Research Paper Review

Maximum Respiratory Pressure Alterations after Spinal Manipulation

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ABSTRACT

OBJECTIVE: To verify the immediate effect of spinal manipulation in rotation of the third cervical vertebra (C3) and the 12th thoracic vertebra (T12) in maximum inspiratory (MIP) and expiratory (MEP) pressure in healthy people.

METHODOLOGY: Healthy university students, sedentary, of both sexes (n = 59), were randomly divided into four groups: placebo group (PG/n = 14/21 ± 1.4 years/mobilization of ankle); cervical manipulation group (CMG/n = 15/21 ± 2.4 years); thoracic manipulation group (TMG/n = 15/21 ± 1.7 years); and cervical and thoracic manipulation group (CTMG/n = 15/21 ± 1.5 years). The MIP and MEP were measured by manometer immediately before and after intervention and the highest value was used as the value of valid tests. The data was normalized by dividing the obtained values on the lower limit of normal range predicted by gender and age for each variable.

RESULTS: There was a significant increase in intragroup comparisons of the variables in the CMG (MIP-pre: 0.72/post: 0.76/p < 0.05, MEP-pre: 1.09/post: 1.15/p < 0.01) and CTMG (MIP-pre: 0.64/post: 0.72/p < 0.01; MEP-pre: 0.90/post: 1.01/p < 0.05) in post-intervention compared with baseline, which was not observed in PG and in TMG. There was no difference in intergroup comparisons.

CONCLUSION: Manipulation of C3 alone or combined with manipulation of T12 increased maximum inspiratory and expiratory pressure.

ANALYSIS

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Background Information
Spinal manipulation introduces mechanical forces that bring about transitory lengthening of the joint capsules which can alter segmental biomechanics. In theory, these changes are thought to alter the sensory signals of the tissues, which in turn can improve the body's biomechanical efficiency and physiological function.

Additionally, there is some evidence that spinal manipulation can stimulate the central nervous system, affecting the structures that are innervated by the manipulated segment and increasing the strength of the associated muscles.

The hypothesis of this study is that spinal manipulation of the third cervical vertebra (C3), which corresponds to the phrenic nerve and innervation of the diaphragm, as well as manipulation of the 12th thoracic vertebra, which is near the insertion of the diaphragm, may improve maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) in normal individuals.

The study's objective, therefore, was to determine the immediate effect of rotational spinal manipulation of C3 and T12 on MIP and MEP in healthy subjects.

PERTINENT RESULTS

Both cervical manipulation (CMG) and the combination of cervical and thoracic manipulation (CTMG) were effective in increasing both MIP and MEP. In contrast, there were no such increases observed in the placebo (PG) and thoracic manipulation (TMG) groups.

No significant differences were observed on intergroup comparisons.

CLINICAL APPLICATION & CONCLUSIONS

Spinal manipulation increased MIP immediately after the intervention in this study, which is thought to be the result of improved strength of respiratory muscles. This improvement is consistent with other studies that have reported increased electromyographic activity and muscular strength following manipulation, and these findings have been consistent in both symptomatic and asymptomatic individuals.

One of the study's initial hypotheses was that manipulation of T12 would increase MIP because of the level's close proximity to the insertion of the diaphragm. This hypothesis was not confirmed, however, which supports the view that manipulation must be directed to the segments that innervate the analyzed region in order for results such as these to occur. Thus, manipulation promotes the increase of motor neuronal excitability only at a segmental level, and not globally.

Increased muscular strength may explain the increase in maximum inspiratory pressure, but not for maximum expiratory pressure. The authors suggested that it may be related to an increase in inspiratory reserve volume which subsequently increased pulmonary distension and produced greater elastic retraction force during the test. In other words, since the participants could breathe deeper, they had more volume of air to exhale and could therefore exert greater maximum pressure.

A possible synergistic effect was observed in that the CTMG group received the greatest improvement in MIP, even though the thoracic manipulation only group did not show improvement. This finding may lend support for the argument that the use of combined techniques often produces better results.

This study investigated the effects of manipulation on MIP and MEP in healthy subjects, so its clinical applicability is uncertain and the topic will need to be investigated further before clinical claims can be made. Hypothetically, spinal manipulation could be useful in the treatment of lung disease, improving patients' ability to generate increased respiratory pressure, and possibly improving the production of pulmonary pressure and performance of athletes.

Another well-known study by Balon et al. (1) that dealt with spinal manipulation in asthmatic children also reported improved peak expiratory flow, though similar improvements were noted in both the active and simulated manipulation groups. Nonetheless, Balon and Mior (2) in a subsequent review on chiropractic manipulation and asthma indicated that "…certain clinical circumstances may warrant a therapeutic trial [of chiropractic care] in patients with asthma."

STUDY METHODS

Study participants were 67 Universidade Estadual do Oeste do Paran á (UNIOESTE) students between 20 and 30 years of age from both sexes. Volunteers must not have been engaged in any kind of systematic physical activity.

The exclusion criteria were:

- A positive Decklein test (sic), which reproduces symptomology of vertebral artery insufficiency [Decklein test should actually have been "de Kleyn's" test (3)];
- frequent cephalic presentations or episodes of dizziness, vertigo or pre-syncope;
- chronic or acute musculoskeletal injuries of the spine;
- medical history of cervical, thoracic or dominant ankle region fractures;
- spinal manipulation in the last 5 days;
- use of analgesics in the last 2 days;
- long-term use of corticosteroids;
- cardiorespiratory diseases; and
- smoker or ex-smoker for less than 2 years.

Also excluded from the study were cases where data were lost due to technical problems.

Participants were randomly assigned to the following groups:

1. cervical manipulation of C3 group (CMG),
2. thoracic manipulation of T12 group (TMG),
3. cervical and thoracic manipulation group (CTMG), and
4. placebo group (PG).

Manipulations were high-velocity, low amplitude thrusts in a supine position for the cervical spine and in a side-posture position for the lower thoracic spine. The placebo group received an anterior tibiotarsal mobilization with the purpose of simulating an intervention.

MIP and MEP were assessed by means of a Ger-Ar® analog vacuum manometer. Five measurements were taken for both the MEP and the MIP, with a 1-minute rest between each recording. The highest value of all attempts was considered most valid and was used in the statistical analysis.

STUDY STRENGTHS/WEAKNESSES

This was a reasonably well-conducted randomized clinical trial that employed appropriate blinding of the assessor. However, it is unclear whether the clinicians that provided the manipulations were blinded. It is highly likely that they were not, since they were surely aware of which structures they were manipulating as well as each structure's relationship to pulmonary neurology.

The vast majority of participants were women (100% in the PG and TMG groups, and 93.4% and 80% in the CMG and CTMG groups respectively) which may limit the generalization of the study's results to males.

As mentioned in the Clinical Application & Conclusions section above, this was not a clinical study, so the results cannot be used as evidence to support treatment.

Additional References:

1. Balon J, et al. A comparison of active and simulated chiropractic manipulation as adjunctive treatment for childhood asthma. N Engl J Med. 1998 Oct 8;339(15):1013-20.
2. Balon JW, Mior SA. Chiropractic care in asthma and allergy. Ann Allergy Asthma Immunol. 2004 Aug;93(2 Suppl 1):S55-60.
3. de Kleyn A, Nieuwenhuyse P. Schwindelanfalle and nystagmas bei einer bestimmten stellung des kopfes. Acta Oto-laryngolica 1927;11:155-7.