The Neurophysiology of Chiropractic Treatment

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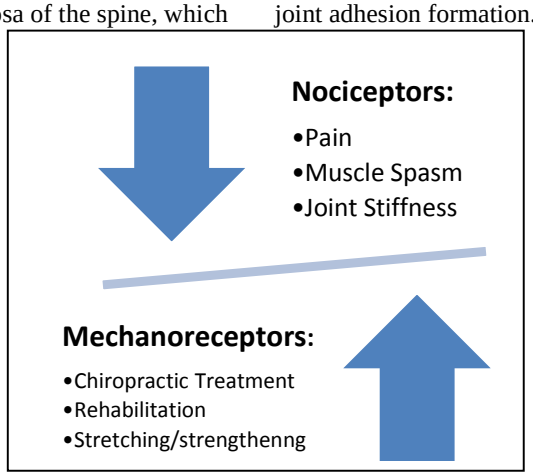
Research over the past several years has demonstrated that chiropractic care is successful in treating spinal injuries [1-7], yet many doctors are unable to adequately describe how or why that is the case. This ambiguity leads medical providers to lack confidence in knowing who, when, or why to refer to a chiropractor. This letter is a brief, technical explanation of the neurophysiology of spinal injuries, as well as how properly applied chiropractic treatment is effective at reversing the deleterious effects of such injuries. When examined in closer detail, one can see that chiropractic treatment stimulates spinal joint mechanoreceptors, which in turn decreases nociceptive activation, decreasing pain, muscle spasm, and joint stiffness. The goal is to provide the reader with a better scientific understanding of why chiropractic is effective.

Nociceptors – The Pathway to Pain

Virtually all structures in the spine, including the outer 1/3 of the disc, are innervated by nociceptors [8, 9]. Injury to one or more of these structures, through repetitive microtrauma or acute macrotrauma, sensitizes nociceptors, either mechanically, or by the release of inflammatory cytokines like prostaglandin E-2, leukotriene B-4 and bradykinin [10, 11]. These nociceptors release substance P in the substantia gelatinosa of the spine, which results in pain, sympathetic hyperactivity, and reflex muscle spasm [12-16].

a. **Sympathetic Hyperactivity** – In addition to causing local and referred pain, nociceptive input causes the release of norepinephrine by the postganglionic sympathetic nerve fibers at the segmental level [17]. The release of norepinephrine causes inflammation, vasoconstriction and hypoxia [18]. Hypoxia in tissues leads to adhesion formation which results in joint stiffness, which eventually can lead to scar tissue and degeneration [19, 20].



b. **Reflex Muscle Spasm** – Nociceptors have direct entry to the alpha and gamma-motor neurons [21]. Nociceptive stimulation and sensitization of somatomotor neurons results in local muscle spasm [12]. It is important to note that the resulting superficial muscle spasm is a natural, compensatory reaction which serves to protect the injured joint and avoid further damage [22-25]. These patients think they have "pulled a muscle in their back", and are unaware that the muscle pain and spasm they feel is not the cause of the problem, but rather a result of nerve irritation due to joint injury. Consequently, it is not wise to direct treatment solely at reducing muscle spasm with muscle relaxants, massage, or physical therapy, as that may lessen the normal protective mechanism and worsen the original injury.

Mechanoreceptors

Aside from nociceptors, the other main category of joint receptors is mechanoreceptors (MR's) [26]. MR's, such as golgi tendon organs and muscle spindles, are activated by movement and stretch and relay information about position sense and proprioception to the CNS [27]. Like nociceptors, MR's are found in the vast majority of spinal structures and they terminate in the substantia gelatinosa of the spine [28]. Unlike nociceptors however, MR's are larger, faster A-beta fibers which compete with, and block the uptake of substance P by nociceptors at the substantia Gelatinosa. This is the basis of Gate Control Theory, which suggests that when MR's are stimulated, they "close the gate" for uptake from nociceptors [29]. Therefore, anything which stimulates MR's, such as chiropractic treatment, will inhibit pain, reduce muscle spasm, and inhibit sympathetic activation; effectively restoring normal joint function and reducing symptoms.

Chiropractic Treatment

Chiropractic physicians have long sought (with history, examination, palpation, and now x-ray and MRI analysis), to identify areas of the spine with altered alignment or biomechanics called spinal subluxations or vertebral malpositions [30, 31]. When seen on x-ray, these vertebrae are tilted, rotated, or shifted out of normal position. Such subluxations can cause uneven or increased unilateral facet joint loading, which irritates the facet joint capsule, causing nociceptor activation [32]. Additionally, spinal subluxations create disc wedging which is often the cause of disc bulges and herniations [33]. As mentioned previously, such injuries cause pain, muscle spasm, and joint adhesion formation.

For many years, chiropractors told their patients that the goal of treatment was to "re-align the spine" to take pressure off the nerves. While that occurs to some degree, the benefit of chiropractic treatment lies more in restoring normal joint motion in the spine, effectively stimulating mechanoreceptors, thereby reducing pain, lessening muscle spasm, breaking up joint adhesions, and normalizing joint function.

Our office primarily utilizes intersegmental traction and high velocity, low amplitude manipulations, wherein a gentle, quick force is applied to the joint, taking it beyond the limit of passive range of motion, but within the limit of anatomical integrity. In doing so, the chiropractic manipulation momentarily gaps the facet joints, breaking up intra-articular adhesions, stimulating mechanoreceptors, and improving normal biomechanics of the joint [34-38]. In addition, nearly every patient we see is given specific stretching exercises to stimulate joint mechanoreceptors and a core strengthening program to stabilize the spine and reduce facet joint strain. Together with treatment, the right exercises can enable the patient to return to activities of daily living and avoid further injury or need for treatment.

Chiropractors have been successful in treating spinal injuries for more than a century, but until recently, have been unable to describe exactly how or why that is the case. While there is a great deal more neurophysiology involved than one page can thoroughly address, hopefully the reader has a better understanding of the science behind chiropractic treatment, and feels more confident in referring patients who may benefit from its success.

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