ORIGINAL ARTICLE

Influence of manipulation at range of rotation of the cervical spine in chronic mechanical neck pain*

Influência da manipulação osteopática na amplitude de rotação da coluna cervical em indivíduos com cervicalgia mecânica crônica

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ABSTRACT

BACKGROUND AND OBJECTIVES: Neck range of motion may be decreased by vertebral and myofascial dysfunctions, which may be treated with osteopathic manipulation through the cervical rhythmic articulatory technique. This study aimed at verifying whether osteopathic manipulation with rhythmic articulatory technique improves cervical rotation range measured by fleximetry.
METHODS: The group was made up of 58 individuals of both genders, mean age of 36±6.5 years, with chronic mechanical neck pain, who were randomized to cervical rotation control fleximetry, to osteopathic manipulation through the rhythmic articulatory technique, to 5-minute rest and to cervical rotation study fleximetry.
RESULTS: The comparison of cervical rotation fleximetry means through Student's *t* test for paired data at significance level of 0.05 (5%) has shown significant cervical rotation improvement in all cases (p<0.05), going from 151.4º to 162.5º in total movement arch (7.3% improvement).
CONCLUSION: Results were as expected, confirming that osteopathic manipulation using the rhythmic articulatory technique generates significant improvement of cervical rotation range in all cases and may be an alternative to treat diseases related to vertebral mobility reduction, such as neck pain and cervical osteoarthritis.
Keywords: Joint range of motion, Neck pain, Osteopathic manipulation, Specialty physiotherapy, Spinal manipulation.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A amplitude de movimento do pescoço pode ser reduzida pela presença de disfunções vertebrais e miofasciais, as quais podem ser tratadas pela manipulação osteopática através da técnica articulatória rítmica cervical. O objetivo deste estudo foi verificar se a manipulação osteopática, através da técnica articulatória rítmica gera aumento da amplitude de rotação cervical mensurada por fleximetria.
MÉTODOS: A casuística foi constituída de 58 indivíduos de ambos os gêneros, com idade média de 36±6,5 anos, com cervicalgia mecânica crônica, que foram submetidos de maneira randomizada à fleximetria controle da rotação cervical, à manipulação osteopática, através da técnica articulatória rítmica, ao repouso de 5 minutos e à fleximetria estudo da rotação cervical.
RESULTADOS: A comparação entre as médias das fleximetrias de rotação cervical através do teste *t* de Student para dados pareados, ao nível de significância de 0,05 (5%), mostrou que houve aumento significativo da rotação cervical em todos os casos (p<0,05) passando de 151,4º para 162,5º no arco total de movimento (aumento de 7,3%).
CONCLUSÃO: Os resultados foram dentro do esperado, confirmando que a manipulação osteopática, através da técnica articulatória rítmica gerou aumento significativo da amplitude de rotação cervical em todos os casos, podendo servir de tratamento de doenças que se relacionam à redução da mobilidade vertebral, como cervicalgia e osteoartrite cervical.
Descritores: Amplitude de movimento articular, Cervicalgia, Fisioterapia especialidade, Manipulação da coluna, Manipulação osteopática.

INTRODUCTION

Somatic vertebral neck dysfunctions are in general caused by abrupt and unexpected movements[1,2]. These dysfunctions generate neural medullar peripheral and autonomous circuit sensitization, called sensitization phenomenon or spinal facilitation. This neural sensitization may affect cervical spine nervous, vascular and musculoskeletal communications and induce neck pain, postural changes and decreased range of some movements[2-6].
Somatic vertebral dysfunction is also called vertebral hypomobility, that is, a vertebra which is not free to move with regard to the other vertebra and to the intervertebral disk. This impairs the spine and in general creates a compensatory hypermobility in vertebra(e) above or below, or in contralateral interfacet joint. Vertebral hypomobility is maintained by spasm of intertransverse, multifidus and rotator muscles,

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which maintain interfacet joint firm[3,6,7] and may cause myofascial tensions in temporomandibular joints (TMJ) and cranial bones[2,3,7,8].

The presence of somatic vertebral dysfunctions may in the long term cause local osteoarthritis because hypomobility may induce structural changes[2,3,9]. Cervical spine biomechanics and range of motion (ROM) may be affected or decreased by osteoarthritis[2,9], by aging[10-12] and by the presence of somatic vertebral dysfunctions, including cervical dysfunction (neck pain by mechanical dysfunction)[3-7].

Osteopathic manipulative treatment (OM), which includes several techniques, among them cervical rhythmic articulatory technique (CRAT) with sliding and rotation, aims at treating somatic vertebral dysfunctions or vertebral hypomobility, by sliding and rotation movements respecting the physiology[3,7,8,13-15]. Osteopathic manipulation (OM) decreases the spasm of deep muscles fixing vertebral dysfunctions, normalizes intervertebral movement, decreases joint and disk pressures, relieves discomfort and neck or cervicobrachial pain[3,7,13-18] and improves muscle strength and resistance[19].

Arthrometry, which uses some pieces of equipment, such as goniometer, inclinometer and fleximeter, aims at evaluating the musculoskeletal integrity of different body segments by measuring ROM[4,5,10-12,20-22]. To measure ROM of cervical spine active rotation in supine position it is considered, in adults, that normal range is approximately 70º to 90º to each side or, in complete arch, of approximately 140º to 180º[12,23].

The hypothesis is that osteopathic manipulation with cervical rhythmic articulatory technique (OM-CRAT) may immediately improve cervical spine range of rotation and may be more significant for the group with previous rest.

Face to the above, this study aimed at evaluating whether OM-CRAT may improve neck range of rotation in individuals with chronic mechanical neck pain.

METHODS

The group was made up of 58 individuals (18 males and 40 females), with mean age of 36.0±6.5 years, being males 36.5±6.1 years and females 34.8±7.3 years, with common chronic mechanical neck pain of mild to moderate intensity according to the Neck Disability Index. Volunteers involved were employees of the Clinicas Hospital, Federal University of Paraná. Study period was from August 2010 to March 2012.

Inclusion criteria were individuals aged from 25 to 45 years of both genders, complaining of neck discomfort or common mild to moderate pain, with mild or moderate reduction of neck ROM. Exclusion criteria were any change preventing the execution of the protocol, such as severe or disabling pain, dizziness or vertigo and other vertebrobasilar insufficiency signs and symptoms, severe neck hypomobility (e g.: uncoarthrosis, discopathy, bone malformation), spinal deformity (e g.: Scheuermann disease), individuals in post-surgical stage, sequelae by head or spine trauma, using clutches, walking frames or wheelchairs.

Individuals were randomized submitted to neck rotation control fleximetry (CF), to one OM-CRAT and to 5 min rest (and alternate sequence of rest and OM-CRAT), and to neck rotation study fleximetry (SF). Procedures were carried out in a single session of 15 min. After the interview, data collection and signature of the Free and Informed Consent Term, individuals laid down on a stretcher with small and low pillow (child style), remaining in silent environment until the end of the following sequence of procedures:

Group A (29 individuals): (1) CF, (2) OM-CRAT, (3) Rest, (4) SF.

Group B (29 individuals): (1) CF, (2) Rest, (3) OM-CRAT, (4) SF.

Methods were always performed by the same professional.

Randomization was for procedures 2 and 3. Rest should help decreasing muscle tone and should release movement for both groups. However, group B should be further benefited, because people would be more relaxed for the passive OM-CRAT technique.

In group A, time between OM-CRAT and SF was 5 min and 20s, including rest and time for fleximeter replacement. For group B, time between OM-CRAT and SF was approximately 20s.

Active cervical rotation fleximetry

Cervical rotation amplitude was measured with a Brazilian fleximeter, brand *Instituto Code de Pesquisa* (Reg. UM. 8320-3 – RJ – Brazil)[23]. Fleximeter was placed on the vertex of the head being zero degree aligned by the base of the nose (Figure 1) and maximum active head rotation to the right was requested (Figure 1). ROM degrees indicated by the equipment were recorded. The same procedure was performed for the left side (Figure 1). All individuals have received previous orientation: rotation movement looking the maximum to the right and then looking the maximum to the left, avoiding compensations, such as extension or lateral inclination. The pillow has helped and prevented cervical extension compensation, but not mild lateral inclination, both physiological.

Osteopathic manipulation – cervical rhythmic articulatory technique

The operator involved with his hands the neck of the individual, leaving forefingers close to each vertebra and its interfacet joint (posterior region of vertebra) and performed passive rhythmic and smooth movements with three repetitions for each interfacet joint, associating lateral sliding (translation) to rotation (Figure 2), forming movement in "8" in the axial plane. The process was started in the first thoracic vertebra (T1) going up through all cervical vertebrae until atlanto-occipital joints. In upper cervical spine, three mobilizations in flexion and three in bilateral extension of occipital condyles (OC or atlanto-occipital joint) were added, plus three lateral slidings for atlas and three rotations for C3 and 3 rotations for C2-C1 (Figure 2). For atlanto-occipital joints, one hand remained on the head of the individual (frontal or lateral region).

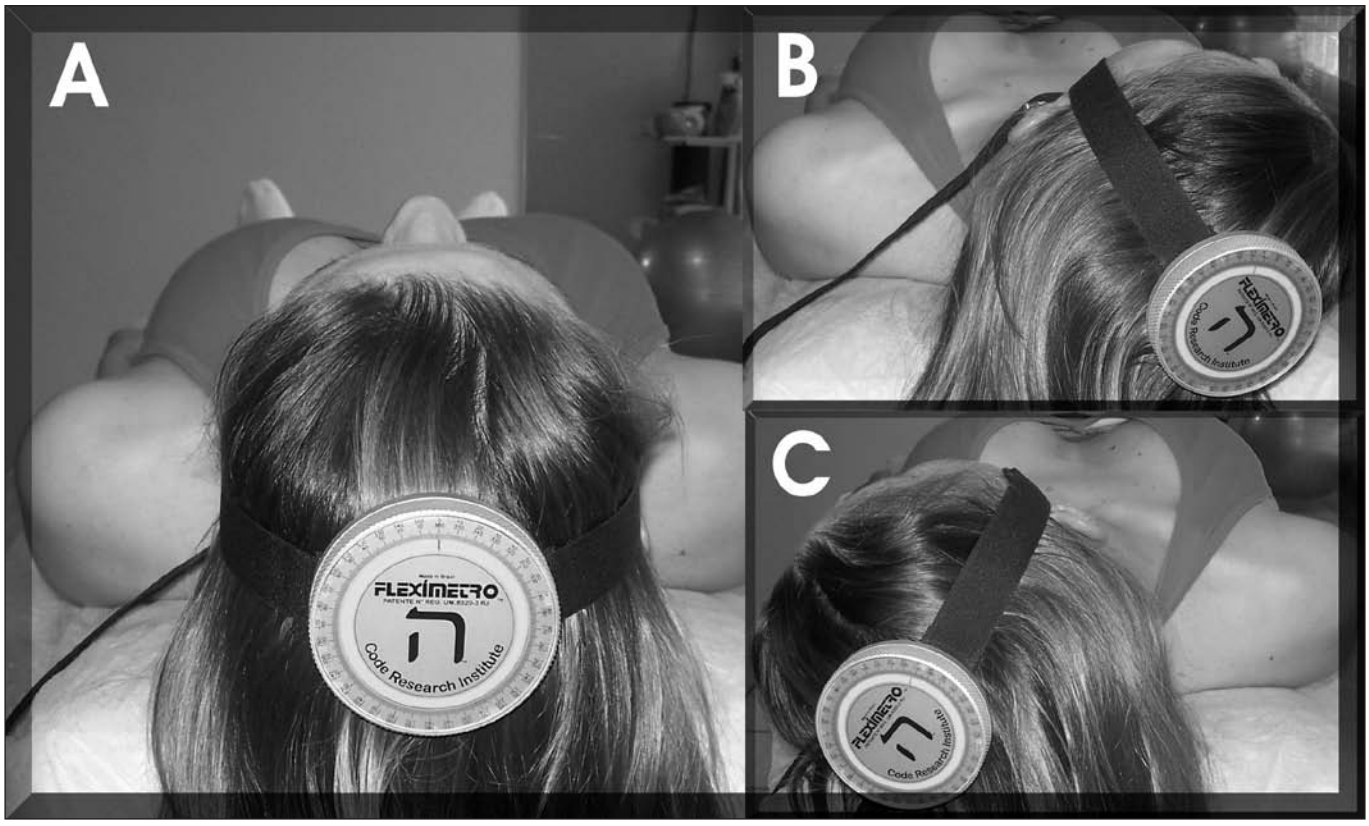

Figure 1: A: Fleximetry in zero degree, B and C: rotation fleximetry

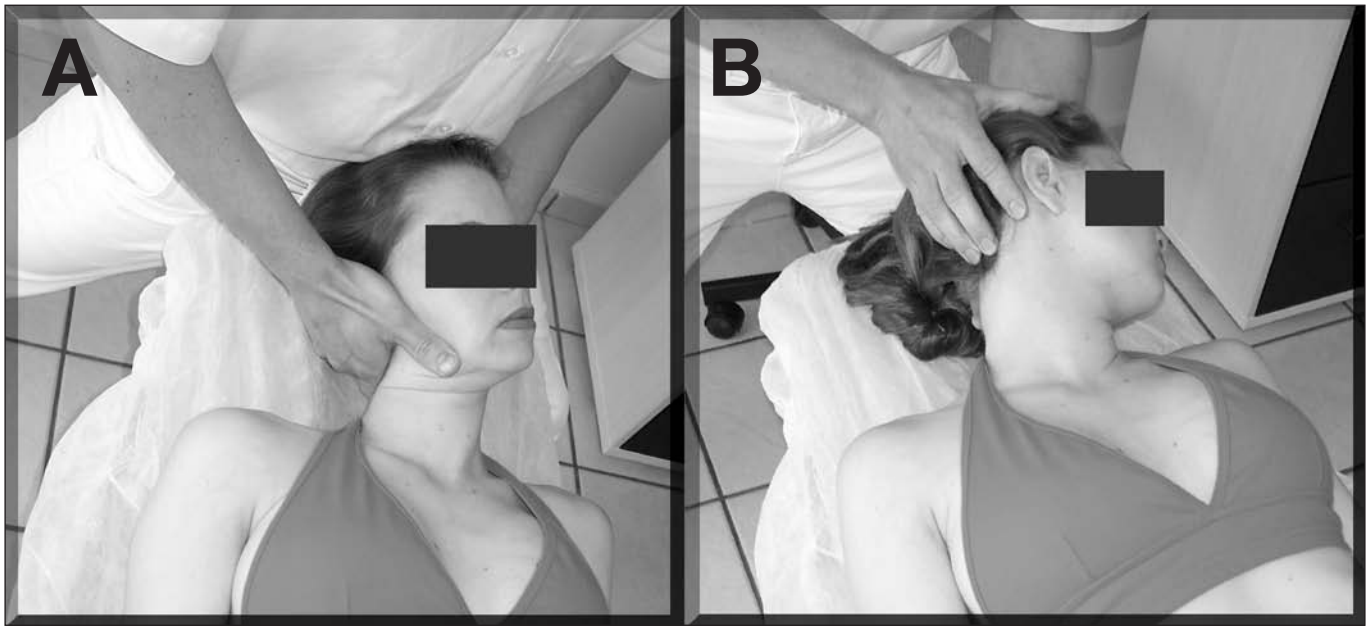

Figure 2: Osteopathic manipulation cervical rhythmic articulatory technique
(A) Sliding in "8", (B) C1-C2, C3 rotation.

Rest

Individuals were oriented to relax and rest for five minutes aiming at decreasing muscle tone.

Statistical analysis

Descriptive statistical methods were used (mean, minimum, maximum and standard deviation) and Student's *t* test for paired data was used to compare CF and SF, considering significant 0.05 (5%). Computer program used was Excel 2010 (Microsoft).

This study was approved by the Research Ethics Committee, Clinicas Hospital, Federal Unversity of Paraná, registration 2233.127/2010-06.

RESULTS

Table 1 shows ROM differences in left and right rotation degrees between fleximetries before and after OM-CRAT, that is CF and SF. In average, there has been significant ROM improvement in all cases. For example, right rotation has increased from 75.1º to 81.0º. Total rotation was the sum of left and right rotations and mean has increased from 151.4º to 162.5º.

Table 2 shows comparison between CF and SF means. The comparison between means by Student's *t* test for paired data with significance level of 0.05 (5%) shows that mean rotation increase was significant for all cases.

Table 3 presents percentage of cervical range of rotation increase after OM-CRAT, which has been significant for all cases, both for left and right rotation and total arch movement rotation.

Additional data

CF has shown that 22.4% (13 cases) were below 140º and 13,8% (8 cases) were above 180º, being that in SF 10.3% (6 cases) have remained below 140º and 17.2% (10 cases) have remained above 180º. There has been fleximetry difference in the age group from 20 to 29 years (n=12 individuals) as compared to the group from 30-45 years (n=46 individuals), where mean and standard deviation were as follows: 20-29 group with 162º rotation (SD=24) and 30-45 group with 149º rotation (SD=20).

There has been prevalence of T1 dysfunction or hypomobility to the atlanto-occipital joint (or OC) obtained by OM-CRAT, which is also an evaluation technique, however subjective and dependent on professional experience. Results were according to the vertebral hypomobility side (interfacet joint). Most prevalent vertebra with dysfunction (hypomobility) was C3.

The order of prevalence considering each side of the vertebra (joint facet) was left C3 (37.9%), right C6 (31.0%), right C5 (17.2%) and, with the same prevalence (15.5%) C2, right C4 and OC pseudorotation (left and right), right C7 (13.8%), and so on. Lowest hypomobility incidence was observed in T1 and C1 (both with 1.7%). Atlas dysfunction (C1) was in left laterality and some secondary dysfunctions in rotation. For occipital condyle (OC) dysfunctions, there has been one case of bilateral dysfunction (in flexion or extension) and pseudorotation cases (anterior OC in one side and posterior OC in the other) and unilateral dysfunction.

Table 1. Fleximetry descriptive statistics (in degrees)

Fleximetry	n	Mean	Minimum	Maximum	Standard deviation
Left rotation – CF	58	76.3	50.0	110.0	12.30
Left rotation – SF	58	81.5	63.0	109.0	10.49
Right rotation – CF	58	75.1	52.0	100.0	11.27
Right rotation – SF	58	81.0	58.0	107.0	9.62
Total rotation – CF	58	151.4	107.0	190.0	21.23
Total rotation – SF	58	162.5	121.0	205.0	18.01

CF: control fleximetry (before osteopathic manipulation cervical rhythmic articulatory technique (OM-CRAT)); SF: study fleximetry (after OM-CRAT).

Table 2. Comparison between control and study fleximetry means

Fleximetry	n	Mean - CF	Mean - SF	p value
Left rotation	58	76.3	81.5	0.0000*
Right rotation	58	75.1	81.0	0.0000*
Total rotation	58	151.4	162.5	0.0000*

CF: control fleximetry (before OM-CRAT); SF: study fleximetry (after OM-CRAT).

Table 3. Percentage increase of control fleximetry mean rotations as compared to study fleximetry

Cervical rotation	Calculation for difference CF & SF	Rotation increase percentage
Left rotation	(81.5 – 76.3)/76.3	= 0.068 (6.8)
Right rotation	(81.0 – 75.1)/75.1	= 0.059 (5.9)
Total rotation	(162.5 – 151.4)/151.4	= 0.073 (7.3)

CF = control fleximetry (before OM-CRAT); SF = study fleximetry (after OM-CRAT).

DISCUSSION

After OM-CRAT some individuals have reported muscle relaxation or body comfort sensation. No participant had painful symptoms immediately after OM-CRAT. This study has not aimed at verifying changes in pain severity and posture, but results suggest that decreased ROM is related to the presence of somatic vertebral dysfunctions and muscle tension, because after OM-CRAT there has been significant cervical rotation ROM improvement confirmed by fleximetry, among other potential benefits and correlations which may occur according to the following descriptions: OM significantly improves pain, mobility and functional capacity[3,7,13-19]. ROM may decrease with age[10-12] and with the presence of somatic vertebral dysfunctions, including cervical dysfunction[3-5,7].

There has been no significant difference in the randomization with alternate sequence of procedures (group A: OM-CRAT/rest, and group B: rest/OM-CRAT), where group B should have had further benefits with the passive OM-CRAT technique due to previous relaxation time. In group A, SF was 5 min and 20s after OM-CRAT and in group B SF was immediately after OM-CRAT. This shows that the effect of the technique to improve ROM is regardless of rest period being before or after OM-CRAT and has immediate effect which may last for more than 5 min. It is believed that the effect of the technique may last for weeks or months, and long term studies are needed. According to the literature, the effect of rest on OM-CRAT would be that rest would decrease muscle activity[24,25].

With regard to additional data, total fleximetry has shown that some cases were below normal ROM and others were above normal ROM, being most within normal ROM established by the theory. This number of cases was decreased after OM-CRAT, as shown by SF. According to the theory, normal active rotation is approximately 70º to 90º to each side or 140º to 180º of total rotation arch[12,23].

Other additional data have shown ROM decrease with age and CF showed less ROM with regard to theory[10-12]. ROM changes confirmed by CF and SF may be related to the somatic vertebral dysfunction theory[3,7] and to mechanical neck pain[1,22].

Some cases, at CF, had excessive ROM to one side and decreased ROM to the other and, in SF, the excessive side has decreased ROM and the side with reduction has increased ROM, that is, there has been a search for ROM balance between sides.

OM-CRAT as physical vertebral evaluation technique may be considered subjective and dependent on professional experience; even so, it was considered relevant to present our results which were related to the osteopathic clinic theory. Additional data have shown significant presence of somatic neck dysfunctions (joint hypomobility) which, according to the literature, are associated to decreased neck ROM[1,3-5,7].

OM-CRAT was effective for cervical rotation ROM gain and may be a treatment alternative for situations where there is ROM loss because, according to the literature, ROM loss and somatic dysfunctions may be related to neck pain, cervicobrachialgia, cervicogenic headache, temporomandibular joint disorders, spinal osteoarthritis, etc.[1,3-5,7,15,18,19]. One may say that OM-CRAT acts as prevention and treatment of mechanical neck pain and spinal arthritis because, according to the literature, vertebral and myofascial dysfunctions are related to joint movement loss, as well as to the arthritis process[1,3-5,9,11].

CONCLUSION

Differences in cervical rotation fleximetry before (CF) and after (SF) OM-CRAT application have shown significant range of motion improvement, from 151.4º to 162.5º (7.3% improvement), being significant for all cases. OM-CRAT was effective for cervical rotation range gain and may be a treatment alternative for diseases related to vertebral hypomobility, such as neck pain and cervical arthritis.

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