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RESEARCH ARTICLE

Ischemic Compression versus Traditional Physical Therapy in Treatment of Chronic Mechanical Neck Pain.

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Abstract

Introduction: Neck pain is a common complaint that may contribute to substantial medical consumption and disability. **Methods:** 40 patients with chronic mechanical neck pain (CMNP) were randomly assigned into group-A received ischemic compression treatment (ICT) plus traditional physical therapy treatment (TPTT)(including infrared, ultrasound, plus trapezius muscle stretching) or group-B received TPTT only. Both treatment regimens were applied trice weekly for 2 weeks. **Results:** Pain (evaluated by Visual Analogue Scale (VAS), neck pain & disability scale (NPADS)), and cervical range of motions (CROMs) were evaluated before and after the study. At the end of the study; VAS and percentage of improvement (%) for the groups-A and B were 2.10±0.8 (71.91%) and 6.25±1.13 (14.94%) respectively. NPADS and (%) for the groups-A and B were 1.36 ± 9.23, (16.81%), 160 ± 8.2, (2.19%) respectively. Cervical flextion and (%) for the groups-A and B were 42.85±3.2 (144.51%) and 29.25± 4.36 (71.10%) respectively. Cervical extension and (%) for the groups-A and B were 53.85±4.23 (116.64%) 36.8±4.175 (42.01%) respectively. Cervical right rotation and (%) for the groups-A and B were 74.45±4.69 (98.05%) and 45.7±4.94 (30.11%) respectively. Cervical left rotation and (%) for the groups-A and B were 74.45±4.69 (95.24%) and 52.7±7.21 (25.21%) respectively. Right lateral flextion and (%) for the groups-A and B were 42.15±2.66 (162.74%) and 29.3±4.44 (78.09%) respectively. Left lateral flextion and (%) for the groups-A and B were 42.15±2.66 (162.74%) and 29.3±4.12 (79.61%) respectively ($P<0.05$). **Conclusion** ICT is effective and is better than TPTT in improving pain sensation, disability, and CFROMs in patients with CMNP.
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INTRODUCTION

Neck pain can have an insidious (mechanical) or traumatic onset. Mechanical neck pain is defined as pain in the cervical spine and/or shoulder area with symptoms provoked by neck postures, movements, or palpation of the cervical muscles. Neck pain constitutes a significant health care problem affecting 45% to 54% of the general population (Côté et al., 1998). A systematic review reported 1-year prevalence for neck pain ranges from 16.7% to 75.1% (mean, 37.2%)(Fejer et al., 2006). In addition, the economic burden associated with the management of neck pain is second only to low back pain in annual workers' compensation costs in the United States(Wright et al., 1999).

There are some evidences of the presence of myofascial trigger points (MTrP) in subjects presenting with mechanical neck pain which present in neck musculatures (trapezius, levator scapulae, and sternocledomastoid) (Fernandez-de-las-Pen et al., 2007).The MTrP is a hyperirritable spot in a taut band of a skeletal muscle that is painful on contraction, stretching, or stimulation and elicits a referred pain distant from the point(Simons et al., 1999).MTrP can be clinically classified as active or latent; active MTrPs are those causing spontaneous pain symptoms, which elicited referred pain reproduces the patient's symptoms and is recognized as a familiar phenomenon for the patient. Latent MTrPs are those not responsible of symptoms of the patient **(**Shah et al., 1996).

Physical therapist may use hot packs, ultrasound, and TENS in order to relieve patient symptoms **(**Bornstein et al., 1996).Ischemic compression is a manual therapy technique which is frequently employed as a mean of deactivating MTrP, it involves applying direct sustained digital pressure to the MTrP with sufficient force over dedicated time duration, to slow down the blood supply and relieve the tension within the tight muscle, the pressure is applied, maintained and the releasedgradually (Gemmel et al., 2008).

Although many modalities and procedure were previously introduced and proved to be effective in the treatment of patients with neck pain; but still many of them need further evaluation. This study will stimulate elaboration of a new therapeutic procedure in the treatment of chronic mechanical neck pain (CMNP). Until now- and up to our knowledge and available literature- none of them investigated the effects of ischemic compression treatment (ICT) on pain, neck disability and cervical range of motion (CROM) in patients with CMNP. Understanding such effects could lead to establishment of proper treatment protocol. This study will stimulate elaboration of new researches regarding the utilization of ICT on different spine mechanical disorders.

Material and Methods

Subjects

Forty patients (18 male (45%) and 22 female (55%)) with CMNP were recruited from the outpatient clinic of Kasr Al-Aini Hospital. All treatment procedures were applied in the outpatient clinic in Faculty of Physical Therapy, Cairo University, Egypt. All patients fulfilled the inclusion criteria of the study and had no exclusion criteria. This study was carried out according to the principles of the Declaration of Helsinki 1975, revised Hong Kong 1989 and was approved by the corresponding department council and ethics committee.

Inclusion criteria:

Patients with CMNP over the last 3 months that has been diagnosed and referred by a physician or an orthopedist, Presence of bilateral active MTrPs in the upper trapezius muscles, age ranged between 30 to 40 years, have not been involved in any type of any physical Therapy program within the previous 6 months.

Exclusion Criteria:

Patients diagnosed to have neck pain due to inflammatory diseases, patient with acute inflammatory diseases of musculoskeletal system, Pathology or structural deformities of the neck, Patients with radicular symptoms (radiating pain, loss of sensation, muscle dysfunction, or loss of reflexes), disc prolapse, severe scoliosis, spondyloarthrosis, previous neck surgery, other specific and serious causes of neck pain, significant or unstable cardiac, vascular or psychological problems. All patients were initially aware about and fully understand the purpose and procedures of the study and so an informed consent was obtained from each patient; giving agreement to participation and publication of the results of the study. All patients received the same medical care and education during the study and were asked to maintain their regular diet, normal daily activities and lifestyle throughout the study.

Patients were randomly assigned into two groups through two stages by a person who did not share any other part of the study. First; eligible patients who fulfilled the inclusion criteria were initially recorded. Secondly; all reported patients were randomly assigned to either group-A (n=20; received ICT plus trapezius muscle stretching) or group-B (n=20; received TPTT including infrared, ultrasound, plus trapezius muscle stretching) through random number generation using an online random permutation generator from http://www.randomization.com.

Evaluation:

Patients in both groups underwent an identical battery of tests; pre and post-study evaluations. All evaluative procedures were conducted at the same time of the day (between 9-11 am). Evaluated variables include Pain (evaluated by Visual Analogue Scale (VAS) and neck pain & disability scale (NPADS)), and cervical range of motions (CROMs) (evaluated by digital Water level). Weight in Kg and height in cm were also evaluated using a

standard laboratory scale. Involvement and assessment of the patients was conducted after agreement of their physician.

Pain and disability evaluation:
Evaluations of Pain and disability were carried out according to standardized protocols using neck pain and disability scale (NPAD) which is a valid and reliable tool (Wheeler et al, 1999).Patients were asked to properly answer each question by marking along a 10-cm visual analogue scale that belongs to each item. Item scores ranged from 0 to 10, and total score was a total of item scores, the maximum total score equal 200 points, that indicating maximum neck pain and disability. The lesser the total score, the more is the improvement in neck pain and disability (Clair et al., 2009).

Cervical range of motions (CROMs) evaluation:
Evaluations of CROMs were carried out according to standardized procedures (Gemmel et al., 2008), (Mullaney et al., 2010)using the digital water level. Each ROM evaluation was repeated trice, and then the mean of the three readings was used in the analysis. Calibration of the utilized apparatus was done periodically**.**

Pain assessment:
Patients were asked to mark along a 10-cm visual analogue scale (VAS) tool. Data collected pre and post-study for all patients were used for analysis(Marianne et al., 2011).

Interventions:
Each group adhered to the prescribed regimen throughout the study. After the physician permission; group-A received ischemic compression treatment (ICT) plus traditional physical therapy treatment (TPTT) (including infrared, ultrasound, plus trapezius muscle stretching), while group-B received TPTT only. Both treatment regimens were applied trice weekly for 2 weeks. No adverse events were recorded throughout the study.

Trapezius myofascial trigger points (MTrPs) allocation:
Trapezius MTrPs were located according to exploration diagnostic criteria established by Simons et al (Simons et al., 1999)and Gerwin et al **(**Gerwin et al., 1997).

The ischemic compression treatment (ICT):
The ICT was performed according to the methodology described by Fryer and Hodson**(**Fryer and Hodson, 2005), each point received ischemic compression for 90 seconds per session.

Traditional physical therapy treatment (TPTT):
Composed of infrared, ultrasound application and trapezius muscle stretching. Ultrasound application was conducted using sonopulse 905 by EnrafNonius (Holand). Ultrasound was applied in continuous mode, at intensity of 1 W/cm^2 and a frequency of 1 MHz for 5 minutes on both trapezius muscles (starting on the right side) and paraspinal muscles of the neck. Infrared was applied using Infrared rays of 220V, 400W, 50HZ, model 4004/2n, Verreet Quartz Dixwell, France. Infrared was applied so that a mild comfortable warmth sensation was obtained for 15 minutes on both trapezius muscles (starting on the right side) and paraspinal muscles of the neck. Stretching was applied while the patient was in supine relaxed position, stretching was repeated trice on upper fibers of trapezius muscles starting with right side, then the left one, holding for 30 s and relaxing for 15 s.

Statistical analysis
All data were examined using SPSS version 16.0. Data were collected and statistically analyzed using pre and post study T-test to test hypothesis and to control both within and between variabilities. Results were reported as means and standard deviations. For all procedures, significance was accepted at the alpha level of < 0.05.

Result

For this study, forty patients with CMNP, with bilateral trapezius muscle trigger points, referred for Physiotherapy, were identified as eligible for enrollment in this study. They underwent initial pre-study evaluation, received the prescribed treatment, completed the study and underwent the final post-study evaluation.

Patients' characteristics

The general characteristics of the participants of the two groups (pre-study evaluation) are shown in Table I. Results revealed that there were non-significant differences in age, weight, and height between the two groups (P > 0.05)**.** In this study; data were collected and were compared both within and between groups.

Table I: Demographic data of participants in both groups (pre- study).

Variables	Ischemic compression group (ICT group; n=20)	Traditional Physical Therapy treatment group (TPTT group; n=20)	T value	P value☼
Age (year)	31.4 ± 4.546	32.4± 4.405	0.706	0.484**
Height (m)	1.71 ± .046	1.72 ± .044	0.418	0.678**
Weight (kg)	72.85 ± 3.93	73.32 ± 4.17	0.0371	0.713**
BMI (Kg/m^2)	24.71 ± 0.27	24.58 ± 0.35	0.61	0.56**

Level of significance at P<0.05.* = significant ** = non-significant

Within groups

Post-study results revealed that there were significant decrease in pain and disability (evaluated by VAS and NPAD, there was significant increase in cervical range of motionsmean values within both groups (P < 0.05),(Table II).

Table II. Within and between groups' comparisons of VAS, NPAD, and CROMs mean values (T & P values).

Variable	Group	Pre	Post	T & P values
VAS	**ICT group**	7.33 ± 1.1	2.11±0.8	32.57, 3.9 -18*
	TPTT group	7.33±1.1	6.26±1.13	14.2, 1.44 -11*
	T & P values	0.0, 1.00 **	-13.39-, 5.81 -16*	
NPDS	**ICT group**	164.1±8.28	136.55±9.23	24.09, 1.06 -15*
	TPTT group	164.1±8.28	160.5±8.21	10.99, 1.13 -9*
	T & P values	0.00, 1.00 **	-8.67-, 1.53 -10*	
CFROM	**ICT group**	19.2±6.06	42.85±3.2	-17.18-, 4.98 -13*
	TPTT group	17.7±4.73	29.25± 4.36	-26.73-, 1.55 -16*
	T & P values	0.873, 0.388 **	11.24, 1.2 -13*	
CEROM	**ICT group**	25.7±4.81	53.85±4.23	-18.95-, 8.47 -14*
	TPTT group	26.2±4.6	36.8±4.175	-28.99-, 3.42 -17*
	T & P values	-0.34-, 0.74 **	12.82, 2.23 -15*	
CRtR	**ICT group**	38.15±4.91	74.45±4.69	-38.48-, 1.72 -19*
	TPTT group	35.35±5.20	45.7±4.94	-24.02, 1.11 -15*
	T & P values	1.75, 0.09 **	18.88, 6.64 -21*	
CLtR	**ICT group**	39±6.22	74.45±4.69	-30.63-, 1.23 -17*
	TPTT group	42.35±6.68	52.7±7.21	-12.7-, 9.94 -11*
	T & P values	-1.641-, 0.109 **	11.31, 9.99 -14*	
RtLatFlex	**ICT group**	16.9±3.88	42.15±2.66	-26.32-, 2.06 -16*
	TPTT group	16.9±3.88	29.3±4.44	-18.72-, 1.06 -13*
	T & P values	0.0, 11.106 **	1.0, 1.71 -13*	
LtLatFlex	**ICT group**	16.9±3.88	42.15±2.66	-26.32-, 2.06 -16*
	TPTT group	16.9±3.88	29.45±4.12	-17.8-, 2.63 -13*
	T & P values	0.0, 1.0 **	11.57, 5.04 -14*	

Level of significance at P<0.05.* = significant ** = non-significant

Ischemic compression treatment group (ICT group), Traditional Physical Therapy treatment group (TPTT group), Neck pain and disability scale (NPDS), Cervical Flextion Range of Motion (CFROM), Cervical Extension ROM (CEROM), Cervical Right Rotation (CRtR), Cervical Left Rotation (CLtR), Right Lateral Flextion (RtLat Flex), Left Lateral Flextion (LtLatFlex**).**

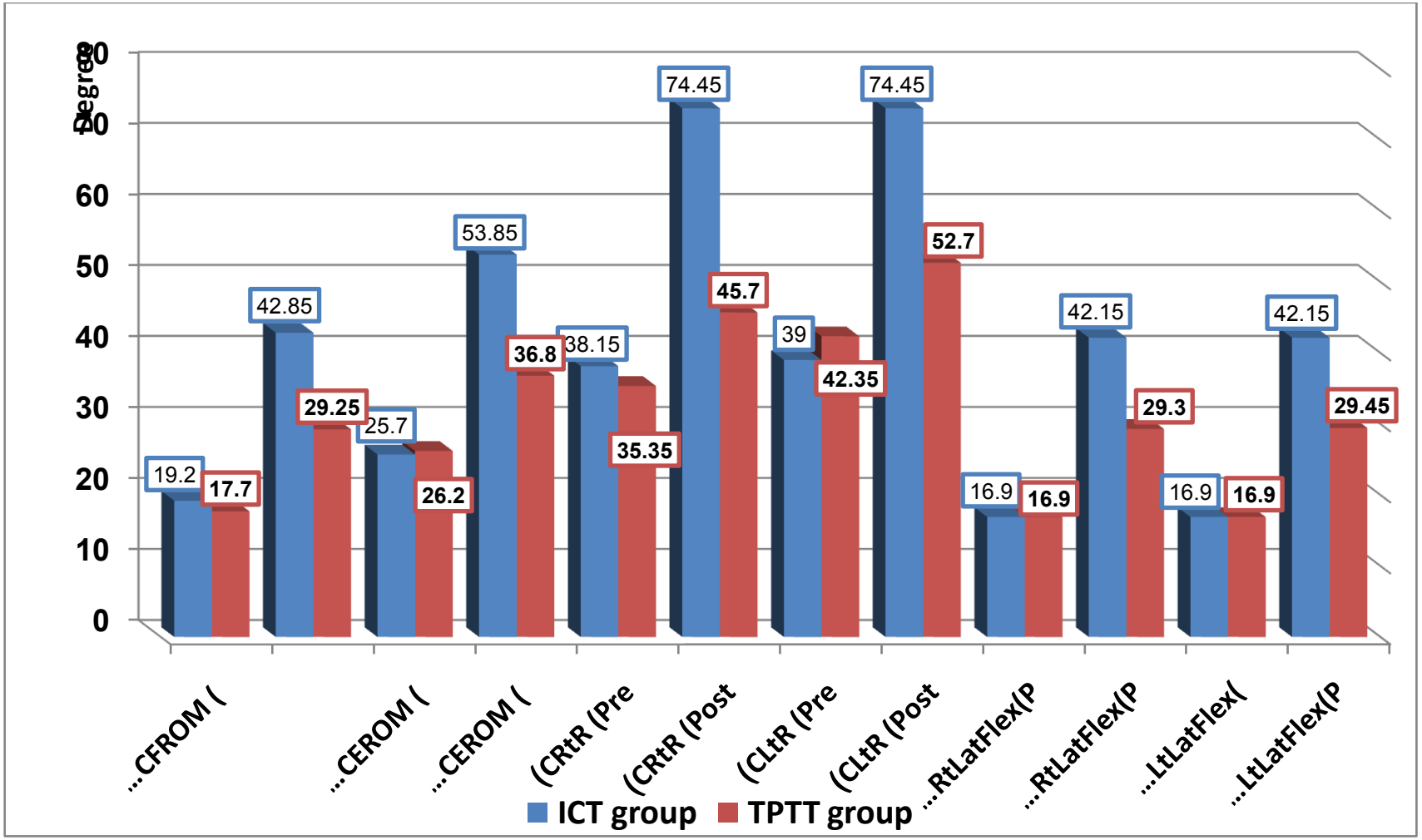

Figure (1):Mean values of cervical range of motions for both groups.

Ischemic compression treatment group (ICT group), Traditional Physical Therapy treatment group (TPTT group), Neck pain and disability scale= NPDS, Cervical Flextion Range of Motion= CFROM, Cervical Extension ROM= CEROM, Cervical Right Rotation= CRtR, Cervical Left Rotation=CLtR, Right Lateral Flextion= RtLat Flex, Left Lateral Flextion= LtLatFlex.

Between groups:
Post-study results of between groups' comparisons revealed that there were significantdifferences in VAS, NPAD, and CROMs mean values ($P < 0.05$) (Table II), (Figure 1).

Pain assessment (by VAS)
The pre and post-study mean values of VAS are reported in table II. By comparing the mean values of VAS at pre and post-study evaluations for ICT and TPTT groups; there was statistically significant decrease in VAS by about (71.91±0.084) %, (14.94±0.054) % for ICT and TPTT groups respectively (Figure 1).

Neck pain and disability assessment (by NPDS)
The pre and post-study mean values of NPDS are reported in table II. By comparing the mean values of NPDS at pre and post-study evaluations for ICT and TPTT groups; there was statistically significant decrease in NPDS by about (16.81±0.031) %, (2.19±0.01) % for ICT and TPTT groups respectively (Figure 1).

Cervical range of motions (CROMs) assessment
The pre and post-study mean values of CROMs are reported in table II. By comparing the mean values of cervical flextion range of motion (CFROM), cervical extension ROM (CEROM), cervical right rotation (CRtR), cervical left rotation (CLtR), right lateral flextion (RtLat Flex), left lateral flextion (LtLatFlex) at pre and post-study evaluations for ICT and TPTT groups; there was statistically significant increase in CFROM, CEROM, CRtR, CLtR, RtLatFlex, LtLatFlex by about {(144.51±0.78) %, (71.10±0.26) %}, {(116.64±0.45) %, (42.01±0.11) %}, {(98.05±0.25) %, (30.11±0.08) %}, {(95.24±0.31) %, (25.21±0.1) %}, {(162.74±0.65) %, (78.09±0.27) %}, {(162.74±0.65) %, (79.61) %}for ICT and TPTT groups respectively (Figure 1).

Discussion

This study was designed to clarify the effect of ischemic pressure on trapezius trigger points in treatment of CMNP. A comparison was conducted between 2 groups of patients with CMNP (ICT and TPTT groups). The results of this study revealed that ICT treatment produced significantly positive results in reducing pain, disability and increasing CROMs in patients with CMNP, results obtained from ICT group were superior to those obtained from TPTT group. ICT was more effective in reducing pain, disability and increasing CROMs than TPTT.

Patients with CMNP are frequently experiencing neck pain, reduced CROMs and physical deconditioning that impairs their functional status. The results of relieving pain with ischemic pressure were consistent with Fernández-de-lasPeñas et al, who utilized the VAS to examine the sensitivity of changes in active and latent MTrPs in the trapezius muscle after the application of ICT for 90 s, results proved satisfactory in both cases (Fernández-de-lasPeñas et al, 2006).
Manipulating MTrPs and stretching of tight structures proved to be beneficial in reducing pain and increasing CROMs. Wilk et al, evaluated the short term effect of acupuncture plus stretch on pain reduction and CROM improvement in patients with cervical myofascial pain syndrome and found satisfactory and statistically significant improvements in group utilized acupuncture plus stretching (Wilke et, al,2014). Also Rajalakshmi et al investigated the effect of transcutaneous electrical nerve stimulation (TENS) followed by stretching on trapezius trigger points in acute trapezius muscle spasm and found that companying TENS with passive stretch to trapezius muscle relived pain and increased cervical ROM (Rajalakshmi et al, 2013).
Another study conducted by Thomas et al, examined the effect of TENS on acupuncture points and neck exercise in chronic neck pain patients, patients were randomized into three groups, receiving either TENS over the acupuncture points plus infrared irradiation, exercise training plus infrared irradiation, or infrared irradiation alone twice a week for six weeks. Patients in the TENS and exercise group had a better and clinically relevant improvement in disability, isometric neck muscle strength, and pain compared with other groups (Thomas et al, 2005).

Results of our study were consistent with previous studies reported that ICT yielded statistically significant improvements in pain pressure threshold (PPT) and ROM parameters. Gemmell et al worked with subjects with nonspecific neck pain,three treatment groups (IC, pressure release, and sham US) were created for the treatment of active MTrPs of the trapezius muscle. Examiners obtained measurements of Pain Pressure Threshold and AROM. Ischemic compression was performed for 30 to 60 seconds. Ischemic compression was released when tension of MTrPs decreased, when pain disappeared, or when 60 seconds had elapsed, whichever happened first. To determine pressure release, the examiner applied a non-painful pressure with the thumb over MTrPs until a tissue resistance barrier was felt. Pressure was maintained until the barrier disappeared. Then, pressure was increased until a new

barrier was found. This process was repeated until tissue resistance disappeared or 90 seconds had elapsed, whichever happened first. These results and the results of our study coincide with the fact that neck pain and AROM show improvement after performing a pressure stimulus (Gemmell et al, 2008).

Results of the current study were consistence with results obtained from a study conducted by William et al, to determine the effectiveness of a home program of ischemic pressure followed by sustained stretching for the treatment of MTrPs in the neck and upper back, in this study there were two groups experimental group (ischemic pressure followed by sustained stretch) and control group (active range of motion exercises), pain was examined by VAS, the difference between two groups was found in VAS , so a home program consisting of ischemic pressure and sustained stretching, was shown to be effective in reducing MTrPs sensitivity and pain intensity in individuals with neck and upper back pain (William et al, 2000).

The application of ICT beneficially affects patients with neck pain and disability. Results of the current study were further supported by a study conducted by Barbara et al, on office workers with mild neck and shoulder complaints in order to determine the short-term effect of ischemic compression (IC) for trigger points (TPs) on joints mobility, pain, and disability in office workers and the effect on disability and general pain at 6-month follow-up, they examine Pain by (Numeric Rating Scale and algometry), cervical ROM by (inclinometer), and neck function by Neck Disability Index (NDI). They found that the ICT resulted in significant short term improvement in general complaints, pain and joints mobility in office workers with mildly severe chronic neck pain (Barbara et al, 2013).

The major limitations of our study were the limited study time and absence of follow-up after treatment cessation. The results of this study have clinical significance to physical therapists dealing with patients with CMNP. The utilized ICT program in this study can be easily and safely applied in clinical practice settings and serve as an adjunctive treatment protocol to alleviate pain, disability and improving CROMs in patients with CMNP.

Conclusion

For a long time, manually applied treatment procedures have long been prescribed in the treatment of patients with CMNP. ICT proved to be an effective, safe therapeutic procedure for patients with CMNP. Participation in a 2-week ICT plus traditional physical therapy treatment program is effective in improving general neck complaints, neck pain sensitivity, range of motions, and neck disability. ICT proved to be effective in reducing pain, disability, increasing CROMs during management of patients with CMNP.

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