CASE STUDY

A Structural Approach to Post-Surgical Laminectomy: A Case Study

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ABSTRACT

Objective: Case report of a patient, having persistent low back and leg pain following a L4-L5 surgical laminectomy, who underwent Clinical Biomechanics of Posture® (CBP®) protocol designed to correct postural distortions.

Clinical features: A thirty-five year-old male suffered from low back/leg pain following a work injury despite having a lumbar spine laminectomy 6 months prior to chiropractic care. Radiographic analysis revealed a 16mm left lateral thoracic translation and a 47mm forward head translation with loss of the cervical lordosis. Generalized decreased lumbar range of motion and multiple positive orthopedic and neurological tests were present.

Intervention and Outcome: The patient received 36 treatments, utilizing CBP® protocol, over the course of 12 weeks with total correction of a thoracic translation, as well as a significant reduction in forward head posture, resulting in alleviation of positive orthopedic tests. Post examination at 9 months indicated that the improvements in thoracic translation, forward head posture, and cervical lordosis had been maintained. The changes in structure and function appear to be related to the correction of both the thoracic and cervical postural aberrations and the concomitant reduction in the pons-cord tract pathological tension.

Conclusion: A post-surgical laminectomy patient was successfully treated with CBP® protocol, achieving a significant reduction in symptoms not obtained following recent surgery. Normalization of posture resulted in the elimination of positive orthopedic and neurological tests. A 9-month follow-up examination revealed preservation of both the postural correction and patient health and well-being. These results indicate that the correction of thoracolumbar and cervical deformity following surgical laminectomy is achievable and may be a desirable clinical outcome.

Key Indexing Terms: *Post-Surgical Laminectomy, Lumbar Traction, Trunk List, Thoracic Translation, Chiropractic Adjustment, Subluxation.*

Introduction

Lumbar disc herniations and lumbar spinal stenosis are the two most frequent reasons for lumbar surgery.[1] Using the National Spine Network database for patients with back and neck problems from January 1, 1995 to June 31, 1998, Levy et al.[2] reported that 14% (2,878/21,195) were diagnosed with lumbar disc herniation and 18% (3,801/21,195) for lumbar spinal stenosis. Despite the fact that disc herniations have a tendency to resolve with time,[3] neurological symptomatology often dictate immediate surgical decompression intervention for the purpose of removing abnormal nerve root or spinal cord impingement.[4]

Selection of appropriate surgical procedures to decompress the neural elements is made by determining the location and type of impinging source, this having heavy reliance on advanced imaging. A general rule of surgery is that when the pressure is anterior, the decompression of choice is anterior; alternatively, when the pressure is posterior, the decompression of choice is posterior.[4] However, regarding the lumbar spine, the majority of times decompression of neural elements is achievable by the simpler posterior approach. Thus, for anterior midline lesions, such as herniated discs, the common guideline in the 1980s and 1990s was for multiple posterior laminectomies,[4,5]

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while in 2000, Nachemson and Jonsson[6] stated that there is no clear scientific evidence for laminectomy. However, they recommended discectomy and chemonucleolysis for patients with lumbar herniations and long-term sciatica.[6]

In the 1990s, microsurgery became the standard of care for decompression. In 2000, Kambin and Savitz[7] listed the 4 main factors that give microsurgery an advantage over macrosurgery. These were (1) one-hour operative time, (2) negligible blood loss, (3) avoidance of significant scarring, and (4) anterolateral fenestration of the annulus for continuing relief of intradiscal pressure and nerve root decompression.

This case report will describe the successful treatment, using CBP® structural rehabilitation methods, of a patient having post-surgical double laminectomy of the L4 and L5 vertebrae suffering from persistent chronic leg and back pain.

Clinical Features

At the time of his first chiropractic visit, a 35 year-old male complained of low back and leg pain. These symptoms were a direct result of a work injury sustained 11 months prior to his first chiropractic visit. Immediately following his injury he reported having constant, severe low back pain with numbness along his posterolateral left leg into his foot and occasional numbness/ache in the right leg. Due to the severity of his condition, 5 months after the initial accident he consulted an orthopedic surgeon who diagnosed him with L4-5 and L5-S1 disc herniations. He subsequently underwent a double laminectomy to the fourth and fifth lumbar vertebrae on March 27, 2001, and was prescribed a narcotic analgesic pain medication (Vicodin), that he took twice daily since the operation.

At his initial chiropractic examination, the patient presented with low back and left leg pain. The pain was rated on a numerical rating scale (NRS) as 8/10 (0 = no pain; 10 = bed ridden), and scoring of the Oswestry chronic low back pain disability index revealed a 74% disability.[8] All lumbar range of motion values were limited. Only 15 degrees of lumbar flexion was possible, while extension could not be performed. Muscle strength testing revealed weakness of the left leg flexors (4/5); all others were normal. Reflexes were normal except the left achilles reflex could not be elicited. Dermatome testing revealed a lack of pricking sensation of the left L5 dermatome. Positive orthopedic tests included left leg Minor's sign, Kemp's sign, toe walk, and straight leg raiser at 45°. Milgram's test was positive as was the well-leg raiser at 45°. All other orthopedic tests were normal. Posture evaluation[9] revealed the following: forward head translation (+TzH), left head translation (+TxH), left thoracic translation (+TxT), posterior thoracic translation (-TzT), right thoracic lateral bending (+RzT), and left posterior pelvic rotation (+RyP). Figure 1A depicts his posture in the AP view.

Radiographic evaluation was determined to be free of pathology and demonstrated an 'osteopenic hole' indicative of the double laminectomy at the L4 and L5 levels. Radiographic mensuration procedures[10-12] demonstrated significant forward head posture (47mm), left head translation (14mm), reduced cervical curve (19°), reduced lumbar curve (23°), and left thoracic translation (16mm). Figure 2A demonstrates the initial AP lumbar radiographic view.

Intervention and Outcome

The patient was put on Clinical Biomechanics of Posture® protocol (CBP®) that utilizes mirror image adjustments, exercises, and traction procedures.[13] During the first 3 weeks, some lumbar and lower thoracic manipulations were provided. The lumbar manipulation was performed unilaterally only with the right hip down on the table (side posture), since the patient presented with a left posteriorly rotated pelvis compared to the feet. Regarding the patients' abnormal postures as aforementioned, mirror image adjustments were performed on an OMNI drop table. Clinically, the forward head translation with reduced cervical curvature, as well as the lateral thorax translation postures were chosen as the major postures to be targeted with the full CBP® protocol including mirror image exercises, and traction procedures as well as the postural adjustments that were given for all deviated postures.

The patient began CBP® structural rehabilitation protocol from the first visit.[13] On the initial visit, radiographs were obtained. Brief re-evaluation examinations were performed every 12 visits. Follow-up radiographs were taken, including AP lumber and Lateral cervical, at 12 weeks and 36 weeks after initial presentation. Examination results will be reported from these two re-evaluation dates.

The first 12 weeks consisted of 3 visits per week; all abnormal postures were mirror image adjusted. Both head retraction and right thoracic translation isometric exercises were performed in-office. Cervical traction consisted of extension-compression type (originated by Dr. Dwight DeGeorge, Target Force, Saugus, MA) where the patient laid supine with his head extending posteriorly over the edge of the inclined backrest.[14] Thoracic translation traction consisted of pure right lateral translation traction (originated by Dr. Robert Berry, Berry Translations, Montour Falls, NY) where the patient lay supine, their torso and pelvis were secured to separate table sections and the torso section was then slid laterally to the right according to patient tolerance[15] (Figure 1B). Traction durations began with a few minutes, progressing to 20 minutes for maximum ligamentous creep.[16]

After 4 weeks of treatment, on and prior to the 36th visit, a re-exam was performed including both an AP lumbar and a lateral cervical radiograph. The patient's chief complaint was left lateral calf pain, and was reported to be a 2/10 on the NRS. Scoring of the revised Oswestry chronic low back pain disability questionnaire indicated a 40% or 'moderate disability' rating. Lumbar range of motion demonstrated an ability of the patient to perform extension, where flexion was limited to 70°. All originally positive orthopedic exams were now negative. The achilles reflex was now able to elicit, though not normal (1/2). Dermotome testing demonstrated an improved sensation to 'pricking' in some areas along the left L5 dermatome. Radiograph analysis indicated that the forward head translation was reduced from 47mm to 43mm, the cervical curve increased from 19° to 29°, and the atlas plane line increased from 16 degrees to 20°. Thoracic translation was corrected from 16mm left to 1mm to the right (Figure 2B).

Following the 4-week exam, there were 72 more treatments given during the succeeding 6 months. The final exam was performed at the end of the ninth month; this resulted in a total of 108 treatments. The same protocol used during the first 4-week treatment period was used during the succeeding 6-months with the addition of thoracic extension exercises that were performed utilizing a 'roman chair' (10-15 repetitions), the lateral thorax translation traction was no longer performed because of correction, and cervical traction was changed to treat the anterior head translation on the extension-compression table.

This consisted of the supine positioned patient hanging their head off the end of a horizontal bench, where the time and weight were incrementally increased to the maximum achievement of 8 pounds for 12 minutes. At the 9-month exam the patient reported that his chief complaint was low back stiffness and was rated as a 0/10 at the time of the exam. Scoring of the revised Oswestry chronic low back pain disability questionnaire revealed a 24% or 'moderate disability' rating. Lumbar range of motion was within normal limits with a report of stiffness on extension. All orthopedic tests were negative. The achilles reflex was still reduced on the left (1/2) and testing of the left L5 dermatome revealed the 'prick' sensation to be present throughout the entire dermatome, however, this remained somewhat less of a feeling than the right leg.

Significantly, the patient no longer required analgesic narcotic pain medications. Lateral cervical radiograph analysis revealed a reduction in forward head translation to 36mm, a further increase in the cervical curve to 32°, and an atlas plane line of 23° (Figure 3). AP lumbar x-ray demonstrated the maintenance of the correction of the presenting lateral thoracic translation as it measured 1mm to the right (Figure 2C).

Discussion

Even though micro-surgery is considered standard procedure since the 1990s,[7] this patient had a double laminectomy in 2001. As mentioned, surgical guidelines suggest anterior decompression for anterior pressure,[1] however, a contradictory guideline exists for the lumbar spine, where "in the large majority of situations, the neural elements can be decompressed through a posterior approach."[4] However, there are significant numbers of post-surgical patients treated by posterior decompression for lumbar disk herniations that fail to respond to treatment. As Bennet and McCallum[17] found, laminectomy treatment for abnormal neurologic, histologic, and electrophysiologic changes in cats subject to experimental tumors, was only successful for posterior implants; not for anterior cord implants.

Our case illustrates the unsuccessful outcome in a patient receiving multilevel laminectomies for the treatment of lumbar disc herniations. Perhaps the occurrence of unsuccessful outcomes in those enduring the standard laminectomy treatment for posterior disc herniations can be explained through understanding the biomechanics of the nervous tissue.

The brainstem, spinal cord, cauda equina, and nerve roots may be collectively referred to as the *pons-cord tissue tract*. The static and dynamic characteristics of the pons-cord tissue tract constitute a self-contained compartment of biomechanics.[18] This results from the way the cord is maintained within the canal by its many attachments: from above (being continuous with the brainstem), from below (sacral and coccyx attachment through the cauda equina), as well as throughout its length (intermittent dural attachments to the posterior longitudinal ligament, ventral attachments of the nerve root sleeves exiting the intervertebral foraminae, and bilateral dentate ligament attachments ranging from the upper cervical region down to the level of L1). Under relatively normal static posture without pathological processes, dynamics produce normal or 'physiological' tension as transmitted by its constraining elements, and without neurological compromise.[19]

Pathological processes including disc herniations, if severe enough, interfere with normal pons-cord biomechanics,[20-21] where the normal tension transmitted by the pons-cord restraining elements may then be referred to as 'pathological' tension.[22] Independent but equally as significant, abnormal spinal postures may create adverse tension within the neural elements as well. In fact, Stein found that "in a deformed kyphotic cervical spine, even a 'normal' amount of movement in the cervical spine may cause compression of the spinal cord."[23] This is because the spinal cord adopts the length of the bony canal.[24] Further, as suggested by Harrison et al.[25] static neutral postures or dynamic adopted combinations of postures; that is, rotations and translations of the head, thorax, or pelvis,[9] would exert larger stresses and strains onto the pons-cord tract. Thus, it is deduced that the combination of pathological processes and aberrations in posture may disrupt normal CNS biomechanics, and at levels below that at which either factor would elicit neurological symptoms alone.

Therefore, the successful outcome resulting from postural correction following unsuccessful surgical decompression may now be conceived. In this patient surgical decompression was rendered to the area where disc herniations where suspected to be impinging the nerve roots producing neurologic deficits. This treatment may have reduced local intermedullary pressure,[26-28] though not sufficiently enough to reduce it to the level that would alleviate neurologic impairment. Postural correction towards a more normal spinal alignment as achieved in the lumbar spine in the frontal plane, and the cervical spine in the sagittal plane probably reduced the pathological tension in the pons-cord tract sufficient enough to surpass some pathological threshold in pons-cord tension, alleviating neurological symptomatology.[25,29]

On the surface, the large number of treatments might be a concern. However, it is noted that there was a progressive improvement in the patient's condition over the entire duration of care. Additionally, in this case of failed surgery and extreme chronic pain with numbness to the foot (VAS = 8/10), there is a cost comparison that is important to note. In 1999, Nelson et al.[30] stated, "low back disease ranks third as a reason for surgical procedures in the USA." They also stated that the average lumbar fusion (before 1999) cost $168,732 and the average lumbar laminectomy cost $82,614.

These figures do not include the minimum of 15% failure rates for spinal surgeries, which is exactly what this patient

experienced. Instead of another surgery and ongoing disability that Nelson et al.[30] claim can reach as high as $500,000 per case, this patient had 108 conservative chiropractic visits that totalled $4,188. This conservatively equates to about five percent ($4188/$82,614 = 5%) of the costs of laminectomy surgery as the surgical costs could escalate. Thus, the chiropractic cost could be less than one percent ($4188/$500,000 = 0.8%) of traditional medical care. In fact, "substantial cost savings are possible by first attempting aggressive" conservative care.[30] In this case, the costs and results speak for themselves: the patient achieved a VAS = 0/10, with a clinically significant decreased Oswestry disability index from 74% to 24% with a fraction of the cost of spine surgery.

Since there were multiple treatment parts of the CBP® protocol given to the current patient, it is not known which specific treatment may have resulted in the postural correction and subsequent symptom alleviation. Despite the fact that manipulation was not given to this patient after 3-weeks of care, it is known that manipulation alone typically does not cause structural change by altering spinal alignment,[31-34] nor has exercise proven effective for correcting human posture.[35] The combination of mirror image adjusting, exercises and traction, however, has proven to correct cervical and lumbar spine deformities and head and thorax postures in both the lateral and frontal planes.[13-15,32,36-38] Of these, it is likely that the mirror image traction resulted in the postural correction in this patient as mirror image traction procedures stress the ligamentous tissues to plastic deformation,[16,39] presumably creating a new postural position toward a more normal postural alignment. However, without further study it is unknown precisely which aspect of the CBP® protocol, and to what extent the mirror image adjustments, exercises, and traction procedures contribute to posture and spinal correction.

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Figure 1. This patient had a left lateral translation posture of the thoracic cage relative to the pelvis (also termed trunk list). The left photograph illustrates this posture, which is characterized by the side-shift of the thoracic cage and the extra space between the elbow and the pelvis being larger on the left. In the right photograph, the CBP mirror-image postural traction procedure is illustrated, i.e., left thoracic translation posture is stressed into right translation posture.

Figure 2. On the left is the initial AP lumbar radiograph of a 35 year-old male. This patient had a post-surgical double laminectomy of the L4 and L5 vertebrae and suffered from persistent chronic leg and back pain. The L4 and L5 surgical laminectomy is evident by the 'osteopenic hole' on the film. The translation (horizontal) distance from the estimated center of mass of the 12th dorsal vertebra to the vertical axis line bisecting the second sacral tubercle is 16mm left of mid-line. The middle photograph is of the 3-month follow-up AP lumbar radiograph, which shows a near perfect AP alignment after chiropractic treatment with CBP® methods. The right photograph is the 9-month follow-up AP radiograph, which demonstrates maintenance of the correction found on the 3-months follow-up radiograph.

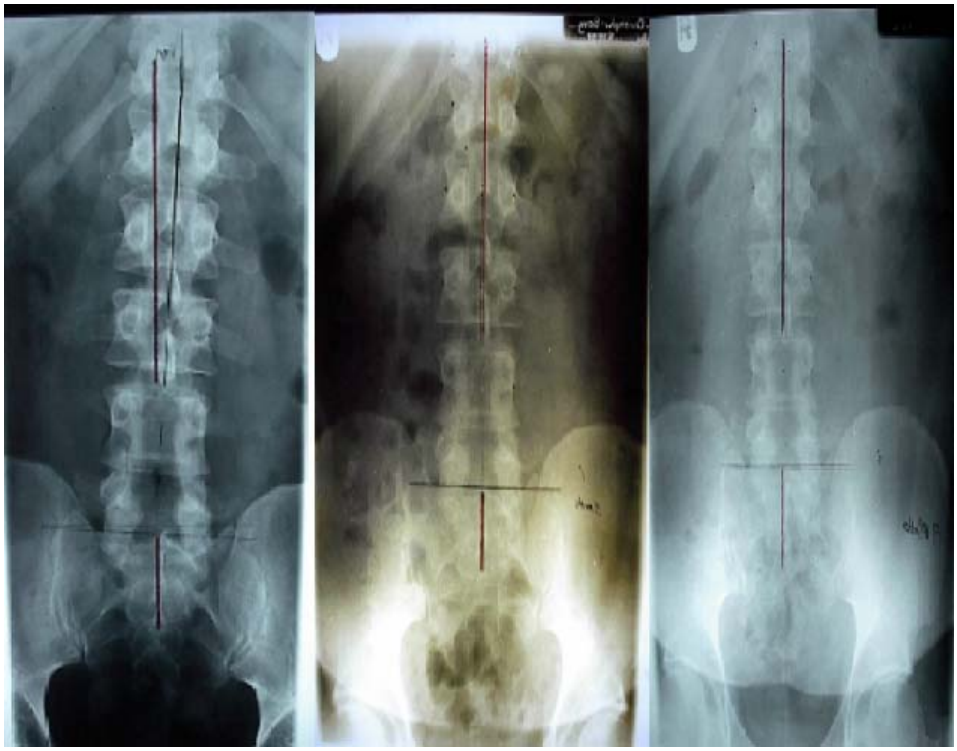

Figure 3. This figure demonstrates the pre- and post-treatment lateral cervical radiographs of a 35 year-old male subject. The left radiograph is the initial lateral cervical and the right radiograph is the 9-month follow-up. Note that the cervical curve, measured at C2 and C7, increased from 19° to 32°. The inclination of the atlas to horizontal increased from 16° to 23°. The anterior translation as measured horizontally from superior-posterior C2 body to the vertical line from posterior-inferior C7 reduced from 47mm to 36mm.