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ORIGINAL ARTICLE

Effects of the Neuromuscular Abdominal Technique on the Craniocervical angle in patients with Chronic Mechanical Cervicalgia

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ABSTRACT

Introduction: The abdominal muscles play an important role in maintaining the posture. There is evidence that dysfunctions in the abdominal wall have a profound effect on back pain and, in particular, on chronic mechanical cervicalgia (CMC).

Objectives: To assess the immediate effect of the Neuromuscular Technique (NMT) at the level of the rectus abdominis sheath in workers maintaining their position for more than 4 hours in front of a computer, for pain noticed during a cervical movement, in cervical mobility and in the head's position.

Material and methods: A randomised clinical trial was carried out, in parallel with an experimental treatment compared to a control treatment, in 34 patients (n=34), Control Group (CG: n=17) and Experimental Group (EG: n=17). The control group received a technique simulating a functional balance at the epigastric level, and on the experimental group we applied the Neuromuscular Technique at the level of the rectus abdominis sheath.

Results: No statistically significant differences were found in the craniocervical angle in a sitting position (p=0.033) with a 4.93 ± 5.7% change in the experimental group and 0.6 ± 3.77% in the control group. No differences were found in the craniocervical angle in a standing position, in the pain noticed during cervical movement or in the range of neck mobility (p>0.05).

Conclusions: NMT at the level of the rectus abdominis sheath improves the head's position sitting down, but it is not useful to balance the cephalic position when standing, increase the cervical mobility or modify the pain noticed during a cervical movement.

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INTRODUCTION

Posture refers to the position and direction of the human body in its space, as well as the arrangement that the different body segments establish among themselves, with regard to the gravitational force[1,2]. Campignion[3] differentiates between posture and postural attitude. Postural attitude is the body's external arrangement, which is intrinsically related to each person's way of being and to the way each person has of relating with their environment. Posture is determined by the somasensatory, visual and vestibular levels[4].

The supposition that postural behaviour contributes to pain is often made because some positions increase the load on specific tissues and, therefore, could cause damage and/or pain to the tissue. Specific literature does not describe any uniformity between the correlation of posture and pain[5].

Posture is an acquired function and each individual has his own structure. In accordance with needs, each body segment is balanced with the adjacent segment. In the musculoaponeurotic system, everything is connected; each gesture is performed starting from a set of actions that complement each other to achieve the final objective. Therefore, the initial tension is responsible for a succession of related tensions[6].

The forward or backward position of the individual[7, 8], in connection to the vertical line of gravity produces structural changes on the cervical and lumbar curves. From the biomechanical point of view, the muscles that are inserted on the cranium exercise a direct vector action on their skeletal elements[9]. This posture can be altered by the postural attitude maintained whilst working, as in case of the office workers[10-12], desk and/or computer workers who tend to adopt a forward head position (FHP).

Osteopathic treatment can affect balance and posture through numerous central interconnections of the autonomous system and of the balance control that could have a direct effect on the vestibular functioning[13].

Pain in the cervical and lumbar column is one of our daily challenges as physiotherapists and often, they are related and connected to stress[14]. Pain at the cervical column level means a problem for the health system. In 1988, a survey was conducted, in which 66% of the population said they had suffered neck and back pain in the previous year[15]. The prevalence in Spain[16] was 19.5% in 2006, with it being greater in women (26.4% and 24.5%) than in men (12.3% and 15.1%). It affects 45-54% of the population in general during their lifetime[17], which may result in situations of extensive disablement[18].

Activation and perpetuation of the suboccipital muscles, according to Travell and Simons[19], could be due to a FHP, or to the effect of the occipital rotation and for other reasons among which we highlight the abuse of its physiological kinetic brake (control) during the flexion maintained by the head, by abuse of the extensor function during ascending basculation, sustained by the head and by the combination of this latter reason with a maintained cervical rotation, which could cause hyperextension of the neck or an increase of cervical lordosis.

The clinical decision for treating patients with cervical pain[20] is often based on the findings obtained during the medical examination, based on the patient's signs and symptoms and not on technical imaging diagnoses. In a study conducted in 2003 by Wang et al.[21], cervical mobility was used as a measure of the results in a clinical decision algorithm, designed as a therapy for patients with cervical pain. The abdominal muscles and the diaphragm play an important role in maintaining posture[22-24] and in visceral functions, both thoracic and abdominal.

The rectus sheaths, one anterior and the other posterior, are made up from aponeurotic expansions of the oblique and transverse muscles that in the mid line

make up the *linea alba*, the place of sinewy crossover for these muscles [25].

These four pairs of muscles and their aponeurosis are responsible for a large part of the resistance in the abdominal wall. Their insertions in the thoracolumbar fascia strengthen the support of the abdominal viscera and assist in trunk flexion and rotation[26]. This joint connects to the abdominal wall by bonding the thoracolumbar fascia with all the back muscles and the deep fascia of the nape of the neck[27].

This study's approach was to analyse whether the neuromuscular technique applied at the level of the rectus abdominis sheath could contribute to improving cervical mobility and reduce the pain noticed during the neck movement, balancing the head's forward position in patients that have chronic mechanical cervicalgia (CMC) and specific requirements in the neck at work, maintaining a seated position for more than four hours in front of a computer.

In such a case, we think that we could make a contribution to innovative aspects in therapy and health and safety at work.

MATERIAL AND METHODS

Study design

A randomised double-blind clinical trial in parallel with experimental treatment against a control treatment, carried out in Madrid in 2012.

Sampling and size of the sample

We carried out a non-probabilistic sampling for the study's convenience, selecting a sample of the eligible population, comprising patients that attended the main researcher's office in Madrid (Spain) that fulfil the criteria for selection and voluntarily accepted to take part in the study. We calculated the necessary sampling size, using the Granmo version 7.12 (Granmo, IMIM Hospital del Mar, Barcelona, Spain) software for the difference of the two independent media starting with a previous pilot study, accepting an alpha risk of 5% (α=0.05) and a beta risk of 20% (β=0.2) in a unilateral contrast, we found that 16 subjects were required in the first group and 16 in the second to detect a difference equal to or more than 14% (0.14) in the craniocervical angle between the groups. It assumed that the usual deviation was 15% (0.15). A rate of losses in monitoring was estimated at 6% (0.06) with a study potential (1- β) of 80% (0.8). Therefore, we recruited 34 patients in total, distributed over the two groups as 17 patients in each. There were no losses in monitoring.

Study population

Thirty-four patients (n=34) who fulfilled the criteria for selection took part in our study. They were distributed randomly into two groups of seventeen patients each; a control group (CG; n=17) who received a simulation technique of the functional balance as a placebo at the epigastric level and an experimental group (EG: n=17), who received the Neuromuscular Technique at the rectus sheath level, as an experimental procedure.

Criteria for selection

To take part in this study, the following inclusion criteria were strictly followed: patients of either sex, aged between 18 to 50 inclusive, office workers or those working for four or more hours daily sitting in front of a computer who showed CMC[28-30] (more than 8 weeks of progress) with a degree of I-II[31] who had not received osteopathic treatment in the previous month, so as not to interfere in the results and signing an informed consent form.

Participants were excluded from this study who fulfilled at least one of the following criteria: contraindication to the neuromuscular technique [32] (acute injuries in the first 72 hours), showing psychiatric disorders or a diagnosed psychological change (schizophrenia, depression), patients who due to their culture or language would have difficulties in understanding the researcher's orders, rejection for taking part in the study, patients with secondary mechanical cervicalgia, other pathologies such as whiplash in the acute phase, congenital or acquired torticollis, rheumatoid arthritis in an advanced stage, pregnant at the time of the study, taking analgesic and/or anti-inflammatory medicine, be suffering from previously diagnosed neurological pathologies such as

congenital diabetic polyneuritis or any neurological alteration.

Randomisation

The sequence for assignment was generated through software, with a 1:1 ratio, by an unconnected collaborator. The assessors and the patients did not know the randomisation sequence and the assignment in accordance with it, which was concealed and kept safe by administration personnel who did not know the study's objective.

Study protocol

We informed the patients of the study's general aspects using an informed consent form, in accordance with the Spanish legislation on the subject of personal data protection (Act 15/1999). After signing the informed consent the pre-procedure measurements and side photographs were taken and goniometric tests performed. We assessed the patients' weight and size with an electronic medical scale (Seca 703, Seca, Hamburg, Germany) and completed the data collection sheet (name, age, body mass index – BMI – and handedness). Then, photographs were taken using a tripod, in a sitting and standing position. Then, the patient went into another room fitted with an examination bed and a chair, separated by a room divider. Both rooms remained at a constant temperature between 20 and 23ºC. We conducted measurements on pre-procedure cervical mobility, in flexion, extension, rotation (left and right) and lateral flexions (left and right) and assessment of the perception of pain on moving using the visual analogue scale (VAS) for pain. Subsequently, we applied the procedures to each study group (control and experimental) and finally, we performed the post-procedure measurements of cervical mobility and the perception of pain on moving. We collected all the data for their subsequent statistical analysis.

Applied procedures

To the experimental group. We applied the Neuromuscular Technique (NMT) on the rectus abdominis sheath. NMT is a treatment method on the soft tissue capable of improving general function, relaxing muscular tension and through its effects on the points which triggered the muscular aponeurosis, treating the underlying causes of an extensive range of symptoms. The basic abdominal technique was described by Chaitow[33]. This technique has an effect on the central tendon of the lateral side of the rectus muscles' sheaths, and we think it will affect cervical mobility and the forward head position. The period for applying the NMT on the rectus sheath and on its rib insertions was similar to the placebo manoeuvre applied to the control group.

The objective of NMT is to relax the abdomen's musculoaponeurotic tissue and to do this, we proceeded in the following way[33]: the patient remained in the supine position, with the lower limbs in flexion and supported on the bed. During the first phase, pressure is applied on the costal arch and to do this the physiotherapist stands in feint at the height of the patient's shoulder, contacting the costal arch with the thumb and applying a series of brief passes, following the costal arch, starting at the xiphoid apophysis, putting on profound pressure with the thumb and with the fingertips. During the second phase, the procedure focuses on the rectus abdominis sheath, carrying out a series of brief passes of intense and painless pressure using the thumb, from the xiphoid apophysis to the pubic crest (figure 1); the passes to the pubic crest (figure 1) were repeated on each side several times, according to the degree of tension, congestion and sensitivity.

Finally, several brief, deep and slow passes were applied with the thumb from the ribs' arches until reaching the inguinal ligament, on both sides.

To the control group. This group received a placebo technique using a simulation manoeuvre of functional balance at the epigastric level; to do this, the patient remained in a supine position with the lower limbs in flexion, feet supported on the bed. The physiotherapist sat at the patient's left and placed the left hand at the height of the patient's epigastrium and simulated a functional balancing technique, for a minute and a half, without applying a therapeutic purpose. The similarity of the procedures implied the blindness of the subject and to this effect, both techniques were performed at the level of the patient's abdomen and for a similar period of time.

Assessments made

All the assessments of the variables of interest were made before the procedure and immediately after the procedure (pre/post) by experienced osteopaths, different from those who applied the procedures, who did not know the patients in the study groups, the research objectives and the randomisation sequence, which was hidden and kept safe by administration personnel who did not know the study's objectives.

Measurement of the forward head position. The FHP is one of the most common postural alterations that influences those individuals predisposed to pathological conditions, such as head and neck pain, temporomandibular alterations, dyskinesia, scapular-humerus or even alteration to the length and strength in the soft tissue[34]. To assess FHP the craniocervical angle[35-36], can be used or the sagittal C7 tragus angle which is the angle formed by the crossover of the line drawn between the tragus of the ear and C7 with the horizontal (figure 1). This angle describes the head position in relation to C7, in a sagittal photograph, for example, of the left side, the head is placed more forward when this value is increased, measured in degrees. The average standard sagittal angle would be 131.1º (+/- 6.5º), with a confidence interval of 1.0º.

To determine the craniocervical angle, two lateral images are used, from the patient's left side, one in a relaxed standing position and the other in a relaxed sitting position. First the anatomical references are clearly marked. With a demographic marker the colour blue marks the tragus of the ear and the spinal apophysis of the C7 vertebra is marked with a plastic pointer.

The photographs were taken with an Olympus (E-420, Olympus, Hamburg, Germany) camera with an Olympus Digital 14-42 mm objective, mounted on a tripod and placed in marks on the floor at a distance of 1.5 metres from the subject. We placed the camera at a sufficient height so that the patient's head and trunk as well as the marks located on a plumb line and a metric reference (50 cm) that was located in the same plane as the patient appeared in focus through the viewer. The photographs were processed using the SAPO[37] software (software for postural analysis) to discover the craniocervical angle.

Measurement of cervical mobility. Pain related to posture, work or stress causes variations in mobility. Cervical mobility represents an important measurement in the results for assessment of the degree of effort and gravity of the limitation of patients' movements with cervical involvement[38]. The most basic method to assess cervical mobility is visual. Youdas et al.[39], compared visual estimation, goniometry and devices for the range of cervical articular movement (ROM – range of motion). Bad reproducibility was observed in the visual estimation (ICC 0.42-0.7). We used a cervical inclinometer known as CROM (CROM de Luxe, Performance Attainment Associates, Minnesota, USA) that is made up of 2 gravity inclinometers to measure the cervical mobility in flexion, extension, lateral flexion (in the sagittal and frontal planes) and rotation; the latter through a magnetic inclinometer (figure 1). Reproducibility of the obtained results with the device is clinically satisfactory. Studies carried out by Capuano-Pucci et al.[40] and Peolsson et al[41] have established an ICC (Interclass Correlation Coefficient), intra-rater reliability range ICC: 0.63-0.9 for the first measurement and ICC: 0.62- 0.91, for the second measurement; and an ICC intra-rater reliability range: 0.8- 0.87 in the first and ICC: 0.74-0.85 in the second.

The CROM cervical inclinometer was placed on the patient's head and we followed the cervical mobility assessment protocol, sequentially recording the movements in the sagittal plane (flexion-extension), then the frontal plane (left and right lateral flexion) and finally those of the transversal plane (left and right rotation). Each movement was repeated three times consecutively and the arithmetical average of the three measurements was calculated.

Measurement of pain noticed during the cervical movement. In the first measurement by inclinometer (of the three repetitions performed) of each cervical spine movement, both in the pre-procedure and post-procedure tests, the patient was asked to indicate a pain value noticed in cervical movement on the visual analogue scale (VAS) at the end of the movement with 0 being the value relating to the absence of pain and 10 being the value assigned to unbearable pain.

The Visual Analogue Scale (VAS) is considered as an effective, accurate, reliable, sensitive, easy-to-use

and reproducible method[42] to measure acute or chronic pain.

In the bibliography[43], there was a highly reliable intra-rater index (ICC: 0,992-0,998) for assessment using VAS. Each patient was informed on what VAS consisted of.

Statistical analysis

The quantitative variables are described using centralisation and dispersion measurements (average and typical deviation, mid and interquartile range, Q1-Q3). The qualitative variables are described using absolute frequencies (N) and relative frequencies (%). To represent distribution of the data, box-plot diagrams are used that represent the mid and interquartile range and enable identifying the outliers and extreme values. For univariate analysis the control and experimental groups were compared using non-parametric methods for the small sampling size. Univariate tests were performed to study the basal situation; the Fischer exact test in the case of qualitative values and the Mann Whitney U test in the case of quantitative variables. The same test was used to compare the post-procedure measurement and for the absolute pre and post procedure measurements relative to each group.

All the tests were considered bilateral and a p-value of <0.05 as a statistically significant value. The SPSS statistical software v.17 and STATA v.12 for Windows was used.

RESULTS

The total sample for this study was made up of 34 participants, aged between 18 and 50, inclusive (38.38 ± 4.66), assigned randomly to the study groups. Of them, 17 belonged to the procedure group (12 women and 5 men) and the remaining 17 made up the control group (9 women and 8 men). There were no losses in the monitoring phases or during the analysis (figure 2). Table 1 includes the basal characteristics for each group and no notable differences were detected between the groups. Table 2 includes the results of the pre and post-procedure absolute differences, calculated as pre and post for goniometry and as pre/post for VAS; table 3 shows the relative references with regards to the basal measurement in terms of percentage. Statistically significant differences were found in the craniocervical angle in sitting position, p=0.033 with a 4.93 ± 5.7% change in the experimental group and 0.6±3.77% in the control group. Effects of the procedure were not found in VAS, goniometry, nor in the craniocervical angle in a standing position.

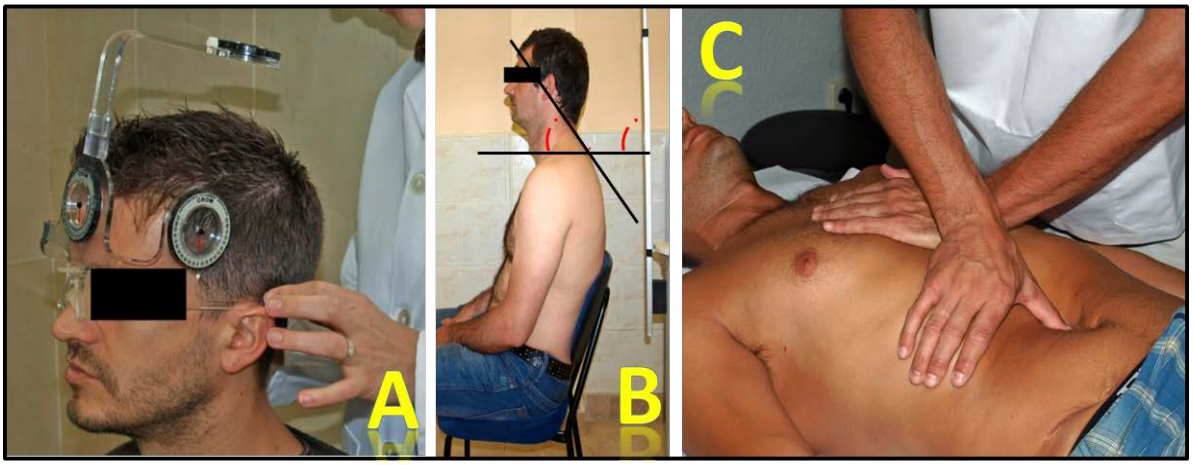

Figure 1.- Cervical mobility assessment (A) and FHP sitting down (B).
NMT procedure applied on the Experimental Group (C).

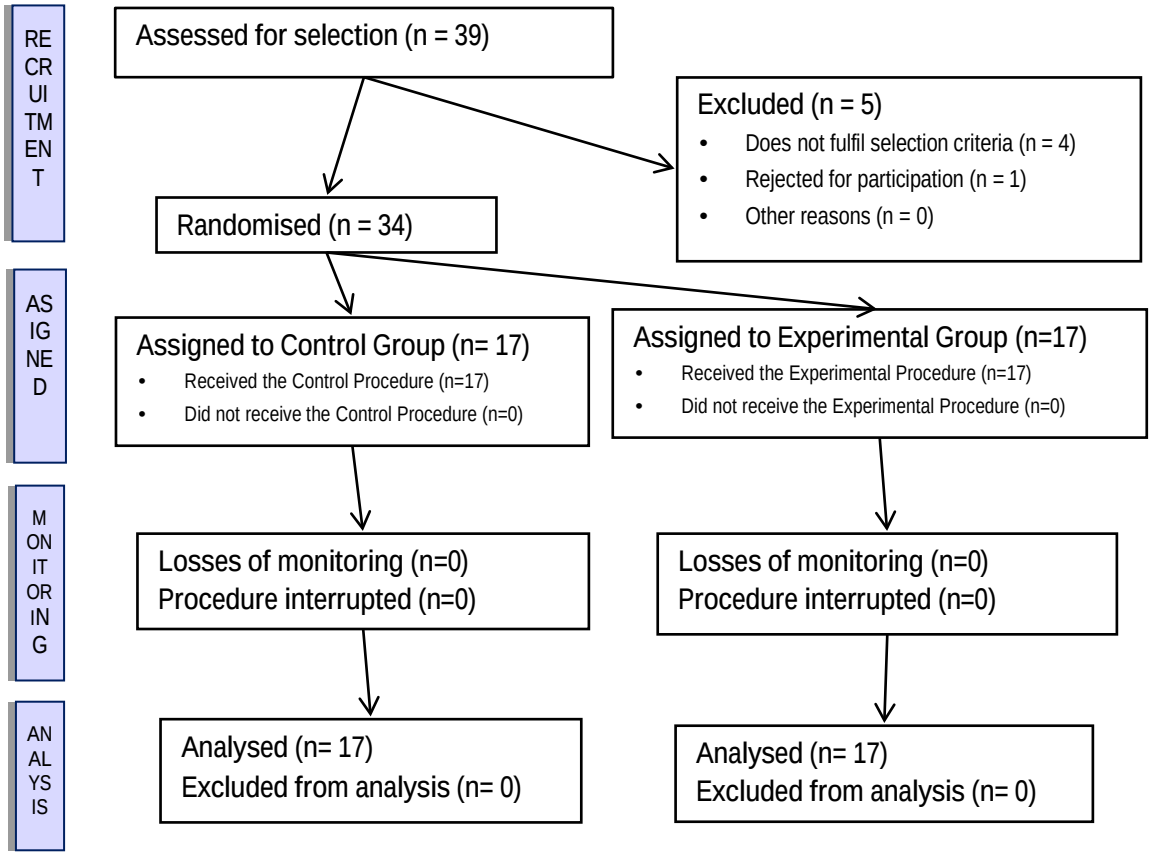

Figure 2. Flow chart according to the CONSORT declaration for the Randomised Trials Reports [44] of the parallel groups

DISCUSSION

After performing NMT at the rectus abdominis level we saw significant changes in the craniocervical angle while in a sitting position, which could benefit patients who show pain, related to positions maintained overtime during their employment activities.

However, we did not find changes in the craniocervical angle standing up, nor did we obtain any significant modifications in the cervical mobility or in the pain noticed during a neck movement.

This leads us to believe that NMT applied at the rectus abdominis level could be an efficient method in the treatment of patients with chronic mechanical cervicalgia, since it could help them to balance the head position in the space, making it match the gravitational vertical position more closely and, thereby, reducing the related mechanical stress on the cervical muscles. However, contrary to what we first thought, this new situation on balance is not connected to a reduction in pain level noticed during neck movements.

		TOTAL (n=34)	CONTROL (n=17)	EXPERIMENTAL (n=17)	P-value
SEX	MAN	13 (38.2%)	8 (47.1%)	5 (23.4%)	0.481
	WOMAN	21 (61.2%)	9 (52.9%)	12 (70.6%)	
AGE (years)		38.38 ± 4.66	37.94 ± 4.41	38.82 ± 4.99	0.808
BODY MASS INDEX (rate)		23.76 ± 2.97	24.23 ± 2.85	23.29 ± 3.09	0.293
CRANIOCERVICAL ANGLE STANDING UP (degrees)		50.10 ± 5.49	49.73 ± 5.56	50.47 ± 5.56	0.667
CRANIOCERVICAL ANGLE SITTING DOWN (degrees)		50.74 ± 5.37	51.24 ± 4.76	50.24 ± 6.03	0.449
GONIOMETRY FLEXION (degrees)		52.55 ± 9.55	53.24 ± 9.34	51.86 ± 9.99	0.593
VAS FLEXION (scale 0-10)		0 (0 - 1.25)	1 (0 - 3)	0 (0 - 0)	0.027*
GONIOMETRY EXTENSION (degrees)		63.87 ± 9.98	61.14 ± 10.50	66.61 ± 8.90	0.148
VAS EXTENSION (scale 0-10)		1 (0 - 3)	2 (0 - 4)	0 (0 - 2.5)	0.225
GONIOMETRY LATERAL FLEXION LEFT (degrees)		45.59 ± 8.99	44.75 ± 8.95	46.43 ± 9.22	0.931
VAS LATERAL FLEXION LEFT (scale 0-10)		2 (1 - 3)	3 (1 - 3.5)	2 (0.5 - 2.5)	0.140
GONIOMETRY LATERAL FLEXION RIGHT (degrees)		43.32 ± 9.52	42.24 ± 9.20	44.41 ± 10.00	0.459
VAS LATERAL FLEXION RIGHT (scale 0-10)		2 (0.75 - 4)	3 (1 - 4.5)	1 (0 - 2.5)	0.112
GONIOMETRY ROTATION LEFT (degrees)		67.92 ± 7.00	66.61 ± 8.08	69.24 ± 5.67	0.309
VAS ROTATION LEFT (scale 0-10)		0 (0 - 1)	1 (0 - 1.5)	0 (0 - 1)	0.221
GONIOMETRY ROTATION RIGHT (degrees)		68.57 ± 7.63	69.41 ± 5.87	67.73 ± 9.17	0.490
VAS ROTATION RIGHT (scale 0-10)		0 (0 - 1.25)	1 (0 - 2.5)	0 (0 - 0.5)	0.018*

TABLE 1. Demographic characteristics and basal measurements in the total sample and by treatment groups. VAS: Visual Analogue Scale; the p-values are the result of the univariate analysis; *Express statistical significance.

We were not able to compare our results with other similar studies, since we have not found any similar study and we suppose that our results are due to the fact that we have assessed the immediate effects of pain noticed after NMT application.

It would be logical to think that balancing the head's position will reduce the mechanical load of the cervical muscles and that those suffering pain will reduce their changes, although in those pain effects it is likely that the time factor will be decisive and, therefore, future research should be conducted that will assess these effects in the medium and long term, in addition to carrying it out immediately after the application of NMT on the rectus abdominis sheath.

The relationship between the function of the abdominal muscles and the position of the cervical spine was analysed by other writers[45] in 1995, objectifying

	Control (n=17)	Experimental (n=17)	P-value
CRANIOCERVICAL ANGLE STANDING UP (degrees)	*2.59 ± 6.54*	*4.47 ± 4.70*	*0.209*
CRANIOCERVICAL ANGLE SITTING DOWN (degrees)	*0.60 ± 3.77*	*4.93 ± 5.78*	*0.031**
FLEXION GONIOMETRY (degrees)	*-2.80 ± 12.82*	*0.32 ± 13.33*	*0.796*
EXTENSION GONIOMETRY (degrees)	*5.53 ± 9.76*	*6.39 ± 10.28*	*0.513*
LEFT LATERAL FLEXION GONIOMETRY (degrees)	*3.79 ± 11.45*	*3.96 ± 8.85*	*0.823*
RIGHT LATERAL FLEXION GONIOMETRY (degrees)	*4.08 ± 9.08*	*3.82 ± 9.39*	*0.730*
LEFT ROTATION GONIOMETRY (degrees)	*4.14 ± 8.28*	*-0.44 ± 8.36*	*0.098*
RIGHT ROTATION GONIOMETRY (degrees)	*0.21 ± 10.88*	*1.55 ± 11.90*	*0.730*

TABLE 2. Pre and post-procedure absolute differences. The data is represented as an average ± typical or mid deviation range (interquartile range).

	Control (n=17)	Experimental (n=17)	P-value
GONIOMETRY FLEXION (degrees)	*-1.92 ± 7.34*	*-0.33 ± 6.72*	*0.743*
VAS FLEXION (scale 0-10)	*0 (0 - 1)*	*0 (0 - 0)*	*0.767*
GONIOMETRY EXTENSION (degrees)	*2.92 ± 5.35*	*4.53 ± 6.5*	*0.293*
VAS EXTENSION (scale 0-10)	*0 (0 - 2)*	*0 (0 - 1)*	*0.595*
GONIOMETRY LATERAL FLEXION LEFT (degrees)	*1.43 ± 5.03*	*1.29 ± 4.1*	*0.877*
VAS LATERAL FLEXION LEFT (scale 0-10)	*1 (0.5 - 2)*	*1 (0 - 1.5)*	*0.457*
GONIOMETRY LATERAL FLEXION RIGHT (degrees)	*1.33 ± 3.89*	*1.33 ± 4*	*0.769*
VAS LATERAL FLEXION RIGHT (scale 0-10)	*1 (0 - 2)*	*1 (0 - 1.5)*	*0.986*
GONIOMETRY ROTATION LEFT (degrees)	*2.61 ± 5.51*	*-0.41 ± 5.65*	*0.088*
VAS ROTATION LEFT (scale 0-10)	*0 (0 - 1)*	*0 (0 - 1)*	*0.924*
GONIOMETRY ROTATION RIGHT (degrees)	*-0.08 ± 7.2*	*0.63 ± 7.54*	*0.783*
VAS ROTATION RIGHT (scale 0-10)	*0 (0 - 1)*	*0 (0 - 0.5)*	*0.762*

TABLE 3. Relative differences in so many percent given a basal situation. *Express statistical significance.

that the neck and pelvis alignment could affect the electromyographic activity of the torso's flexor and extensor muscles.

In our case, we can confirm that this happens in the neck after applying a NMT in the rectus abdominis sheath given that we have not electromyographically assessed the cervical muscles, which we consider useful for future research, although we have objectified the absence of changes in cervical mobility, which could be related to the state of the hypertonic cervical muscles.

Perri et al.[46] analysed in a study the defective respiration and CMC, suggesting that for the treatment of the latter, respiratory disorders must be assessed and treated, due to their great influence on back pain and in particular on cervicalgia. This may be due to the fact that at a myofascial level there is a functional unit. Mihalache, G. et al.[47] observed that the deep cervical fascia is continuous, like a hose, surrounding the neck and torso and that in the mid-ventral line it is very dense and resistant and continues from the hyoid bone to the pubis. At the neck level, it surrounds the sternocleidomastoid and trapezium muscle, continues to the thorax level surrounding the major pectoral and wide dorsal muscles, and at the abdomen´s level, it becomes very fine and covers the anterior rectus sheath of the abdomen. In our case, we are convinced that the respiratory muscles contribute functionally to the state of the neck's mobility and therefore to the state of health or illness, with a relationship existing between both. That is why we recommend that it is integrated into the treatment protocols of patients with CMC or NMT at the rectus abdominis sheath level, since it contributes to balancing the head's position vertically in gravity. It could also be included in the protocols for health and safety at work, in those individuals who perform tasks sitting down with a forward head position for more than 4 hours a day.

Study limitations

Our study has limitations in several aspects, such as the sample size, for example, which we recommend to be increased in subsequent studies. Also, we did not assess the obtained effects after a more prolonged period of time, nor did we monitor in the short, medium and long term and, therefore, these actions could be performed in future researches. Finally, we have to add that we only assessed the effects of one technique and, therefore, the results and conclusions of greater clinical importance in the future must be included within a comprehensive treatment of the subject, in which several therapeutic procedures are included.

CONCLUSIONS

Application of NMT at the level of the rectus abdominis sheath produces an immediate significant increase in the craniocervical angle while sitting down, but no statistically significant differences were seen in cervical mobility, in pain noticed during a neck movement or in the craniocervical angle while standing.

ETHICAL STANDARDS

Our study fulfils the ethical standards of the Helsinki Declaration[48], and its subsequent revisions and was approved by the Ethical Experimentation Committee at the Seville University, on the 26th of November 2011, therefore fulfilling all the requirements demanded for experiments on human beings and animals, and adapting it to the current regulations in Spain and the European Union.

CONFLICT OF INTEREST

The authors declare they do not have any conflict of interest.

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REFERENCES

1. Rodríguez Romero, B; Mesa Jiménez, J; Paseiro Ares, G; González Doniz, ML. Síndromes posturales y reeducación postural en los trastornos temporomandibulares. Rev Iberoam Fisioter Kinesiol. 2004;7:83-98.

2 .García de Paula e Silva Fw, Musolino de Queiroz A, Díaz-Serrano KV. Alteraciones posturales y su repercusión en el sistema estomatognático. Acta Odontologíca Venezolana. 2008;46:517-22.

3.Campignion P. Cadenas musculares y articulares. Conceptos GDS. Nociones de Base. Madrid: Axón; 2001.

4.Paulus W, Straube A, Brandt. Visual postural performance after loss of somatosensory and vestibular function. J Neurosung Psychiatry. 1987;50:1542-5.

5. Wellens F. The Traditional Mechanistic Paradigm in the Teaching and Practice of Manual Therapy: Time for a Reality Check. [serie en Internet]. [citado 12 Mayo 2012]; [aprox. 11 p.]. Disponible en: http://www.physioaxis.ca/realitycheck.pdf

6.Bienfait M. Os desequilíbrios estáticos: fisiologia patologia e tratamento fisioterápico. São Paulo: Summus; 1993.

7. Léopold Busquet. Las Cadenas musculares. Tomo II. 7ª Ed. Barcelona: Paidotribo; 2006.

8. Méndez R. Evaluación y analisis de la influencia de la manipulación global de la pelvis. Estudio baropodométrico y estabilométrico. [Tesis] Madrid: EOM; 2006.

9. François Ricard D.O. Tratado de osteopatía craneal. Análisis ortodóntico. Diagnóstico y tratamiento. Manual de los síndromes craneomandibulares. Madrid: Panamericana; 2002.

10. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, Jørgensen K. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon. 1987 Sep;18(3):233-7.

11.Vernaza-Pinzón P, Sierra-Torres CH. Dolor músculo-esquelético y su asociación con factores de riesgo ergonómicos, en trabajadores administrativos. Rev Salud Publica. 2005 Sep-Dec;7(3):317-26.

12.Wong E, Lee G, Zucherman J, Mason DT. Successful management of female office workers with «repetitive stress injury» or «carpal tunnel syndrome» by a new treatment modalityapplication of low level laser. Int Jl Clinl Pharmacol Ther. 1995;33:208-11.

13. Balaban CD, Porter JD. Neuroanatomic substrates for vestibulo-autonomic interactions. J Vestib Res. 1998 Jan-Feb;8(1):7-16.

14. Chiriboga C, Rodriguez V, Proaño P, Salinas F. Dolor cervical y terapia neural: Resultados en 64 casos. Ecuador: XIV Jornadas Médicas Hospital Alcívar: Servicio de Ortepedia y traumatología; 2006.

15.Linton SJ. Impacto socioeconómico del dolor de espalda crónico: ¿se está beneficiando alguien? Rev Soc Esp Dolor 1999;6:333-342.

16. Fernández de Las Peñas C, Hernández Barrera V, Alonso Blanco C, Palacios Ceña D, Carrasco Garrido P, Jiménez Sánchez S, Jiménez García R. Prevalence of Neck and Low Back Pain in Community-Dwelling Adults in Spain: A Population-Based National Study. Spine (Phila Pa 1976). 2011 Feb 1;36(3):213-9.

17.Côte P, Cassidy JD, Carroll L. The factors associated with neck pain and its related disability in the Saskatchewan population. Spine 2000 May 1;25(9):1109-17.

18.Côte P, Cassidy JD, Carroll L. The Saskarchewan Health and Back Pain Survey. The prevalence of neck pain and related disability in Saskatchewan adults. Spine. 1998 Aug 1;23(15):1689-1698.

19.Travell y Simons. Dolor y disfunción miofascial. El manual de los puntos gatillo. Vol. 1 Mitad superior del cuerpo. 2ª ed. Madrid: Panamericana; 2002.

20.Cleland JA, Childs JD, Fritz JM, Whitman JM. Interrater reliability of the history and physical examination in patients with mechanical neck pain. Arch Phys Med Rehabil. 2006 Oct;87(10):1388-95.

21.Wang WT, Olson SL, Campbell AH, Hanten WP, Gleeson PB. Effectiveness of physical therapy for patients with neck pain: an individualized approach using a clinical decision-making algorithm. Am J Phys Med Rehabil. 2003;82(3):203-18.

22.Andrzej Pilat. La relajación miofascial en las patologías de la columna cervical. Revista de Rehabilitación integral Kinesis. 2000:23-31.

23.Andrzej Pilat. Terapias miofasciales: Inducción Miofascial. 1ª Ed. Madrid: McGraw-Hill-Interameriacana; 2003.

24.Kendall FP, Kendall E. Músculos pruebas y funciones. 2ª Ed Barcelona: Jims; 1985.

25.Askar OM. Surgical anatomy of the aponeurotic expansions of the anterior abdominal wall. Ann R Coll Surg Engl. 1977 Jul;59(4):313-21.

26. Ahluwalia HS, Burger JP, Quinn TH. Anatomy of the Anterior Abdominal Wall. Operative Techniques in General Surgery. 2004. 6(3) Sept:147-155.

27. Loukas M, Shoja MM, Thurston T, Jones VL, Linganna S, Tubbs RS. Anatomy and biomechanics of the vertebral aponeurosis part of the posterior layer of the thoracolumbar fascia. Surg Radiol Anat. 2008 Mar;30(2):125-9.

28. Vernon H, Humphreys BK: Manual therapy for neck pain: an overview of randomized clinical trials and systematic reviews. Eura Medicophys 2007; 43(1):91-118.

29. Koes BW, Bouter LM, van Mameren H, Essers AH, Verstegen GM, Hofhuizen DM, Houben JP, Knipschild PG. Randomised clinical trial of manipulative therapy and physiotherapy for persistent back and neck complaints: results of one year follow up. BMJ 1992; 304 (6827): 601-5.

30. Groeneweg R, Kropman H, Leopold H, Assen LV, Mulder J, Tulder MW, Oostendorp RA. The effectiveness and cost-evaluation of manual therapy and physical therapy in patients with sub-acute and chronic non specific neck pain. Rationale anddesign of a Randomized Controlled Trial (RCT). BMC Musculoskelet Disord 2010; 11(1): 14.

31. Guzman J, Haldeman S, Carroll LJ, Carragee EJ, Hurwitz EL, Peloso P, Nordin M, CassidyJD, Holm LW, Côté P, van der Velde G, Hogg-Johnson S. Clinical practice implications of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders: from concepts and findings torecommendations. J Manipulative Physiol Ther 2009; 32(2 Suppl): S227-43.

32.Chaitow L, DeLany J. Aplicación clínica de Técnicas Neuromusculares. Vol 1. Parte superior del cuerpo. Barcelona: Elsevier; 2009.

33.Chaitow L. Modern Neuromuscular Techniques. London: Churchill Livingstone; 1996.

34.Lau HM, Chiu TT, Lam TH. Measurement of craniovertebral angle with Electronic Head Posture Instrument: Criterion validity. J Rehabil Res Dev. 2010;47(9):911-8.

35. Raine, S; Twomey, LT. Head and shoulder posture variations in 160 asymptomatic women and men. Arch Phys Med Rehabil. 1997 Nov;78(11):1215-23.

36.Johnson, GM. The correlation between surface measurement of head and neck posture and the anatomic position of the upper cervical vertebrae. Spine (Phila Pa 1976). 1998 Apr 15;23(8):921-7.

37.Alves-Ferreira E, Duarte M, Puig-Maldonado E, Nogueira-Burke T, Pasqual-Marques A. Postural Assessment Software (Pas/Sapo): Validation and Reliability. Clinics (Sao Paulo). 2010;65(7):675-81.

38.Prushansky T, Dvir Z. Cervical motion testing: methodology and clinical implications. J Manipulative Physiol Ther. 2008 Sep;31(7):503-8.

39.Youdas JW, Carey JC, Garrett TR. Reliability of measurements of cervical spine range of motion—comparison of three methods. Phys Ther.1991;71:98-106.

40.Capuano-Pucci D, Rheault W, Aukai J, Bracke M, Day R, Pastrick M. Intratester and intertester reliability of the cervical range of motion device. Arch Phys Med Rehabil. 1991 Apr;72(5):338-40.

41.Peolsson, A; Hedlund, R; Ertzaard, S; Oberg, B. Intra- and inter-tester reliability and range of motion of the neck. Phys Canada 2000; 52: 233-242.

42. Jamison RN, Gracely RH, Raymond SA, Levine JG, Marino B, Herrmann TJ, Daly M, Fram D, Katz NP. Comparative study of electronic vs. paper VAS ratings: a randomized, crossover trial using healthy volunteers. Pain. 2002 Sep;99(1-2):341-7.

43. Wagner, DR; Tatsugawa, K; Parker, D; Young, TA. Reliability and utility of a visual analog scale for the assessment of acute mountain sickness. High Alt Med Biol. 2007 Spring;8(1):27-31.

44.Schulz KF, Altman DG, Moher D, for the CONSORT Group. CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials. BMJ 2010;340:c332.

45.Shirado O, Ito T, Kaneda K, Strax TE. Electromyographic analysis of four techniques for isometric trunk muscle exercises. Arch Phys Med Rehabil. 1995 Mar;76(3):225-9.

46. Perri M, Halford E. Pain and faulty breathing: a pilot study. J Bodyw Mov Ther. 2004. 8:237-312.

47.Mihalache G, Indrei A, Tăranu T. The anterolateral structures of the neck and trunk. Rev Med Chir Soc Med Nat Iasi. 1996 Jan-Jun;100(1-2):69-74.

48.Krleza J, Lemmens T. 7th Revision of the declaration of Helsinki: Good news for the Transparency of Clinical Trials. Croat Med J 2009;50:105-10.

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