Advances in neurodynamics for acute sciatica

Dr Michael Shacklock, FACP, Dr Marinko Rade and Professor Olavi Airaksinen introduce novel concepts in neurodynamics for acute sciatica with a particular focus on recently published research on dynamics of the spinal cord and its relation to lumbar nerve root behaviour.

Treatment of neural tissue has remained a popular aspect of diagnosis and treatment in physiotherapy and manual therapy between the introduction of such approaches in the 1970s and now (Elvey 1979; Butler 1991, 2000; Shacklock 1995, 2005; Hall & Elvey 1999). As a natural progression into the nervous system, pain and the neurosciences have garnered such utility that an emphasis on informing the patient of the role that their nervous system plays in producing pain, has developed. Clearly, this is appropriate and further development of this area is vital. A consequence has been that physical treatments that target a specific mechanical mechanisms (active or passive) are becoming a lesser part of patient care; however, there continues to be a need and scope for developing mechanically specific and effective methods of conservative management of physical problems.

A subgroup of physical treatments, neurodynamics is experiencing ongoing usage but it is the recipient of misconceptions which, when clarified, could lead to improvements in treatment of neural problems in the musculoskeletal patient.

One such misconception is: ‘neurodynamics is neural mobilisation plus neurophysiology, so if we just add some neurosciences to flossing techniques, there we have it, the neurosciences justify the technique.’ Clearly, this is in part correct but what is often lacking is mechanical specificity. Also, occasionally, nerves are mobilised when they do not tolerate it.

Little attention has been paid to the actual causes of neurodynamic problems which has led to over-simplistic approaches that lack development of specific treatments. Nee and colleagues (2013) and Schäfer and colleagues (2011) have shown that specific selection and treatment of patients influences therapeutic outcomes, which supports the idea of accuracy in the specifics.

The most common cause of sciatica and lumbar radiculopathy is disc protrusion. It seems intriguing that we use a mobilisation that applies force to a nerve root that is already being forced upon. Perhaps adaptation of the nerve root is an operative mechanism. But one of the often-unused cornerstones of neurodynamics is that, in specifically selected patients, nerves need protection rather than mobilising, particularly in the severely irritated state. A case in point is the lumbar nerve root, which our group has been studying in order to develop techniques with newly validated mechanisms (Rade et al 2014a, 2014b, 2015; Shacklock 2016). The techniques actually reduce force in the nerve root so that mobilisations can relieve pain instead of provoking it.

Shacklock (2005) proposed that it is possible to draw the spinal cord downward in the spinal canal with the straight leg raise (SLR) and, based on physics modelling and the anatomy, this should produce a reduction in tension in the nerve roots and dura on the contralateral side. In situations of compression in which nerve root ischaemia is consequential (Kobayashi et al 2003), it should be possible to use this mechanism to reduce force (compression and tension) in the root.

In investigating this, Rade and colleagues (2014) created a new model of non-invasive measurement of spinal cord movement with the SLR
In order to investigate whether this effect extended to neurodynamic responses, Shacklock et al (2016) used a model of neurodynamic testing that produced a similar pattern of cord movement with the slump test in asymptomatic subjects. During production of the normal posterior thigh stretch at end range of the slump test, they added contralateral knee extension to draw the cord downward to see if it affected the posterior thigh stretch, as a corollary of lumbar neural tissue behaviour. If the theory were correct, and the subject responses related to the nerve root and dura behaviour, a significant proportion of subjects would report a reduction in posterior thigh stretch with the contralateral knee extension. However, in order to ensure that the effects were not due to possible contaminants such as time-based stretch, proprioception or distraction, sham and control groups were used. The sham and control had no significant effect, whereas all subjects in the contralateral knee extension (intervention) group showed a reduction in the posterior thigh stretch response (Figure 2).

To complete the circle, the second part of that study was on cadavers to ascertain if distal tension applied manually to the lumbar nerve roots (simulating the events in the conscious subjects) produced a reduction in tension of the neural tissues on the contralateral side. When distal tension was applied, the cord moved caudally and tension in all the neural tissue and dura on the contralateral side reduced, including the filum terminale. The above-mentioned series of studies effectively validated the mechanism.

Our final question is whether such manoeuvres can actually produce positional changes in the nerve roots that are meaningful to the patient with radicular leg pain. In the patient with sciatica due to disc protrusion, pressure between the nerve root and disc can be reduced by positioning the spinal cord downward. This can allow the nerve root to displace away from the disc protrusion, as seen radiologically (Figure 3). In the patient presented, a lower position of the spinal cord reduced tension (and compression) in the nerve root and was accompanied by relief of the patient’s leg pain (Shacklock 2007).

This article focuses on specific mechanisms of neurodynamics for application to patients with acute lumbar radicular pain. New studies show that, contrary to popular belief, tension in the lumbar contralateral nerve roots and dura reduces when neurodynamic tests such as the SLR and slump tests are performed. This is shown with a newly validated ‘crossover’ mechanism in which caudally-directed neural tension in the nerve roots on one side produces causal displacement of the cord and a relaxation of the neural tissue on the other.

When this mechanism is produced in asymptomatic subjects, it produces reductions in responses to neurodynamic testing over and above sham and control. The mechanism has radiologically been shown to reduce force in the nerve root and produce relief of sciatic pain in the presence of disc protrusion. Even though various clinical questions arise from this, it can be applied clinically for pain relief in certain patients with acute sciatica.

While on a long road, and not detracting from other approaches, this is an example of the need to continue the search for specific physical mechanisms that target clinical problems.

Email ngeditor@physiotherapy.asn.au for references.

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