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RESEARCH ARTICLE
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Chiropractic Therapy Plus Multimodal Physical Therapy Versus Multimodal Physical Therapy Alone in the Management of Individuals with Cervicothoracic Dorsalgia: A Randomized Clinical Trial

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ABSTRACT

Aim: The study aims to compare the effects of thoracic spinal adjustment and multimodal physical therapy to those of multimodal physical therapy alone in patients with cervicothoracic dorsalgia.

Methods: This single-center, prospective, randomized, clinical study included a total of 43 patients diagnosed with cervicothoracic dorsalgia (aged 20-55; 22 female and 21 male), was conducted between March 2019 and February 2020. The participants were randomly assigned into 2 groups: Multimodal Physical therapy (MPT, n=21) and MPT plus thoracic spinal adjustment (MPT+TSA; n=22). In MPT group, modalities including hot packs, transcutaneous electrical nerve stimulation (TENS), therapeutic ultrasound and neck-posture exercises were applied for 15 sessions. MPT + TSA group received the same MPT approach, with the addition of TSA once a week during 4 weeks of treatment. The Spinal Mouse® posture analysis for thoracic kyphosis and thoracic mobility, Visual Analog Scale (VAS) for pain, Neck Disability Index (NDI), Quebec back pain questionnaire (Quebec) were assessed at baseline and 4th week.

Results: The intra-group comparison outcomes revealed significant improvement in VAS, NDI, Quebec for both groups (MPT and MPT + TSA; $p<0.05$). However, post-treatment postural analysis was not statistically significant when compared with pre-treatment value for both groups. Besides, there was no statistically significant difference between MPT and MPT + TSA groups for all outcomes.

Conclusions: Our study results suggest that adding 4 sessions of chiropractic thoracic adjustment to MPT for cervicothoracic dorsalgia may not influence the outcomes significantly. Further research with large sample size, longer duration and more frequent spinal adjustment is necessary to determine the effectiveness of chiropractic therapy in treating patients with cervicothoracic dorsalgia.

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INTRODUCTION

Cervicothoracic dorsalgia, posteriorly located pain in cervicothoracic spinal region, results from the interplay between spine posture and mobility.[1,2] There are many contributing factors which may ultimately trigger cervicothoracic dorsalgia.[2] Previous studies have shown that poor posture, restricted segmental mobility of the cervical and thoracic regions can give rise to altered joint mechanics or muscle functions, and eventually, cervicothoracic dorsalgia.[2-5] This dorsalgia complaint is frequently diagnosed and categorized as “nonspecific” or “mechanical”.[2]

Interrelation of cervical, thoracic and other regions of the spine emerged from obscurity through extensive research on the biomechanics of vertebral column since 1990.[2,3,5-7] Thus, any mechanical dysfunction in the thoracic spine can create relevant alteration in the cervical spine, causing nonspecific cervicothoracic dorsalgia.[2,6-8]

Appropriate and effective manual therapy management including chiropractic therapy -High Velocity Low Amptitude (HVLA) thrust- has been shown to be helpful in the treatment of individuals with

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nonspecific cervical or thoracic pain in terms of pain reduction, and increase in range of motion (ROM).[1,7,9-17]

To our knowledge, no studies have compared the effectiveness of chiropractic therapy combined with multimodal physical therapy (hot packs, transcutaneous electrical nerve stimulation (TENS), therapeutic ultrasound and neck-posture exercises) to that of multimodal physical therapy alone in the treatment of cervicothoracic dorsalgia. Therefore, the purpose and objective of this randomized controlled study was to examine the effects of chiropractic HVLA thrust plus multimodal physical therapy versus those of multimodal physical therapy alone in individuals with a primary complaint of nonspecific cervicothoracic dorsalgia.

MATERIALS AND METHODS

Selecting the Study Participants

In order to determine the sample size, we performed a power analysis by G Power 3.1.9.2 program and 50 patients with a primary complaint of cervicothoracic dorsalgia were planned to include in the study. The study protocol was approved by the local ethics committee (approval no: 95674917-108.99-E.9740) and the study was conducted in accordance with the principles of the Declaration of Helsinki during March 2019- February 2020. Sixty-one consecutive female patients with dorsalgia, who were referred to our department, were recruited for the study. Among these patients, a total of 50 women who met the eligibility criteria were included in the study. Inclusion criteria were as follows: (i) age interval 20- 55 years; (ii) complaint and diagnosis of cervicothoracic dorsalgia. Exclusion criteria were "red flags", and as follows: (i) fractures; (ii) trauma; (iii) osteoporosis; (iv) malignancy; (v) infection; (vi) prior spine surgery (e.g. cervicothoracic part). Medical history, physical examination, radiological screening (e.g. Magnetic Resonance Imaging (MRI), Full-spine radiography) were practiced in order to rule out "Red flags".[18-20]

The participants were randomly assigned into 2 groups: Multimodal physical therapy (MPT, n=21) and MPT plus thoracic spinal adjustment (MPT+TSA; n=22). Each study individual signed a written informed consent. Seven participants were excluded from our study because they did not participate in the treatment regularly and did not comply with the parameters we applied. See Figure 1 for a flow diagram of subject recruitment and retention.

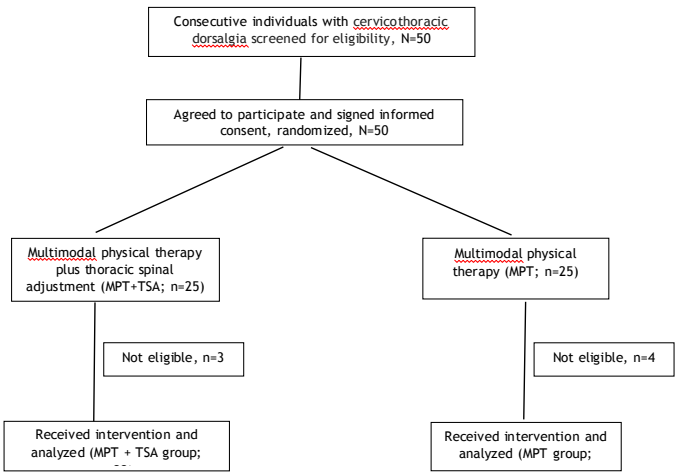

Fig. 1: Flow diagram of subject recruitment and retention

Demographic information, history and physical examination of the participants were completed at baseline. The historical evaluation included questions about age, gender, Body Mass Index (BMI), smoking status, alcohol consumption, physical exercise status, past medical history, characteristics of cervicothoracic dorsalgia (e.g., onset, location, nature, aggravating and relieving factors).

The physical examination including posture, spinal mobility, spine range of motion (ROM), muscle strength testing was fulfilled for each participant in the study. The spinal mobility at each segment was assessed as normal, hypo-mobility, or hyper-mobility. Besides, pain aggravation at each segment was documented as aching or not aching.[21]

We examined posture, thoracic kyphosis and thoracic mobility with the Spinal Mouse® (Idiag, Volkerswill, Switzerland) device.[22-27]

Treatment Procedures

In the present study, the participants were randomly assigned into 2 groups: Multimodal physical therapy (MPT, n=21) and MPT plus thoracic spinal adjustment (MPT+TSA; n=22). Duration of the study was 4 weeks.

Multimodal Physical Therapy Group: In multimodal physical therapy (MPT, n=21) group, modalities including hot packs (20 minutes), transcutaneous electrical nerve stimulation (TENS; 20 minutes, 60-120 Hz), therapeutic ultrasound (1.5 watt/cm^2, 50% intermittent, 6 minutes) and neck-posture exercises were applied for 15 sessions in 4 weeks. Neck-posture exercises were neck rotation, isometric neck extension, levator scapulae stretch, lateral neck stretch in standing and lying position, standing chest stretch, shoulder roll, corner chest stretch, and trapezius muscle stretch as described by Soyer O and Akarirmak ZU [28].

Multimodal Physical Therapy-plus-Thoracic Spinal Adjustment group: Multimodal physical therapy plus thoracic spinal adjustment (MPT+TSA; n=22) group received the same MPT modalities, with the addition of TSA once a week during 4 weeks of treatment.

Thoracic spinal adjustment (TSA) intervention included 4 thoracic spine high-velocity, low amplitude (HVLA) technique as described Mintken PE et al.[10,11] within 4 weeks (once a week).

Examination Procedures

The Spinal Mouse® (Idiag, Volkerswill, Switzerland) posture analysis for thoracic kyphosis and thoracic mobility, Visual Analog Scale (VAS) for pain, Neck Disability Index (NDI), Quebec back pain questionnaire (Quebec) were assessed at baseline and 4 weeks.

The Spinal Mouse® device: Intersegmental mobility, overall and regional spinal ROM and posture were measured in the sagittal plane both in sitting and standing positions using a Spinal Mouse® device (Idiag,Volkerswill, Switzerland), as described by Csuhai EA et al.[22]

Visual Analog Scale: Visual analog scale (VAS) was utilized for pain evaluation of the study population in which 0 represents no pain, 10 represents extreme pain.[29]

Neck Disability Index: The neck disability index (NDI) was used for the participant's pain associative disability. This index contains 10 questions related to activities of daily living in which 0 stands for no disability, and 5 stands for maximum disability for each question.[29,30]

Quebec back pain questionnaire: Quebec back pain questionnaire (Quebec) was used as a disability scale for back pain. It has 20 questions. The questions are related to performing a daily activity in which 0 symbolizes "it is not difficult to perform", and 5 symbolizes "unable to do".[31, 32]

Statistical Analysis

SPSS 25.0 (IBM, USA) was used for all the statistical analyses. P-value was <0.05 was considered as statistically significant. As a statistical method, descriptive statistics (e.g. the mean and standard deviation (SD) were used for continuous variables in order to analyze demographic data. Intragroup comparisons were assessed by Wilcoxon Rank test, and intergroup comparisons were analyzed by Mann Whitney U test.

RESULTS

Subject characteristics in this study is shown in Table 1. The gender distribution is almost equal in both groups (MPT group and MPT plus TSA group). While the mean age was 34.32 ± 10.82 in MPT plus TSA group, the mean age was 36.29 ± 9.63 years in MPT group. There were no statistically significant differences between the groups in terms of gender, age, BMI, smoking status, alcohol habit and exercise status (Table 1).

The intra-group comparison between pre- and post-treatment outcomes revealed significant improvement in VAS, NDI, Quebec for both groups (MPT and MPT + TSA; p<0.05). In other words, the values in all scores decreased and improved significantly when compared to pre-treatment values.

When we considered the intra-group comparison of pre-and post-treatment value of Spinal Mouse® measurement for thoracic mobility, there was significant difference in MPT group (p<0.05). On the other hand, there was no statistically significant difference in MPT plus TSA group (p>0.05). Besides, pre- and post-treatment thoracic kyphosis values by Spinal Mouse® was not statistically significant in both groups (p>0.05). Intra-group comparison of pre-treatment and post-treatment measurements in both MPT and MPT plus TSA groups is seen in Table 2.

Inter-group comparison results showed that VAS, NDI, Quebec, and thoracic kyphosis and mobility was not statistically significant between MPT and MPT plus TSA groups (p>0.05). Inter-group comparison was shown Table 3.

Table 1: Demographic characteristics of the groups

		MPT+TSA group (n=22)	*MPT group (n=21)*
Gender, n (%)	Male	11 (50%)	10 (48%)
	Female	11 (50%)	11 (52%)
Age (years)	Mean ± SD (Min-Max)	34.32 ± 10.82 (22 - 55)	36.29 ± 9.63 (23 - 55)
BMI (kg/m2; n(%))	<18.6	-	-
	18.6-24.9	16 (73%)	20 (95%)
	25-29.9	6 (27%)	1 (5%)
	30<	-	-
Smoking status, n(%)	Yes	5 (23%)	10 (48%)
	No	17 (77%)	11 (52%)
Alcohol habit, n(%)	Yes	7 (32%)	9 (43%)
	No	15 (68%)	12 (57%)
Physical exercise status, n(%)	Yes	4 (18%)	5 (24%)
	No	18 (82%)	16 (76%)

MPT: Multimodal physical therapy. TSA: Thoracic spinal adjustment. SD: Standard deviation. BMI: Body mass index. P value was not significant between groups (P>0.05).

Table 2: Intragroup comparison of the measurements of pre-treatment and post-treatment

	MPT group (n=21)			*MPT+TSA group (n=22)*		
	Mean ± SD (Min-Max)			*Mean ± SD (Min-Max)*		
Intragroup comparison	*Pre-treatment*	*Post-treatment*	*P value*	*Pre-treatment*	*Post-treatment*	*P value*
VAS (Visual Analog Scale) score	6.48±1.25 (4-8)	4.19±1.36 (2-7)	0.000***	6.41±1.26 (4-9)	4.14±1.04 (3-6)	0.000***
NDI (Neck Disability Index) score	22.48±8.61 (10-36)	16.67±7.74 (8-34)	0.000***	20.23±6.94 (8-33)	15.41±5.72 (7-27)	0.000***
QUEBEC (Quebec back pain questionnaire) score	28.71±8.25 (14-46)	22.38±8.12 (10-36)	0.000***	28.86±7.43 (17-48)	20.82±7.50 (10-31)	0.000***
Thoracic Kyphosis value (Spinal Mouse® Upright Position)	42.38±6.97 (26-54)	41.24±6.11 (29-54)	0.124	42.86±6.63 (30-55)	41.59±5.50 (30-52)	0.134
Thoracic Mobility value (Spinal Mouse®)	15.62±8.12 (2-32)	13.33±6.97 (1-25)	0.044*	17.59±9.46 (3-40)	15.95±7.35 (5-33)	0.262

*p<0.05; **p<0.01; ***p<0.001

Table 3: Intergroup comparison of the measurements of pre-treatment and post-treatment

Intergroup comparison MPT group (n=21)		*Mean ± SD (Min-Max)* *MPT+TSA group (n=22)*		*P value*
VAS (Visual Analog Scale) score	Pre-treatment	6.48±1.25 (4-8)	6.41±1.26 (4-9)	0.813
	Post-treatment	4.19±1.36 (2-7)	4.14±1.04 (3-6)	0.900
NDI (Neck Disability Index) score	Pre-treatment	22.48±8.61 (10-36)	20.23±6.94 (8-33)	0.342
	Post-treatment	16.67±7.74 (8-34)	15.41±5.72 (7-27)	0.836
QUEBEC (Quebec back pain questionnaire) score	Pre-treatment	28.71±8.25 (14-46)	28.86±7.43 (17-48)	0.817
	Post-treatment	22.38±8.12 (10-36)	20.82±7.50 (10-31)	0.503
Thoracic Kyphosis value (Spinal Mouse® Upright Position)	Pre-treatment	42.38±6.97 (26-54)	42.86±6.63 (30-55)	0.951
	Post-treatment	41.24±6.11 (29-54)	41.59±5.50 (30-52)	0.733
Thoracic Mobility value (Spinal Mouse®)	Pre-treatment	15.62±8.12 (2-32)	17.59±9.46 (3-40)	0.706
	Post-treatment	13.33±6.97 (1-25)	15.95±7.35 (5-33)	0.349

For intergroup comparison all the p value was not significant ($p > 0.05$)

DISCUSSION

The purpose of this study was to determine if multimodal physical therapy (MPT) plus thoracic spinal adjustment (TSA) resulted in enhanced changes when compared with multimodal physical therapy alone in patients with cervicothoracic dorsalgia. Changes in self-reported measures including VAS, NDI, Quebec and the Spinal Mouse® posture analysis for thoracic kyphosis and thoracic mobility were examined. We found no statistically significant difference between MPT plus TSA and MPT alone in regard to pain or disability, and the Spinal Mouse® analysis. Both groups experienced similar improvement in pain, disability, thoracic posture and mobility ratings at 4-week time point. Within-group improvements of VAS, NDI, Quebec were seen in both MPT+TSA and MPT groups when compared to baseline values. On the other hand, thoracic kyphosis measurement was not statistically significant in both groups when compared to baseline value. Only one of the outcome, thoracic mobility by Spinal Mouse® yielded significant in MPT alone group when compared pre-treatment value ($p<0.05$). However, this value was not statistically significant in MPT + TSA group when compared to pre-treatment value ($p>0.05$).

Mean age of the trial population was 35 (34.32 for MPT + TSA and 36.29 for MPT group), and mean pre-treatment thoracic kyphosis degree was 42 (42.86 for MPT + TSA and 42.38 for MPT respectively). In other words, anatomically normal range of thoracic convexity in the sagittal plane in young adults were observed in the present study as suggested Fon GT et al., [33] and Duangkaew R et al.[34] Besides, our statistically non-significant result of thoracic kyphosis in both groups may be explained that high kyphosis could respond more than normal kyphosis to the physical therapy and thoracic spinal adjustment as described by Briggs AM et al.[35]

In our study, we used multimodal physical therapy approach including hot packs (20 minutes), TENS (20 minutes, 60-120 Hz), therapeutic ultrasound (1.5 watt/cm^2, 50% intermittent, 6 minutes) and neck-posture exercises for 15 sessions in 4 weeks. Most of the previous studies in scientific literature compared only one modality of physical therapy with those of chiropractic therapy in mechanical, nonspecific pain.[36-41] These studies suggested superiority of TSA on the outcomes such as pain, ROM, and disability.[36-38,41] In only one study, multimodal approach of physical therapy including electrotherapy, thermal agents, exercise therapy and cervical spine manual therapy in patients with mechanical neck pain was conducted by Khoja SS et al.[42] In this study, 22 patients with mechanical neck pain (mean age: 38 years) were included. The participants received multimodal neck program (MNP) only or MNP + Thoracic thrust (TTM) for a maximum of 12 sessions. The endpoints were VAS, NDI, ROM during 6-weeks therapy. The authors found that the pain and disability were decreased in both groups after 6 weeks of therapy.[42] Although our study population had cervicothoracic dorsalgia, these results were supported by our results. In our study, both MPT and MPT plus TSA groups had similar improvement in pain, disability and thoracic kyphosis.

In another study, Groeneweg R et al., compared specific type of passive manual joint mobilization (MJM) with those of physical therapy (PT, particularly active exercise therapy). In their study, a total of 181 patients (age interval 18-70) with mechanical, nonspecific neck pain was included. They concluded that neck pain declined in both MJM and PT groups of the patients statistically significantly after a year of monitorization.[43] Even though we used different technique as a manual therapy (thoracic spinal adjustment) and multimodal physical therapy

as a comparison in our study, we concluded similar results that adding 4 sessions of chiropractic thoracic adjustment to MPT for cervicothoracic dorsalgia may not influence the outcomes significantly when compared MPT alone.

Instruments such as Goniometer, spondylometer, scoliometer, inclinometer, Cobb's angle from an X-ray, and Spinal Mouse® are in use for the evaluation of the mobility, function of spine including thoracic region, and the assessment of its curve.[23,25,26,44] We used Spinal Mouse® in our study, and examined thoracic kyphosis and mobility with this instrument. Previous studies showed that the inter and intra-rater reliableness of the Cobb and Spinal Mouse® measurements were perfect. the reliability of thoracic- and lumbar curvature measurements ranged from 0.81 to 0.93; therefore, our protocol demonstrated good to high reliability by using Spinal Mouse® device.[22]

There were some limitations to this study. The individuals' study entry data showed low scores of pain and disability (e.g., VAS was approximately 6), which may influence the endpoints, and generalization of the study results. On the other hand, it should be noted that clinically meaningful improvement was observed at the end of the present study in both groups. Another limitation is that one could disagree with session number of thoracic spinal adjustment. We applied thoracic spinal adjustment once a week during 4 weeks of the study. This may be inadequate when we consider its application in clinical practice. It is probable that an increased number of spinal adjustment sessions could lead to ameliorated outcomes.

CONCLUSION

The results of this study suggest improvement in cervicothoracic disability and pain do not differ, for at least 4-week period, between individuals performing multimodal physical therapy plus thoracic thrust and those performing multimodal physical therapy alone. Further research with large sample size, longer duration and more frequent spinal adjustment is necessary to determine the effectiveness of chiropractic therapy in treating patients with cervicothoracic dorsalgia.

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