [18-20]. Ignoring the presence of atlantoaxial instability and inappropriately treating it can be a major cause of failure of treatment. Atantoaxial instability is frequently associated with cervical spinal degeneration. The flat and rectangular profile of facets of atlas and axis also allows easier evaluation of instability at atlantoaxial joints.

References

1. Goel A: Facet distraction-arthrodesis technique: Can it revolutionize spinal stabilization methods?J Craniovertebr Junction Spine. 2011; 2(1): 1-2.
2. 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(2): 65-6.
3. Goel A. Not neural deformation or compression but instability is the cause of symptoms in degenerative spinal disease. J Craniovertebr Junction Spine. 2014; 5(4): 141-2.
4. Goel A: 'Only fixation' as rationale treatment for spinal canal stenosis.JCraniovertebr Junction Spine. 2011; 2(2): 55-6.
5. Goel A. Vertical facetal instability: Is it the point of genesis of spinal spondylotic disease? J Craniovertebr Junction Spine. 2015; 6(2): 47-8.
6. Goel A: Treatment of odontoid fractures. Neurol India 2015; 63 (1): 7-8.
7. Goel A. Is it necessary to resect osteophytes in degenerative spondylotic myelopathy?J Craniovertebr Junction Spine. 2013; 4(1): 1-2.
8. Goel A: Is syringomyelia pathology or a natural protective phenomenon? J Postgrad Med. 2001; 47: 87-8.
9. Goel A, Shah A: Facetal distraction as treatment for single- and multilevel cervical spondylotic radiculopathy and myelopathy: a preliminary report. J Neurosurg Spine. 2011; 14(6): 689-96.
10. 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 casesJNeurosurg Spine. 2013; 19(6): 672-7.
11. 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(1): 9-14.
12. 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 intraarticularfacetal spacer distraction technique: A lumbar/cervical facet comparison.JCraniovertebr Junction Spine. 2014; 5(4): 157-62.
13. Goel A, Nadkarni T, Shah A, Rai S, Rangarajan V, Kulkarni A.Is only stabilization an ideal treatment of OPLL? Report of early results with a preliminary experience with 14 cases.WorldNeurosurg. 2015; 84 (3): 813-9.
14. Goel A.Only fixation for lumbar canal stenosis: Report of an experience with seven cases.JCraniovertebr Junction Spine. 2014 Jan; 5(1): 15-9.
15. Goel A. Only fixation for cervical spondylosis: Report of early results with a preliminary experience with 6 cases. J Craniovertebr Junction Spine. 2013 Jul; 4(2): 64-8.
16. Goel A. Spinal fixation as treatment of ossified posterior longitudinal ligament. JCraniovertebr Junction Spine. 2015; 6(3): 99-101.
17. Goel A: Can decompressive laminectomy for degenerative spondylotic lumbar and cervical canal stenosis become historical? JCraniovertebr Junction Spine. 2015; 6(4): 144-6.
18. Goel A. Is atlantoaxial instability the cause of "high" cervical ossified posterior longitudinal ligament? Analysis on the basis of surgical treatment of seven patients. J Craniovertebr Junction Spine. 2016 Jan-Mar; 7(1): 20-5.
19. Goel A. Atlantoaxial instability associated with single or multi-level cervical spondylotic myelopathy. J Craniovertebr Junction Spine. 2015 Oct-Dec; 6(4): 141-3.
20. Goel A. Posterior atlantoaxial 'facetal' instability associated with cervical spondylotic disease J Craniovertebr Junction Spine. 2015 Apr-Jun; 6(2): 51-5.