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Case Report

Rapid Recovery of a Patient Constrained in a Wheelchair with Total Gait Impairment Associated to Three Lumbar Herniated Discs After the Application of a Non-invasive Mechanotransductive Vibropercussive Intervention on the Suboccipital Myofascial (Atlasprofilax Method)

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Abstract

Background: Herniated lumbar discs can impair gait. The Atlasprofilax method is a device-mediated and non-invasive intervention that uses vibropercussive mechanotransduction on the suboccipital myofascia. Addressing cervical myofascial abnormalities may benefit descending myofascial chains, relieving the spine, discs, joints, and nerves from overloads and asymmetrical forces, improving motor function and reducing nociception response.

Case report: A 66-year-old patient presented with total gait impairment presumably associated to three lumbar herniated discs. The patient remained wheelchair-bound for four months despite undergoing daily physiotherapy rehabilitation. Symptoms included right brachialgia, severe low back and lower limb pain, and bilateral sciatica associated with the three herniated lumbar discs. The patient experienced a complete inability to stand and walk, necessitating confinement to a wheelchair for the past four months. Three hours following the intervention, the patient exhibited gradual improvement in walking ability, achieving complete gait control within one week. Marked improvement was observed in sciatica and low back pain. Over a follow-up period of 29 months, sustained pain relief and full recovery of gait were observed.

Conclusions: We propose that alterations of the cervical musculature and deep fascia could predispose to the development of lumbar disc abnormalities. We suggest that the observed improvements in this patient may be attributed to the reduction of asymmetric force distribution and elastic loading within the myofascial chains, leading to intervertebral decompression and radicular release. Furthermore, the mechanotransductive effect of the intervention on the suboccipital myofascia may have positively influenced specific brainstem-related myodural connections, subsequently impacting spinal cord function and gait processing as a result of the Atlasprofilax treatment.

Keywords: Gait; Cervical Atlas; Herniated Disc; Sciatica

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Background

Herniated lumbar discs can cause different degrees of gait impairment [1,2]. Gait disturbances in patients with lumbar disc herniation are associated with pain [3]. Nerve root irritation due to lumbar disc herniation can result in a range of symptoms, including lower back pain, sciatica, radicular leg pain, dysesthesias, paresthesias, and weakness in the leg or hip muscles of the lower limbs [4]. These symptoms can significantly impact gait and walking ability, leading to physical limitations in daily life [5]. The cerebellum, particularly involving the brainstem, plays a crucial role in regulating automatic and cognitive processes of posture-gait control [6]. Of particular interest is the posterior dorsal spinocerebellar tract (DSCT), which mediates unconscious proprioceptive information from the lower limbs and trunk to the cerebellum [7]. The DSCT's first-order neurons, located in the dorsal root ganglion at C8-L3 level, receive sensory inputs, and send impulses to upper motor centers such as the cerebellum. Dysfunction or irritation affecting the DSCT can result in proprioception loss, leading to coordination deficits, ataxia, and gait impairment [7]. The ventral spinocerebellar tract also plays a role, with synapses occurring with neurons in layer VII of L4-S3. Another relevant tract is the somatotopically organized spinothalamic tract, spanning cervical, thoracic, lumbar, and sacral segments. Both the spinocerebellar and spinothalamic tracts are located in the outermost part of the medulla, and are associated with nociception and motor function. To reach the cerebral peduncle and the thalamus, these tracts must cross the atlantooccipital hinge segment at the C0-C1-C2 level. The literature extensively describes alterations and disarrangements in the suboccipital myofascia and craniocervical junction (CCJ) structures [8-10], often referred as the Craniocervical Syndrome [11]. These alterations may contribute to biomechanical and metabolic dysfunction, leading to various neurological, myofascial, and musculoskeletal disorders associated with the neck and head, such as headache [9,10,12-18] and migraine [19].

Alterations in the myodural bridge (MDB) and suboccipital muscles, including changes in cross-sectional area and fatty infiltration, have been reported [20]. MDB is a complex soft tissue structure that acts as a bridge in the fascial continuum between the suboccipital muscles, the cervical spinal dura mater and the posterior atlanto-occipital membrane (PAOM) [21,22]. The PAOM forms a membrane-dura complex with the craniocervical dura, extending from the occiput to C3, and involves proprioceptive feedback mechanisms mediated by the MDB to monitor dural tension [23] through various vertebrodural ligaments [24,25].

The "posterior atlanto-occipital membrane-spinal dura complex" (PAOM-SDC) has been defined as the merging structure in the AO space of PAOM and MDB. PAOM-SDC provides dura stabilization and prevents dura infolding . Alterations in PAOM-SDC have been associated with headache and neck pain [21,26]. Several CCJ structures can be affected through excess of tension coming from the MDB [17,24], which has dural connections [21,26-32]. potentially resulting in irritation and dysfunction of DSCT through denticulate ligaments that connect dura, arachnoid and pia . Meningovertebrodural connections and the PAOM could be at the base of some ailments [21]. Compensatory and distorted compliance of anatomic arrangements in the CCJ through induced fibrous hyperplasia of the MDB has been observed in animal models [32]. CSF flow alterations such as the increase in pressure within the intracranial and subarachnoid space could also be linked to some neurological CCJ-related problems involving the MBD [33,34]. It has been suggested that this abnormal mechanism could be related to Arnold-Chiari type 1 malformation [35], a condition which is correlated with gait disorders, decreased body balance stability and risk of fall [36].

In another case report, the Atlasprofilax method shown benefits in impaired gait associated to two herniated discs favorizing disc sequestration reabsorption [37]. Moreover, this treatment has showed benefits in fibromyalgia [38], body balance enhancement [39], myofascial pain syndrome in presence of spine degenerative disease [40], C0-C1-C2 misalignments [41,42], and temporomandibular joint disorders [43]. There is a link between postural control deficits and imbalance and those disorders for which the Atlasprofilax approach demonstrated therapeutic improvements [44-46]. The Atlasprofilax method is a non-invasive device-mediated intervention targeting an improvement of clinical or subclinical altered biomechanical and metabolic patterns in the soft and bony structures of the CCJ [47]. This intervention uses mechanotransductive vibropercussion to ameliorate some structures of the suboccipital myofascia and of the CCJ such as trigger points, an excess of fibroblasts and alterations in the microvacuolar fascia or abnormal MDB tension, improving fascial tensegrity in the CCJ-complex.

Case Report

A white 66-year-old man, with a BMI of 24.78, came to the medical office to underwent the Atlasprofilax intervention. The patient arrived in a wheelchair with his wife and a physiotherapist due to mobility difficulties. The patient was unable to walk and to stand up, been in a wheelchair for 4 months. Patient was previously diagnosed by MRI with L3-L4 herniated disc including listesis, having also herniated discs at L4-L5 and L5-S1 levels. Patient's symptoms consisted of right brachialgia, total gait impairment impeding walking and bipedestation, severe low back pain, and bilateral sciatica. The patient required daily physical therapy and caregiver assistance for daily tasks and wasn't unable to walk by himself using always wheelchair. However, the patient did not respond to the physical therapy management.

Onset of symptoms including severe lumbar pain and severe lower limb pain, sciatica, and motor-sensory disorders was 12 years. Concomitant comorbidities were COPD, hypertension, hypothyroidism, and type 2 diabetes. The medications used were carbamazepine, melatonin for sleep disorders, and atorvastatin. Several falls and a bull charge accident were part of the patient's previously stated traumatic background.

The visual analog scale (VAS: 0-10) was used to report the level of pain in pain-related symptoms. This visual pain scale is commonly used to determine pain level and improvements in patients with radicular chronic low back pain associated with lumbar disc herniation [48]. The PGIC questionnaire (Scale: 1-7) was used to measure patient satisfaction in relation to each symptom during the various post-intervention controls. This questionnaire is a widely used and a validated tool for measuring patient's perception on change related to an outcome of an intervention related to chronic low back pain and confirmed symptomatic lumbar disc herniations [49-51]. Because the patient was wheelchair-bound but regained motor gait function only 3 hours after the procedure, five videos were filmed to asses improvement in gait: the first one was filmed 3 hours after the intervention, another 3 days after the intervention, another 3 weeks after the intervention, another 18 months after the intervention and a final one 29 months after the intervention.

At the baseline analysis before therapy, the description of the patient's symptoms was reported as per in the table 1.

Symptom	Onset of symptom	Frequency of symptom	Intensity of pain (VAS 0-10)
Right brachialgia	1 year	daily	3
Low back pain	12 years	daily	9
Ciatalgia	12 years	daily	8
Pain in lower extremities	12 years	daily	8
Dysesthesias in lower extremities	12 years	daily	n/a
Inability to stand upright	4 months	daily	n/a
Inability to walk	4 months	daily	n/a

Table 1: Symptoms characteristics.

Intervention

The patient underwent the intervention on November 11, 2020. The intervention consisted of a single device-mediated mechanotransductive vibropercussive stimulation on patient's suboccipital myofascia during approximately 8 minutes. The stimulating frequency (in HZ) of the vibropercussive device was regulated by the treating physician according to various anthropometric and clinical criteria. This non-invasive myofascial and neuro-stimulating intervention uses an adapted head that is in contact with various specific targeted points in the suboccipital region using certain angles and with different durations and different pressure and frequency intensities at each applied anatomical point. Lumbar region was not treated on this patient since the intervention focuses only on the suboccipital myofascia. During the control period, more than two years, the patient did not continue to receive physical therapy of his own free will so that the follow-up was not contaminated by other third therapies.

Endpoints

Two endpoints were established for this case study. Primary endpoint was the assessment through PGIC and VAS on the impact of the Atlasprofilax intervention in terms of results satisfaction and pain reduction associated to herniated discs, pain and dysesthesias in the lower limbs, sciatica, as well as in the lumbar area and also in right cervicobrachialgia. Secondary endpoint was the evaluation on the effect of the Atlasprofilax intervention in the probable improvement of the patient's motor control and gait.

Clinical findings and results

In relation to the primary endpoint, the patient reported a significant improvement in lower limbs pain, sciatica, low back pain and right cervicobrachialgia. Dysesthesias in the lower limbs disappeared. The pain results can be seen in table 2 and the PGIC rating score of improvement can be seen in table 3.

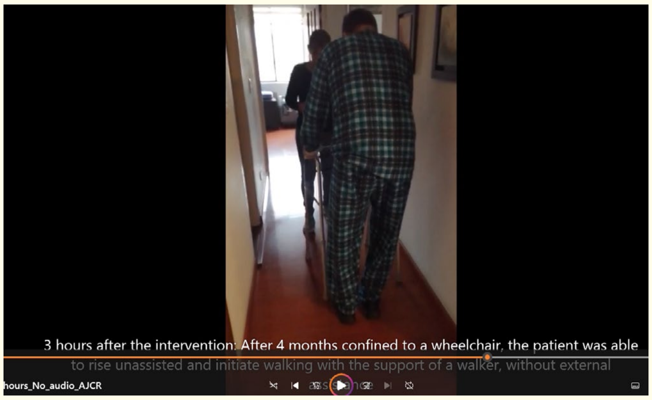
Symptom	Frequency of symptom Baseline at Pre-intervention	Intensity of pain (VAS 0-10) Baseline at Pre-intervention	Intensity of pain (VAS 0-10) 3 weeks after intervention	Intensity of pain (VAS 0-10) 18 months after intervention	Intensity of pain (VAS 0-10) 29 months after intervention
Right brachialgia	daily	3	0	0	0
Low back pain	daily	9	3	2	2
Ciatalgia	daily	8	4	2	2
Pain in lower extremities	daily	8	0	0	0

Table 2: VAS results for pain pre-intervention, and at post-intervention follow-ups at 3 weeks, 18 months, and 29 months after intervention.

Symptom	PGIC 3 weeks after intervention	PGIC 18 months after intervention	PGIC 29 months after intervention
Right brachialgia	7	7	7
Low back pain	7	7	7
Ciatalgia	5	5	5
Pain in lower extremities	6	6	6
Dysesthesias in lower extremities	7	7	7
Inability to stand upright	7	7	7
Inability to walk	7	7	7

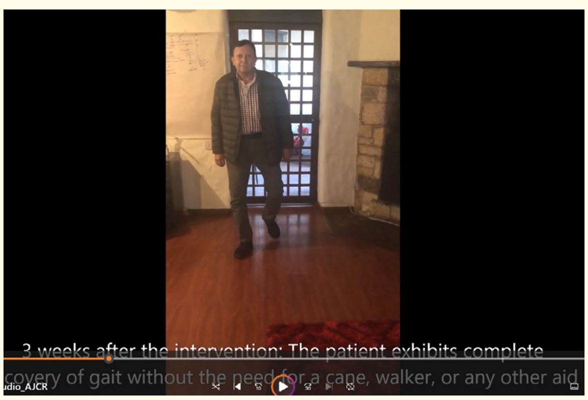
Table 3: PGIC results: satisfaction of achieved results after 3 weeks, 6 months and 18 months, and 29 months after intervention.

In relation to the secondary endpoint, the patient was able for the first time in four months to stand up and walk on his own within three hours after the intervention. At a further check-up 3 weeks later, the patient's gait was normal and he did not require any assistance. Two further check-ups post-intervention after 18 and 29 months respectively showed that the patient continued with motor improvement in gait without any difficulty in walking. The recovery of the patient's gait and its normalization and maintenance can be seen in the attached videos (video 1; 3 hours after intervention; video 2, 3 days after intervention; video 3, 3 weeks after intervention; video 4, 18 months after intervention; video 5, 29 months after intervention). See attached videos 1,2,3, 4 and 5. At the final check-up 29 months after the intervention the patient continued with total gait and motor improvement and pain relief without worsening or relapse.

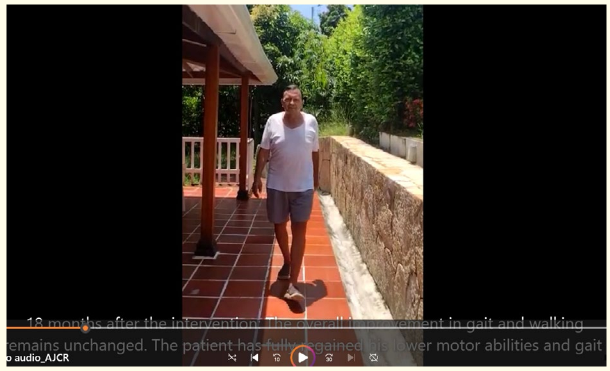


Video 1: 3 hours after the intervention: The patient was able to rise unassisted and initiate walking with the support of a walker, without external assistance.

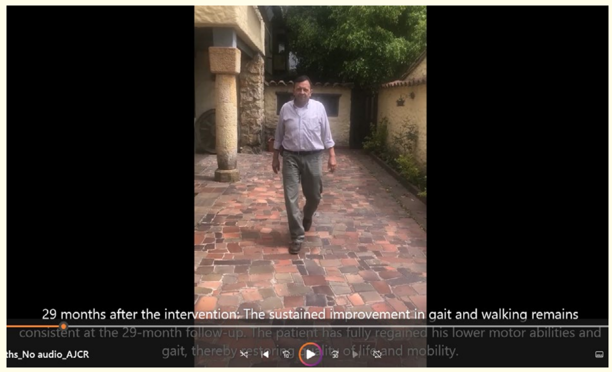
Video 2: 3 days after the intervention: The patient no longer required the walker and began walking independently



Video 3: 3 weeks after the intervention: The patient exhibits complete recovery of gait without the need for a cane, walker, or any other aid.



Video 4: 18 months after the intervention: The overall improvement in gait and walking remains unchanged. The patient has fully regained his lower motor abilities and gait.



Video 5: 29 months after the intervention: The sustained improvement in gait and walking remains consistent at the 29-month follow-up. The patient has fully regained his lower motor abilities and gait, thereby restoring quality of life and mobility.

Discussion

Every significant component involved in experimental models of locomotion, including those that regulate upright posture, gait, balance, and stepping, is virtually linked to the brainstem [52]. Gait disorders, including impairment, decreased body balance stability and risk of fall could involve brainstem affectations though abnormalities in the MDB and the PAOM involving the CCJ and the suboccipital myofascia. Metabolic and/or biomechanical alterations in the suboccipital muscles, the MBD and the PAOM seem to have a correlation with several disorders and pathologies [17,18,21,26-31,35]. The denticulate ligaments of meningeal extensions, spread from the lateral aspect of the spinal cord to the internal aspect of the spinal dura mater [53]. Ascending sensory signals play a dual role: firstly, enhancing kinesthetic conscious awareness of bodily or limb positioning; secondly, facilitating the nervous system's comparison of projected and actual sensory outcomes resulting from movement .This mechanism enables the adjustment of motor instructions and reflex pathway strength based on postural needs and desired responses. The primary route for transmitting proprioceptive and exteroceptive data involves the dorsal column medial lemniscal pathway, coupled with the posterior and anterior spinocerebellar tracts, alongside the spinoreticular tracts [54]. This means that the outermost medullary tracts such would be more exposed to irritation by mechanical traction coming from the pia mater, arachnoid and dura mater through abnormal traction from the dentate ligaments. Dentate ligaments are connect to MDB and the PAOM-SDC. The intracranial first denticulate ligament lead to an increased rotation of the spinomedullary junction by approximately 25% after unilateral transection [55]. An underestimated excess of tension involving suboccipital muscles, MBD, the PAOM, the PAOM-SDC and some denticulate ligaments at CCJ-level could lead eventually to undesired irritation of the spinothalamic and the spinocerebellar tracts involving brainstem affectation and disturbing nociception, proprioception and gait. On the other hand, herniated lumbar discs can cause gait impairment [1,2] being associated to lumbar pain [3]. Irritation of nerve roots irritation with lower back pain, sciatica, radicular leg pain, lower limbs weakness with sensorimotor are associated to herniated lumbar discs [4] leading to gait disturbances and walking disability [5]. In the case of this patient, who had been wheelchair-bound for 4 months and had not responded to daily physical therapy, a very substantial change was observed, recovering gait and motor capacity in the legs three hours after the Atlasprofilax procedure. The painful symptoms associated with the 3 herniated discs as well as other symptoms significantly improved or disappeared. Both improvements in gait total recovery and pain were documented and maintained up to 29 months after the intervention without interference from other therapies. At the 29-month follow-up, the patient had not undergone surgery for herniated discs. In previous studies, the Atlasprofilax intervention has shown effectiveness in the resorption of herniated discs and other pathologies where gait and body balance may be affected [37,39,40]. Atlasprofilax is a non-invasive therapy that focuses on improving alterations of the suboccipital myofascia which has dural and medullary connections through MDB, PAOM and PAOM-SDC [47]. However, such intervention also aims to achieve improvement in the descending myofascial body chains originating in the upper cervical region. The effect of Atlasprofilax on the rebalancing of the descending myofascial chains could have a beneficial impact on joint overloads in the upper cervical region. It is difficult to know if the noticeable improvement in this patient is due to a mechanotransductive effect on the suboccipital myofascia potentially improving certain abnormalities in the MBD/PAOM, PAOM-SDC/denticulated ligaments complex resulting in a neurological enhancement due to the release of certain medullary tracts and optimizing some of the functions of the brain stem. Another mechanism that would explain such improvement could be a biomechanical effect in which the improvement on the suboccipital myofascia turned into spine vectorial decompression of forces and intradiscal overloads, due to a domino effect of a descending cascade, eventually enhancing the capacity of reabsorption of herniated intervertebral discs improving root clamping through enhanced intervertebral disc's coefficient of elasticity. Whatever the mechanism of action observed in the improvement of this patient, the Atlasprofilax method seems to offer an alternative to explore within conservative and non-surgical interventions related to gait problems and disc herniations. More studies with larger samples are needed to increase the scientific evidence on the potential of this intervention.

Conclusion

Subclinical or underestimated abnormalities involving the suboccipital muscles, the MDB, PAOM/PAOM-SDC, and the deep cervical fascia within the CCJ complex should get more attention. Those abnormalities could have a higher involvement than expected probably exhibiting morpho-pathologic correlations with several neurological, musculoskeletal, and myofascial disorders being a preliminary co-factor predisposing to disc herniations arousal and some gait disorders among other ailments. The physiopathology of such abnormalities in the CCJ and its probable contribution to several disorders should be further studied. The same applies for the probable role of altered suboccipital myofascia in the fascial continuum that can downwardly impact on paravertebral muscle chains creating asymmetrical overloads on intervertebral discs that may contribute to disc herniations and musculoskeletal diseases related to benign chronic pain. The Atlasprofilax method is a conservative and non-invasive intervention that showed significant improvements in full gait recovery and pain in this patient. This intervention could be preliminarily recommended as a candidate for additional research and more clinical therapeutic consideration.

Authors' Contributions

Lluís Manent: Writing - original draft, review & editing, supervision; Conceptualization; Orlando Angulo: reviewing, editing, supervision;

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Not applicable

Disclosures

Lluis Manent: Director of the Atlasprofilax Academy Switzerland Latin America corp.

Orlando Angulo: reports no declaration of interest

Consent

Written informed consent from participant was obtained including the use of video footages.

Human and Animal Rights

As an observational case report, no experiments were performed on human subjects. Nevertheless, this case study is within the ethical standards of the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained the subject.

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