Effects of Breathing on Median Nerve Mechanosensitivity

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### Authors and Title

   The Effect of Deep and Slow Breathing on Pain Perception, Autonomic Activity, and Mood Processing
2. Russell ME, Hoffman B, Stroemborg S, Carlson CR.
   Use of Controlled Diaphragmatic Breathing for the Management of Motion Sensitivity in a Virtual Reality Environment
   Effectiveness of Median Nerve Mechanical vs. Autonomic Activity in Patients with Failed Cervical Spinal Nerve Block
4. Yilmaz S, Taş S, Yilmaz OT.
   Comparison of Median Nerve Mechanosensitivity and Pressure Pain Threshold in Patients With Nonspecific Neck Pain and Asymptomatic Individuals
5. Diaphragmatic breathing (DB) group included 31 subjects.
   Control Group included 29 subjects.
6. The 16-item Motion Sensitivity Assessment Questionnaire (MSAQ) was used. Subjects rated items on a 1-9 Likert scale type (1 = minimal symptoms and 9 = maximum symptoms).
7. During the virtual reality experience, subjects were rate their level of motion sickness on a four-point motion sickness self-rating scale every minute by responding to a verbal prompt from the experimenter.
8. Average respiration rate (RR) for the control group was 12.12 +/- 2.77 and 11.38 +/- 3.49 for the DB group.
9. Average self-reported sickness rating (SS) were 1.76 +/- 0.63 for the control group and 1.37 +/- 0.44 for the DB group.
10. Average MSAQ post scores were 2.85 +/- 1.72 for the control group and 2.11 +/- 0.91 for the DB group.

### Methods

- Investigated respiration rate and depth of breathing on pain perception, autonomic activity, and mood.
- Skin conductance levels, indicating sympathetic tone, were measured during DB.
- Thermal detection and pain thresholds for cold and hot stimuli were measured.
- Attentive DB group used guided respiratory feedback that required concentration. Relaxed DB group had training, void of feedback during sessions.
- Significant increase in pain thresholds for the relaxed DB group (p < 0.5).
- Mean skin conductance levels indicating sympathetic activity decreased significantly during the relaxing DB intervention but not during the attentive DB.
- Patients with NNP significantly decreased pain pressure threshold compared to the asymmetric group.
- Patients with NNP demonstrated decreased cervical flexion and lateral flexion ROM.
- The group of subjects with NNP demonstrated decreased ROM secondary to mechanosensitivity versus the asymptomatic group.
- Oil was found to more effectively reduce subjects NRS
t, especially 1 hour after stimulation.
- MNNG diminished gradually reduce pain scores over the long term.
- The QuickDASH measured an increase in function of 65.9% for the Oil group and 47.0% increase for the MNNG group.
- MNNG (6.6%) and Oil (7.5%) were found to be equally effective in increasing ipsilateral cervical ROM in subjects.

### Subjects

- 16 healthy subjects divided into two groups: Relaxed and Attentive DB.
- 40 subjects in the involved group.
- 38 in the uninvolved group.
- All subjects had a positive Spurling’s test, distraction test, and Elvey’s test ≥ 3 months.
- The median nerve mechanical stimulation (MNMS) group received treatment 5 days a week for 6 weeks.
- The standard position for ULNT 1 was used at a rate of 1 repetition (flexion and extension) every 2 seconds without reproduction of symptoms.
- Subjects ages 18 - 45 y/o with a clinical diagnosis of cervical spondylotic pain, confirmed by MRI.
- Subjects divided into those that had non-specific neck pain (NNP) and those that did not.

### Results

- Significant increase in pain perception and autonomic activity for the DB group.
- Skin conductance levels, indicating sympathetic tone, were measured during DB.
- Thermal detection and pain thresholds for cold and hot stimuli were measured.
- Attentive DB group used guided respiratory feedback that required concentration. Relaxed DB group had training, void of feedback during sessions.
- The median nerve mechanical stimulation (MNMS) group received treatment 5 days a week for 6 weeks.
- The standard position for ULNT 1 was used at a rate of 1 repetition (flexion and extension) every 2 seconds without reproduction of symptoms.
- The oral ibuprofen (OI) group was prescribed an ibuprofen tablet that their PCP aimed at achieving the maximum hypogallic acid dose provided patient tolerance.
- Starting dose was 400 mg and increased to a maximum dose of 1200 mg/day divided into 3 doses every 8 hours.
- Outcome measures: Numerical Rating Scale for Pain, the QuickDASH (functional measure) and cervical ROM.
- Outcomes were assessed at baseline, 1 hour after treatment and at sessions number 1, 5 (weeks), and 30 (6 weeks).

### Purpose

The following information is a review of the literature on Diaphragmatic Breathing (DB) and observable influences on pain and physiological markers. The review also includes mechanosensitivity of the nervous system and treatment options for neck pain.

### Mechanosensitivity and Neck Pain:

Mechanosensitivity is the reaction of nerves in the peripheral nervous system moving in response to a changing joint angle. Adhesions can limit these peripheral nerves motion inside the body and change the natural length tension relationship of the nerve. Mechanosensitive nerves may produce pain along a specific pathway. Changes in joint angle at the neck or upper extremity can result in sensitivity along the median nerve pathway.

### What is Diaphragmatic Breathing?

DB is a technique that incorporates the full expansion of the rib cage and abdomen during inspiration in order to combat the muscle contraction of the diaphragm. DB sometimes involves mindfulness of breath and is used to relax the individual who uses the technique.

### Figure 1: Lengthened Position of Median Nerve

A thorough review of the literature revealed that diaphragmatic breathing can significantly increase pain thresholds as well as decrease sympathetic activity. Two issues with many of the studies were the small sample sizes or the researchers made conclusions based on subjective information, both of which drops the validity level of the research.

### Analysis

- DB protocols that incorporate a relaxed breathing style instead of a target frequency show greater improvements in pain tolerance and a decrease in sympathetic responses.
- Relaxation of the sympathetic nervous system can still occur with a respiration rate of roughly 11 breaths per minute, evidenced by a decrease in perceived motion sickness levels when compared to control subjects.
- Median nerve mobilizations show improvement in pain and function for patients with nerve related neck and arm pain.
- Upper Limb Neural Tension Test 1 has been found to be an effective test to identify increased median nerve mechanosensitivity in patients with non specific neck pain when compared to asymptomatic individuals.

### Future Research

Further research is required to determine the influence of DB on people with neck pain and the related mechanosensitivity of the nervous system. To date, no studies have investigated the relationship between DB and mechanosensitivity.

### Bibliography