

Effect of visceral manipulation on forward head posture in subjects with chronic non-specific neck pain – a pilot study

Efeito da manipulação visceral na postura da cabeça para frente em sujeitos com dor pescoço crônica não específica - um estudo piloto

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ABSTRACT | INTRODUCTION: Forward head posture is considered to be the most common musculoskeletal postural imbalance causing protrusion of head anterior to trunk. Internal organs are interconnected and attached posteriorly to the spine through the support membranes. Tension in these support membranes may further cause mechanical restrictions, thereby affecting the mobility of the visceral organ and associated musculoskeletal structure in a two-way mechanism. **OBJECTIVE:** To explore the effect of organ-specific visceral manipulation on posture, disability, strength, and pain in subjects with chronic non-specific neck pain. According to this study hypothesis visceral manipulation aim to explore the effect of organ-specific fascia manipulation on posture, disability, strength, and pain in subjects with chronic non-specific neck pain. **MATERIAL AND METHOD:** Five subjects with chronic non-specific neck pain with forwarding head posture were recruited using a convenience sampling method. This study was conducted in a Physiotherapy department of a recognized multi-specialty hospital, Mohali. Subjects were referred after diagnosis from chronic neck pain from the departments. A single session of placebo visceral manipulation was administered in the first week, followed by a single session of visceral manipulation of the pleural dome and pericardial ligaments in the second week. Posture screen mobile application (posture), Pressure biofeedback unit (muscular activation), Neck Disability Index, and Visual Analog Scales were used to measure the pre and post outcomes. **RESULT:** Between-group comparison of the outcome showed a statistically significant difference in the VAS ($p=0.001$), Posture screening application ($p=0.02$), and NDI ($p=0.07$). No significant changes were observed in the strength outcome. **CONCLUSION:** Single session of visceral manipulation for the pleural dome and pericardial ligaments may benefit in improving the forward head posture, neck disability and reducing the pain.

Keywords: Forward head posture. Visceral manipulation. Posture. Pain. Pleural dome. Pericardial ligaments.

RESUMO | INTRODUÇÃO: A postura anterior da cabeça é considerada o desequilíbrio postural musculoesquelético mais comum, causando protrusão da cabeça anterior ao tronco. Os órgãos internos são interconectados e fixados posteriormente à coluna por meio das membranas de suporte. A tensão nessas membranas de suporte pode ainda causar restrições mecânicas, afetando a mobilidade do órgão visceral e a estrutura musculoesquelética associada em um mecanismo de mão dupla. **OBJETIVO:** Explorar o efeito da manipulação visceral específica de órgão na postura, incapacidade, força e dor em indivíduos com dor cervical crônica inespecífica. De acordo com a hipótese deste estudo, a manipulação visceral tem como objetivo explorar o efeito da manipulação da fásia específica do órgão na postura, incapacidade, força e dor em indivíduos com dor cervical crônica inespecífica. **MATERIAL E MÉTODO:** cinco indivíduos com dor cervical inespecífica crônica com postura anterior da cabeça foram recrutados usando o método de amostragem de conveniência. Este estudo foi conduzido em um departamento de Fisioterapia de um hospital multi-especializado reconhecido, Mohali. Os indivíduos foram encaminhados após o diagnóstico de dor cervical crônica dos departamentos. Uma única sessão de manipulação visceral placebo foi administrada na primeira semana, seguida de uma única sessão de manipulação visceral da cúpula pleural e ligamentos pericárdicos na segunda semana. Aplicação móvel de tela de postura (postura), unidade de biofeedback de pressão (ativação muscular), Índice de Incapacidade Pescoço e Escalas Visuais Analógicas foram utilizados para medir os resultados pré e pós. **RESULTADO:** a comparação entre os grupos do desfecho mostrou diferença estatisticamente significativa na EAV ($p = 0,001$), aplicação da triagem postural ($p = 0,02$) e NDI ($p = 0,07$). Não foram observadas mudanças significativas no desfecho força. **CONCLUSÃO:** Sessão única de manipulação visceral da cúpula pleural e ligamentos pericárdicos pode se beneficiar na melhora da postura anterior da cabeça, incapacidade cervical e redução da dor.

PALAVRAS-CHAVE: Postura anterior da cabeça. Manipulação visceral. Postura. Dor. Cúpula pleural. Ligamentos pericárdicos.

Introduction

Forward head posture (FHP) is defined as the protrusion of the head in the sagittal plane so that the head is placed anterior to the trunk¹. Forward head posture is one of the reasons that changes in biomechanical stress around the cervical spine leading to neck pain, headache, temporomandibular, and muscular dysfunctions². Forward head posture includes both an upper cervical extension and a lower cervical flexion, and it can induce lengthening and weakness of the anterior cervical muscles and shortening of the posterior region³. The prevalence of anterior head translation in neck pain patients was 58% in females and 42% in male⁴.

The prevalence of neck pain varies from 4.8% to 79.5% and is more common in females and high-income countries. Patients without a well-identified source for their neck pain are labeled as having idiopathic, mechanical, or non-specific neck pain⁵.

Visceral manipulation (VM) is developed by French osteopath Jean-Pierre Barral. It is a manual therapy to encourage the normal mobility, tone, and inherent tissue motion of the viscera and their connective tissue attachments⁶. The rule in visceral nociception is that pain is referred to somatic tissues, being felt at a site other than the affected viscera. Visceral referred pain (VRP) occurs, as secondary hyperalgesia, in somatic areas embryonically connected with the affected organs. The overlap of somatic and visceral afferent information into a shared neural pathway seems to be related to a misinterpretation at peripheral, spinal, or supraspinal levels⁵.

The pleura is a double-layered serous membrane that wraps around a large portion of each lung. The visceral pleuron adheres to the lung and dips into the fissures. The parietal pleura attaches to the chest and the diaphragm. It is divided according to the region of the chest which is associated with: costal pleura, mediastinal pleura, diaphragmatic pleura, and the pleural dome or cervical pleura (suspensory apparatus). The three parts of the pleura that have the greatest diagnostic significance from a manual

therapy point of view are the cervicopleural suspensory apparatus (pleural dome), the costomediastinal recesses, and costo diaphragmatic recesses. The apex of Pleural dome ligaments is connected to the cervical spine by three ligaments namely transverse pleural ligament, which passes from the transverse process of C7 and inserted into the pleural dome, costo pleural ligament passes from first rib to the pleural dome and pleura vertebral ligament, which passes from C5/C6/C7 vertebrae and is inserted into the pleural dome.

Pericardial ligaments include vertebro-pericardial ligament which is inserted into upper thoracic and lower cervical vertebrae with more fiber of spine to T4, phrenico pericardial ligament is attached firmly to diaphragm and sternum pericardial ligament which attaches to pericardium from manubrium and xiphoid process and it is subdivided into superior and inferior sternum pericardial ligaments⁷. Restriction in any of these ligaments may cause more forward protruded posture, tight chest and neck pain.

The visceral system is strongly interconnected to the musculoskeletal system through its support membrane system. Restrictions in these membranes can affect and show symptoms in either the visceral or musculoskeletal system (directly or indirectly)⁸. The removal of the restriction in these support membranes through visceral manipulation may help to improve the movement restriction and posture in the associated musculoskeletal area and also improves the mobility and motility of visceral organs⁹. According to this study hypothesis, visceral manipulation aims to determine the effect of organ-specific fascia manipulation on posture, disability, strength, and pain in subjects with chronic non-specific neck pain.

There is a dearth of objective therapeutic evidence for supporting the effect of visceral manipulation on forward head posture, pain, and disability in subjects with chronic non-specific neck pain. The objective of the study was to determine the effect of organ-specific visceral manipulation on posture, disability, strength, and pain in subjects with chronic non-specific neck pain.

Methodology

Study subjects

The study design was a Quasi-Experimental study. Five subjects with chronic non-specific neck pain for three months, aged between 41-60 years, including both male and female, were recruited for the study using convenience sampling. The patient with a history of a whiplash injury, any tumor and infections in the body, post-open-heart surgery, and breathing problem, such as asthma, were excluded from the study. The primary outcome measures used in this study were Posture Screen Mobile application and Pressure Biofeedback unit, Neck Disability Index (NDI), and Visual Analog Scale (VAS) was used as a secondary outcome measure. This study was conducted in a Physiotherapy department of a recognized multi-specialty hospital, Mohali. The data collection was started on 09/19/2019. Subjects were recruited for 2 weeks. The study protocol was approved by the Institutional Ethical Committee of the recognized hospital, Mohali, and registered in Clinical Trials Registry-India (CTRI) (CTRI/2019/10/021566). Written informed consent was obtained from the study participants before the study.

Outcome measures

The primary outcome measures used were the posture screening application and Neck disability index, Pressure biofeedback unit, and Visual analog scale were used as secondary outcome measures.

Posture screening mobile application aims to provide clinicians and researchers with tools for measuring posture and documenting posture changes over time. Posture Screen Mobile® app, when using defined procedures and markers, is a reliable method for assessing posture within and across raters. Intra-rater reliability ranged from 0.71 to 0.99. Inter-rater reliability was good to excellent for all translations¹⁰.

The pressure Biofeedback unit consists of an inelastic, three-section air-filled bag that is inflated to fill the space between the target body area, a firm surface, and a pressure dial for monitoring the pressure in

the bag for feedback on position. Movement of the body part of the bag results in a decrease in pressure while the movement of the body part into the bag results in an increase in pressure¹¹. A systemic review was conducted on the measurement properties of the CCFT using pressure biofeedback unit, the study showed that the ratings were positive, and the level of evidence was moderate for interrater and intrarater reliability and convergent validity. The study concluded that CCFT is a valid and reliable test that can be used in clinical practice as an assessment test¹².

Neck Disability Index is a 10 items questionnaire that measures patients' self-reported neck pain-related disability. Questions include pain, personal care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreation¹³. Most studies suggest that the NDI had acceptable reliability, although intraclass correlation coefficients (ICCs) range from 0.50 to 0.98¹⁴.

Visual Analog Scale is a psychometric response scale used to measure subjective characteristics or attitudes and has been used in the past for a multitude of disorders. VAS is a 100-mm long horizontal line with a verbal descriptor at the end to express the extremes of the feeling¹⁵. Retest reliability of pain scales was confirmed for all scales and across time points and had good reliability (rVAS=0.82-0.95)¹⁶.

Study procedure

Subjects received a single session of placebo visceral manipulation (PVM) technique in the first week. The patient was positioned supine, and the sternal region was exposed. The technique was repeated 3 times in a session. The therapist stood at the head end of the treatment couch. The therapist's hand was placed over the sternum, and no movement with the tissue was initiated. Duration for treatment was for 30 seconds and 3 repetitions.

In the second week, subjects received a single session of visceral manipulation. Visceral manipulation involved the application of a manipulation technique to the pleural dome and pericardial ligaments. The technique was repeated 3 times in a session. The subject was positioned in the supine lying position,

and the sternal region was exposed, with the therapist crosses the middle and index finger with mild flexion at proximal interphalangeal joints to get the finger fixed in the triangle of sedallot to move towards the barrier of restriction. The techniques for manipulation of the pleural and pericardial ligaments are as follows:

Pleural ligaments-

1. Transverse pleural ligament: The movable hand passively moved the neck to contralateral flexion against the non-movable hand in the triangle of sedallot (Figure 1).
2. Costopleural ligament: The neck was moved passively to contralateral flexion and ipsilateral rotation against the non-movable hand in the triangle of sedallot.
3. Vertebropleural ligament: The neck was moved passively to contralateral side flexion & contralateral rotation against the non-movable hand.

Figure 1.



The lengthened ligaments were maintained at the end range for 30 seconds and the technique was repeated 3 times for each ligament. The rest period was for 10 seconds.

Pericardial ligament-

1. Superior sternum pericardial ligament-

Hand placement - One hand is placed above the other, which is positioned over the manubrium. The downward hand is inactive, and a gentle fascial loading was provided by the upper hand on the left lateral part of the manubrium to engage and decompress the ligament to follow the direction of ease of the restriction. (Fig.2)

Figure 2.



2. For inferior sternum pericardial ligament - The hand placement was similar to superior sternum pericardial ligament and the therapist applies the fascial loading on the lower one-third of the sternal body. (Fig.3)

Figure 3.



3. For vertebro-pericardial ligament- The therapist's hand is placed posteriorly between C7 to T4. The other hand was placed on the sternum to engage the line of tension with the posterior hand. The neck was moved passively towards the contralateral right-side flexion and rotation towards left for left vertebro pericardial ligament and right vertebro pericardial ligament, the neck was passively moved towards left side flexion and right side rotation. (Fig.4)

Figure 4.



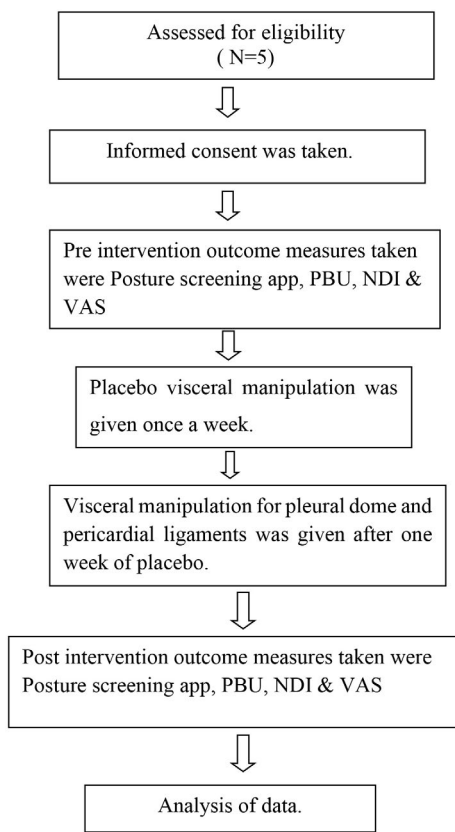
4. For phrenico-pericardial ligament- The study subject is in sitting the flexed position with the therapist positioned behind the patient. Therapist middle finger and index finger of both the hand is positioned below the ribs on the left medial side. Fingers angulated posteriorly to space between the inferior part of the heart and anterior part of the diaphragm, the study participants were moved in slough position by the therapist body weight to engage and follow the direction of ease to gain the release in the restriction between the diaphragm and inferior part of the heart. (Fig.5)

Figure 5.



The lengths of ligaments were maintained at the end range for 30 seconds and repeat 3 repetitions of each ligament.

Figure 6. Summary of the procedure.



Results

The mean age (in years) of five subjects with chronic nonspecific neck pain was 51.4 years. (Table 1) Duration of nonspecific neck pain ranged between 3 months to 2 years. All five subjects completed the study with no adverse effects post-intervention.

Table 1. Shows total number of male and female participated

Characteristics of study participants(N=5)		Number of participants(N)
Age (in years)	41-50	2
	51-60	3
Gender	Male	2
	Female	3
Duration of Pain (Months)	3 months to 12 months	3
	More than 12 months (1-2 years)	2

Within group analysis of the placebo visceral manipulation showed no statistically significant changes in the outcome measures, posture screening, pressure biofeedback, NDI and VAS. (Table 2) Statistically significant changes were observed in the outcome measures, posture screening, pressure biofeedback and VAS in the within group analysis of visceral manipulation.

Table 2. Shows the within group analysis of all the outcome measure

Within group						
	Placebo Visceral Manipulation			Visceral Manipulation		
	Pre intervention Mean(SD)	Post intervention Mean (SD)	P value	Pre intervention Mean(SD)	Post intervention Mean (SD)	P value
Posture Screening Application (cm)	1.76(.85)	1.99(.53)	0.64	3.16(1.2)	1.3(0.46)	0.03
Pressure Biofeedback (mmHg)	26.8(3.34)	28.8(1.09)	0.14	27.2(1.7)	29.2(1.09)	0.03
NDI (%)	3.02(16.3)	3.02(16.3)	< 0.001	30.2(16.3)	26.8(16.1)	0.11
VAS	4(1.2)	3.6(1.5)	0.17	4(1.2)	1.4(1.1)	< 0.001

Post visceral manipulation intervention, statistically significant changes were observed in the outcome measures, posture screening application and VAS. (Table 3)

Table 3. Shows between group analysis of all the outcome measures

Outcome Variable	Mean difference	95% of confidence interval	P value
Posture Screening Application	-2.0	-3.65 - -0.36	0.02
Pressure Biofeedback	0.0	-2.91 - 2.91	1
NDI	-3.4	-7.23 - 0.43	0.07
VAS	-2.2	-2.99 - -1.40	<0.001

Discussion

Visceral Manipulation has shown to increase proprioceptive communication through mechanical relation within the body, thereby relieving symptoms of pain, structural dysfunction, and poor posture⁹. The result of this study showed that visceral manipulation was beneficial in improving posture and reducing neck pain. Releasing the restriction of ligaments between pleural dome, pericardium, and cervical spine through the direct and indirect method of visceral manipulation may have helped in reducing the forward head posture, measured by posture screen mobile application and pain, measured by the visual analog scale. The result goes in linear with the study by Silva et al who studied the effect of stomach and liver visceral manipulation on cervical pain, cervical range of motion, and upper trapezius muscle activity reported that there was a reduction in pain and increase in the amplitude of upper trapezius muscle activity¹². The changes brought by visceral manipulation in forwarding head posture may be related to the mechanism of tension release in the supporting membrane connecting the visceral and musculoskeletal system in the cervical spine. Gluraiz et al reported that factors attributing to pain are multi-factorial¹⁸. Pain may be experienced as a result of dysfunctions in the musculoskeletal, nervous, visceral, psychosomatic, and emotional systems in the body. According to Eguaras et al on the effects of osteopathic visceral treatment in patients with Gastroesophageal reflux disease (GERD). The study showed that the phrenic innervation of the diaphragm and upper abdominal structures has been given as the reason to treat neck pain employing

visceral osteopathic intervention in subjects suffering from digestive disorders, showing positive results in the neck area. The study concluded that osteopathic visceral technique for GERD improves GERD symptomatology, C4 spinous process pressure pain threshold, and cervical mobility. Further, a correlation has been found between greater GERD symptomatology and lower C4 spinous process pressure pain threshold¹⁹. The continuous imbalance between the superficial and deep neck muscles causes the head to a position further forward from the body²⁰. Previous studies have shown that patients with chronic neck pain exhibit a difference in muscular strength and endurance of the sternocleidomastoid (SCM) and deep cervical flexor muscles (DCF). Post visceral manipulation, no significant improvement was observed in the activation of deep cervical flexor muscles, which attributes to the fact that the tone of the muscle may not be influenced by visceral manipulation, and physical therapy interventions such as strengthening exercises will play a vital role in activating muscles post visceral manipulation.

The current evidence for the rehabilitative interventions suggests a multimodal physiotherapy intervention that focuses on exercise strengthening, including a variety of methods such as mobilizing, stretching, isometric/static or dynamic, endurance training, direction-movement control, and proprioceptive exercises²¹. Hence comprehensive multi-system assessment and intervention will be effective in pain and movement dysfunction. Integrated viscera musculoskeletal assessment and visceral manipulation will be one of the effective tools in the rehabilitation strategies. The clinical significance of visceral manipulation stands high in the treatment of the commonest postural dysfunction like the forward head posture in daily clinical practice.

Limitations

Limitations of this study are the study design and a small sample size of this study may not be appropriate to generalize the result, there was no follow-up, which could have shown better results and allowed for the determination of intervention effects. A 2-D postural assessment was used. Further randomized control trial with a larger sample population and 3-D posture assessment with follow-ups are recommended for future studies. The impact of postural changes on functional activities like reading, driving, personal care, etc., and occupational activities post visceral manipulation will also be a key area for further investigation.

Conclusion

This pilot study indicates that a single session of visceral manipulation may be an effective tool in a multi-model intervention in treating forward head posture and pain in patients with chronic non-specific neck pain.

Author contributions

Yangdol S conceived and designed the analysis, collected the data and wrote the paper. Gandhi BK conceived and designed the analysis, helped in collecting the data, reviewed and approved for the final manuscript.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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