Chiropractic Update

Update 94

Does Subluxation Actually Affect The Nervous System?

INTRODUCTION:

Since its inception, the chiropractic profession has hypothesized that abnormal spinal function has an effect on the nervous system. With recent introduction of a successful rat model of chronic vertebral hypomobility, it should be possible to test this hypothetical link between vertebral function and the nervous system. Synapses are thought to be primary sites of plastic changes in the nervous system, and morphologic changes to synapses are believed to be a part of this process. The purpose of this pilot study was to make a preliminary determination if chronic vertebral hypomobility at 1-4-1-6 in the rat would affect synaptic density and/or morphology in the superficial dorsal horn of the L2 spinal cord level.

METHODS:

Using an established rat model of chronic vertebral hypomobility, three contiguous lumbar segments (1-4-1-6) were fixed for eight weeks with a specially engineered vertebral fixation device. Electron micrographs (final X25000) were obtained from the medial portion of the lateral 1/3 of Rexed's laminae I and II on the right side of the caudal portion of the L2 spinal cord segment in two animals from the experimental (fixed) group and each of three control groups (no surgery, surgery but no devices implanted, and devices implanted but not fixed) (total tissue examined/group = 4000 m2). Synapses were randomly selected using a stereological (Physical Disector) approach and were analyzed for symmetry (symmetric versus asymmetric), curvature (straight, positive, or negative), type of postsynaptic profile (dendritic shaft, dendritic spine, or soma), and perforations. The synaptic density was also estimated.

RESULTS:

There was an increased synaptic density and percentage of positively curved synapses in the dorsal horn of experimental animals as compared to controls. Also, experimental animals had a lower percentage of axospinous synapses, with a concomitant increase in the percentage of synapses on dendritic shafts. Even though there were low percentages of perforated synapses identified in this study, there were higher percentages of perforated synapses in the dorsal horns of experimental versus control animals. No differences in the symmetry of synapses was apparent between experimental and control animals.

DISCUSSION:

These data show for the first time that there actually appears to be a relationship between abnormal vertebral function (chronic vertebral hypomobility) and morphologic changes in the nervous system (alterations of synaptic density and morphology in the dorsal horn of the spinal cord). The increased percentage of positively curved synapses, along with the increased number of synapses in the experimental animals, may indicate an increase in synaptic activity in the dorsal horn of animals with hypomobile vertebrae. The decreased percentage of axospinous synapses may indicate a decrease in excitatory synaptic activity in the dorsal horn of the experimental animals as compared to controls. The biologic significance of these findings remains unknown.

CONCLUSIONS:

These preliminary data suggest that chronic vertebral hypomobility at 1-4-1-6 in the rat affects synaptic density and morphology in the superficial dorsal horn of the L2 spinal cord level. Additional, more definitive studies are warranted, and the biological significance of these findings should be investigated.

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REFERENCE:

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