The Effects of Chronic Pain on Motor Control of the Upper Quarter

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Treatment of neck pain has resulted in varying outcomes with up to 44% of those patients going on to develop chronic symptoms (Borghouts, Koes, & Bouter 1998) The inherent complexity of chronic pain may account for the many treatment failures often experienced by therapists. The goals of pain resolution and restoration of motor function are often the focus of treatment with little success once a patient has reached the chronic stage. Recent neurophysiological studies have linked pain development in the lumbar spine region with disturbances in the mechanoreceptors, and speculated impairments of the superior proprioception centers (Luomajoki & Moseley, 2009). Similarly, chronic upper quarter (cervical or upper-extremity) pain has also been associated with problems due to proprioception and motor control (Mossberg & McFarland, 1995). By quantifying the changes between individuals suffering from chronic pain and healthy individuals we can establish an assessment and treatment for individuals with chronic upper quarter pain.

Subjects:

Twenty subjects had a history of pain in the neck or shoulder girdle region of their dominant upper extremity lasting greater than 3 months duration. Twenty additional individuals were used as controls and did not have pain in the neck or shoulder region of their dominant upper extremity. All participants filled out the McGill Pain Questionnaire and the LANSS pain scale to identify if they were experiencing chronic and/or neuropathic pain.

Methods:

Kinesthesia was assessed by asking the participant to draw two lines, ten consecutive circles, and ten consecutive figure "8"s on a 3' x 4' Smart whiteboard, while blindfolded. Three trials were performed. The amount of deviation from the initial figure was assessed for each trial (Kolar, 2008).

To assess the subject's spatial awareness, the subjects were blindfolded and asked to estimate the width of their hips, shoulders and mouth by replicating the measurements vertically on a 2" diameter dowel. Three trials were performed. The difference between the actual measurement and estimated measurement was recorded and averaged over three trials (Kolar, 2008).

To assess graphesthesia, the subject's dominant scapula was exposed. They were asked to identify a number that was drawn on their scapula with the tester's finger. Numbers were drawn within a predetermined area on their scapula which was measured prior to the test being administered. Accuracy was recorded and averaged over three trials (Kolar, 2008).

Proprioception was assessed by displacing the subject's arm and asking them to return their arm to the initial starting position. The amount of error from the original position was recorded and averaged over three trials (Kolar, 2008).

Results:

Kinesthesia:

Figure "8" Drawing Task

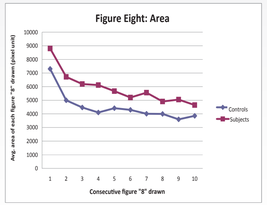
The y-axis error showed statistical significance indicating that the subject's figure "8"s migrated in a downward direction with each consecutive figure "8" drawn as compared to controls .

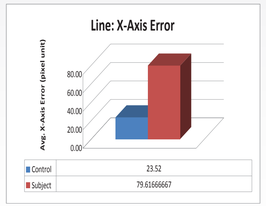
Straight Line Drawing Task

There was a statistically significant difference for the x-axis error between the two groups (p=0.01) indicating that the subjecs missed the intended target compared to controls by overshooting the starting point to a larger extent than the controls.

Circle Drawing Task

No significant differences were found in any of the circle drawing tasks.





Spatial Awareness

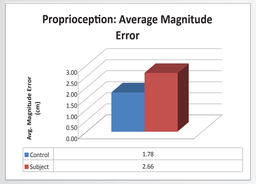
There were no significant differences between the two groups for any of the tests performed to assess spatial awareness

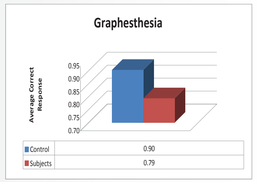
Proprioception:

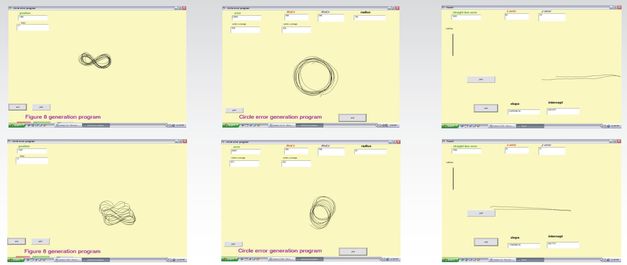
There was a statistically significant difference between the two groups in the average magnitude of displacement that occurred over the three trials during the upper extremit displacement tests (p=0.02). Subjects with chronic pain showed decreased ability to appropriately place their arm at the initial starting position as compared to controls.

Graphesthesia:

There was a statistically significant difference (p=0.02) between the two groups in the ability to identify different numbers drawn on their scapula, which indicates that the subjects tactile acuity was diminished in the painful area.







Discussion:

Disruption in proprioception can occur as a result of direct trauma to the capsule, labrum, ligaments, or surrounding muscles damaging the mechanoreceptors that mediate normal joint proprioception. Even in the absence of trauma, individuals with non-specific chronic upper quarter pain can present with altered proprioceptive acuity of the back seen in chronic low back pain patients. The results of this study re-confirm that a relationship does exist between pain intensity and tactile and proprioceptive acuity.

Given these findings, it may be beneficial to incorporate retraining of a patient's kinesthetic awareness into a comprehensive treatment program. Incorporating this type of kinesthetic training may provide treatment options for decreasing chronic pain in the upper quarter given the relationship between pain intensity and sensory acuity. As sensory acuity increases with training, the intensity of the pain will decrease as seen in previous studies by Moseley.

Conclusion:

Kinesthetic changes may have occurred secondary to abnormal sensory processing due to chronic upper quarter pain. If kinesthesia is disrupted, muscular control may be compromised predisposing the surrounding body regions to insufficient protective repsonses, possible re-injury and further precipitation of the chronic pain cycle.