Does Improvement Towards A normal Cervical Configuration Aid in the Management of Fibromy randomized controlled trial

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ABSTRACT

Objective: *To investigate the short and long term effects of adding Deneroll cervical extension traction to a multi-modal program on fibromyalgia management outcomes in addition to three-dimensional postural measures, and cervical sagittal alignment.* ***Methods****: In this study, 80 patients between 40 and 65 years who experienced fibromyalgia syndrome with definite forward head posture and cervical hypo-lordosis were randomly assigned to the control or experimental group. Both groups received a multi-modal program. Additionally, the experimental group received Deneroll cervical traction. The Fibromyalgia Impact Questionnaire was administered, and the Visual analogic scale, Pain Catastrophizing Scale, algometric score, Pittsburgh Sleep Quality Index, Multidimensional Fatigue Inventory, General Health Questionnaire, Beck Anxiety Inventory, Beck Depression Inventory, three-dimensional postural measures, and cervical sagittal alignment in terms of anterior head translation distance and absolute rotatory angle were measured in all of the patients at three intervals.* ***Results:*** *The general linear model with repeated measures indicated a significant group × time effect in favor of the experimental group on the measures of anterior head translation (P<.0005), absolute rotatory angle (P=.05), the three-dimensional postural parameters (P<.05), Fibromyalgia Impact Questionnaire (P<.0005), Pain Catastrophizing Scale (P<.0005), Algometric score (F= P<.0005), Pittsburgh Sleep Quality Index (P<0.0005), Multidimensional Fatigue Inventory (P<0.0005), General Health Questionnaire (P<0.0005), Beck Anxiety Inventory (P<0.0005), Beck Depression Inventory (P<0.0005), and VAS (P<0.0005).* ***Conclusions:*** *The results suggest that the addition of Deneroll cervical extension traction to a multi-modal treatment program is beneficial in treating patients with fibromyalgia syndrome.*

Key words: *Fibromyalgia syndrome, Cervical, Head posture, Trtion.*

INTRODUCTION

Fibromyalgia syndrome common and chronic Although its defining disorder of pain regulation, as in increased sensitivity to pa (hyperalgesia) and lowered p (allodynia)[37], patients may also h of other symptoms such as fati non-restorative sleep patterns, cognitive difficulties[7,52] along w quality of life[35].

Despite the high preva condition[8], its conservative treat remained a challenge for the available treatments direct fibromyalgia (FM) (e.g. p aerobic exercise, biofeedbac physical therapies, and /multidisciplinary treatments) variable and long-term observational studies have four outcomes are typically poor[9,41,4 1,200 primary care physicians States (33% response rate) fo 14% of respondents indicated excellent satisfaction with man with FM and other medically symptoms[22].

Although the exact cause apparently not been discovered various research theories in nutrition, stress factors, alter pattern of sleep and changes in n transmitters، there is growing central nervous system dysfunct hypothesized that FMS is a co condition that appears to invo afferent processing and whi associated with abnormal integration[46].

Many of our postural ref the vestibulocollic reflex, cervic

pelvo-ocular reflex, vestibuloocular reflex, cervico-ocular reflex, and cervical somatosensory input, are housed, or occur, within the head and neck region[38]. A correction of altered cervical sagittal configuration therefore, could be required to achieve optimal full spine postural correction, where the rest of the spine orients itself in a top-down fashion[13]. More important, this posture correction is essentially required to normalize aberrant afferent input to the CNS, which is considered as an essential component of normal sensorimotor integration[46].

Despite the fact that there is some evidence of a link between cervical posture and fibomyalgia[36,39], to the best of our knowledge, no published randomized controlled trial has addressed the issue of head and cervical posture correction and its impact on the FMS management outcomes. Accordingly, the primary hypothesis of this study was that cervical curve restoration and forward head posture correction will have short and long term effects on the three dimensional (3D) spinal posture parameters as well as FMS management outcomes such as Fibromyalgia Impact Questionnaire (FIQ), Pain Catastrophizing Scale (PCS), Algometric score, Pittsburgh Sleep Quality Index (PSQI), Multidimensional Fatigue Inventory (MFI), General Health Questionnaire (GHQ), Beck Anxiety Inventory (BAI), Beck Depression Inventory(BDI), and Visual Analogue Scale (VAS). In the current study we used a new orthotic cervical traction termed the Denneroll to help restore normal sagittal spinal configuration based on principles of 3-point bending traction methods[21].

METHODS

Methods

A prospective, randomized, controlled study was conducted at a research laboratory of our university. All the patients were conveniently selected from our institution's outpatient clinic. The patients participated in the study after signing an informed consent form prior to data collection. Recruitment began after approval was obtained from our local institutional review board. Patients were recruited from May 2011 to Ju 12-week treatment investigatio follow-up.

Patients were enrolled, if the American College of criteria53 for FMS, experienced at least 48 months with no recer symptoms to any degree, report on the pain intensity, age reported a score ≥59 on the FM",44 and able to read and English.

Exclusion criteria include disease, unstable hyperten cardiopulmonary problems, infection, and history of a medical conditions such as hep lupus, multiple sclerosis, rheum polio, epilepsy, rheumatic fev history of neck or back surg psychiatric disorder affectin compliance.

The patients were random means of a balanced stratified either the experimental grou control group (n=40). The balanced for type of medicatio age by using a stratification generates a sequence of letters (correlatively ordered permutati category and combination of c sequences assigned to patients envelopes containing the alloc study groups. An independent p to the research protocol and involved in the trial, operate assignment.

Interventions

The patients in both grou 12-week multi-modal interven supervised by a physical therap educative program, cogniti therapy, and exercise program.

Educative program

It consisted of twelve 2- delivered over the treatment pe per week). This educative part c included information about typi usual course, medical conditi

causes of the illness, the influence of psychosocial factors on pain, current pharmacologic and non-pharmacologic treatments, the benefits of regular exercise, and the typical barriers to behavior change. The patients were encouraged to be active, to ask questions and to discuss issues with the speakers or with other participants. It was important that they shared their daily experience of the syndrome because it helps to illustrate the theoretical concepts addressed in the sessions. A summary of the contents of each educative session was provided earlier.17

Cognitive behavior therapy (CBT)

The CBT (12 weekly, 2-hour sessions), especially focused on the patients' thinking and involved problem-solving, stress and pain coping strategies, and relaxation 50 was led by a clinical psychologist. Patients were taught the meaning of the stress-tension-pain circle as a cognitive pain model and learned coping strategies and the reduction of catastrophising thoughts. Patients received weekly homework tasks, and encouraged to engage in physical activities. The patients participated in relaxation exercises during and between the sessions. The psychologist emphasized the need to practice the relaxation techniques at home daily. The therapists identified instances of maladaptive thinking and encouraged the group to challenge these instances and to provide more appropriate interpretations and alternatives.

Exercise program

The program conducted for 1 hour 3 times a week for 12 weeks. This exercise program consisted of relaxation techniques based on the published regimen by Ost 42 dynamic (slow, controlled leg and arm swings), active stretching (i.e., bringing the leg up high and holding it there without anything to keep it in that extended position), and passive stretching (i.e., reaching out to the feet while sitting up).1

Those in the control group received only a 12-week multimodal intervention program. The experimental group additionally received Deneroll cervical extension traction (Denneroll Industries (www.denneroll.com) of Sydney, Australia). Here, the patient lies flat on their back on the ground with their and arms by their sides. T encouraged to relax whilst Denneroll. The denneroll was ground and positioned in the p of the neck depending on th addressed. The traction session three times per week for 12 w began with 3 minutes per progressed to a maximum of 2 session in incremental fashion. T Denneroll orthotic was placed i following regions based on l radiographic displacements:

1. In the upper cervical re region. This position allo bending of the upper cerv while cause slight anterior h (AHT). One subject r placement location.
2. In the mid-cervical region ((This position allows extensi the mid-upper cervical se creating a slight posterior he Twenty five subjects r placement location.
3. In the upper thoracic lower-((C6-T1) region. This po extension bending of the lo cervical segments while significant posterior hea Thirty four subjects r placement location.

We did ask participants t starting any new regular physi exercise programs (that were u study) or other non-p interventions for FM during involvement.

Outcome Measures

Patients were assessed at (pre-treatment, 10 weeks post-t the 1-year follow-up).

Fibromyalgia Impact Questionn

The primary outcome determining the treatment as FIQ, which is a valid sel questionnaire developed to participant status, progress, and FIQ is composed of 10 subscales

and symptoms (physical function, work missed day, job ability, feel good, pain, fatigue, sleep, stiffness, anxiety and depression).24 The total scores range from 0 to 100, higher the FIQ score, the greater is the impact of FMS on the participant.

Other outcome measures used to compare effectiveness of the treatment between the study and control groups included the 3D spinal posture parameters, VAS, PCS, algometric score, PSQI,MFI, GHQ,BAI, BDI, and cervical sagittal alignment in terms of AHT distance and absolute rotatory angle (ARA).

Cervical radiographs

A repeatable and reliable method 47 was used to quantify the main outcome measurement represented in cervical lordosis (ARA C2-C7) and any amount of anterior head translation distance AHT (C2-C7).

Rasterstereographic posture analysis

Rasterstereography (Formetric 2, Diers International GmbH, Schlangenbad, Germany) was used to examine posture and back shape characters. All testing procedures were done following Lippold et al's protocol. 32 The Formetric scans were taken in a relaxed standing position. The patient was positioned in front of the black background screen at a distance of two meters from the measurement system. The column height was aligned to move the relevant parts of the patient's back into the center of the control monitor by using the column up/down button of the control unit; to ensure the best lateral and longitudinal position of the patient a permanent mark on the floor was used. The patient's back surface (including upper buttocks) was completely bare in order to avoid image disturbing structures.

After the patient and the system were correctly positioned, the system was ready for image recording. The image processing consists of automatic back surface reconstruction and shape analysis. The sagittal plane parameters (lumbar angles, thoracic angles, and trunk inclination), the frontal plane parameters (trunk imbalance and lateral deviation) and the transversal plane parameters

(vertebral surface rotation and
were selected to cover the pos
three planes**.** A representative e
Formetric system's print o
graphically for a study group pat

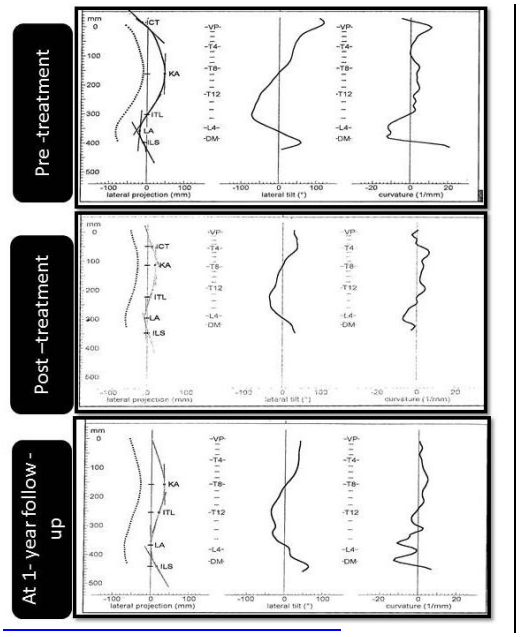

***Fig. (1): Example of the Formetri
out.***

The Pain Catastrophizing Scal

The PCS was used to
factors: rumination, magni
helplessness associated to pain.
items measured on a 5-point
ranging from 0 (not at all) to 4
Higher scores indicate a greate
catastrophize pain symptoms.11

Algometric score

Algometric score (k
calculated as the average of
pain-generating pressure values
18 points.48

Sleep quality

The PSQI10 was used t
quality and disturbances over a
interval. Nineteen individual i
seven "component" scores: su
quality, sleep latency, sleep dur

sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven components yields one global score.

Fatigue

The MFI was used to measure fatigue severity, It covers the following dimensions: general fatigue, physical fatigue, mental fatigue, reduced motivation and reduced activity. Scores on each subscale range from 4 to 20, with higher scores indicating greater fatigue.16

General Health Questionnaire

The (GHQ-20) is a 20-item instrument for measuring psychological distress in chronic diseases. The 20-items use a four-point Likert scale ranging from "no distress at all" to "much more distress than usual" and are summated to give a total score from 0 to 60 where 0 is the best possible score indicating no distress. A score of 24 or more is defined as pathological psychological distress.43

Beck Anxiety Inventory

The BAI instrument measures anxiety severity while discriminating anxiety from depression. It contains 21 items with a total score of 0–63, where higher scores indicate more anxiety.4

Beck Depression Inventory

The BDI is a questionnaire developed and validated for patients with depression. It contains 21 items that assess the cognitive and affective factors associated with depression. The range of score is 0–63, where values above 13 indicate presence of depression, and values above 21 indicate major depression.5

Pain intensity

Evaluation was done according to the VAS, the patients were presented with a 10cm line and asked to mark an X on the line indicating the intensity of their pain over the past week. The line was labeled "no pain" at point zero at one end and "the worst pain you can imagine" at point 10 at the other end. The distance from point 0 was measured with a metric ruler and was scored between 0 and 10.

Sample size determination

The required sample determined for the primary outc i.e. overall score of FIQ. previous research,6 a clinic change is a 15-20% reduction in score (which equals to a ~1 reduction). We can detect diff least 15% with a power of 95% with two groups (intervention a group) of 25 participants, with FIQ of ~70 and a standard dev points. Assuming a maximum l up of 30%, we recruited a total with FM for each group.

Data analysis

To compare the experimer the control group, the statistica based on the intention-to-treat pr values less than 0.05 wer significant. We used multiple i handle the missing data. To impu data, we constructed multip models including variables pote to the fact that data were missi variables correlated with that equality of variances (Levene's normal distribution of the data Smirnov's test) allowed for parametric methods for signifi To examine the comparative eff alternative treatments over the c year follow-up, a 2- way repe analysis of covariance (using the linear model) was conducted patients who entered the study included one independent facto repeated measure (time), and factor (group × time). (The bas the outcome as covariates was the between group differen outcome in the mode= baseline mean baseline value). The indep test was used to determine the forward head correction treatme the traditional treatment at diffe time points.

RESULTS

A diagram of the patients' retention and randomization throughout the study is shown in Figure 2. A total of 150 patients were initially screened. After the screening process, 80 patients were eligible to participate in the study. In total, 80 (100%) comp
follow-up after 10 weeks of trea
of them completed the entire s
the 1-year follow up. The
characteristics of the patients
Table 1.

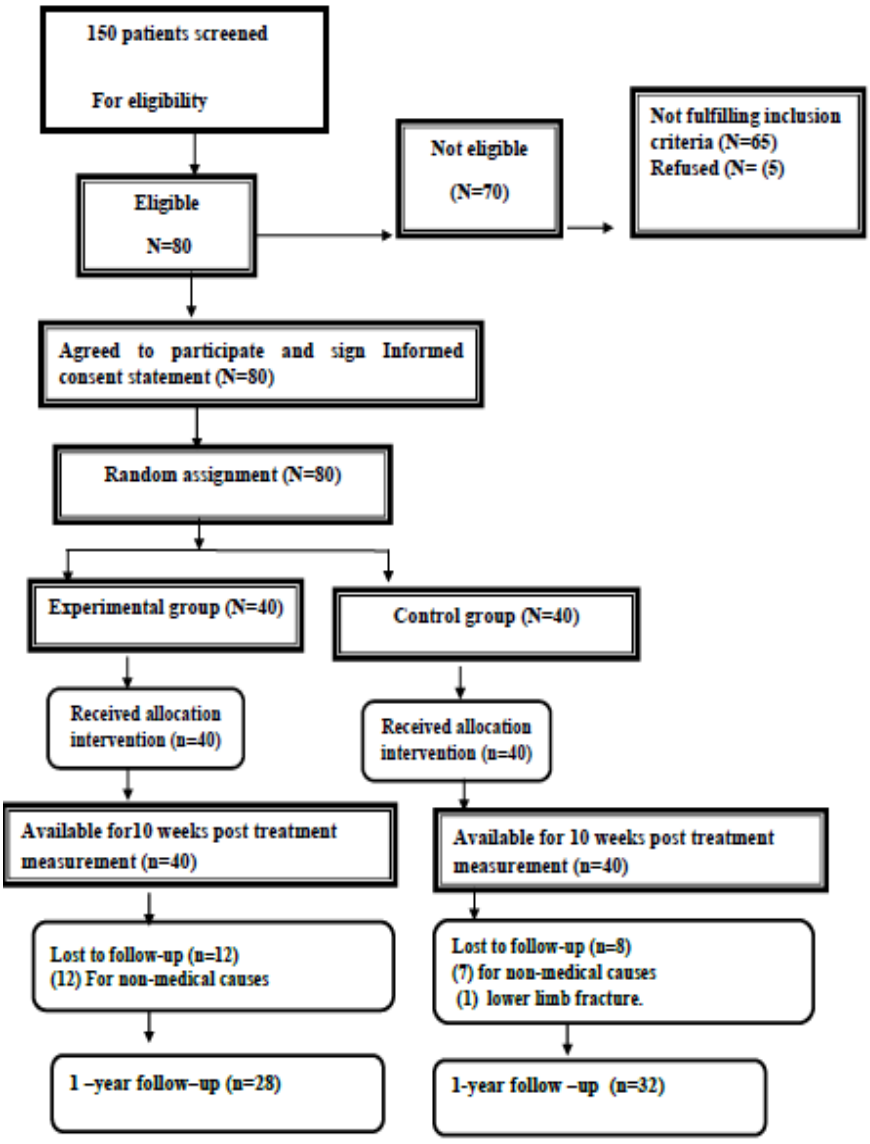

Fig. (2): Flow chart.

Table (1): Baseline participant demographics.

	Study group (n=40)	Control group (n=40)
Age(y)	54.3±7 Range 47–65	52.2±6 Range 45–64
Weight(kg)	75 ± 9	80 ± 10
Gender (%)		
Male	30	28
Female	10	12
Body mass index mean (SD),Kg\m2		
graduation		
Primary school	7(17.5%)	9(22.5%)
Secondary school	14(35%)	12(30%)
Advanced technical colleague certificate	10(25%)	8(20%)
University diploma	7(17.5%)	9(22.5%)
Others	2 (5%)	2(5%)
Marital status (%)		
Single	5(12.5%)	4(10%)
Married	33(82.5%)	35(87.5%)
Separated, divorced, or widowed	2(5%)	1(2.5%)
Pain duration		
1-5 y	12(30%)	9(22.5%)
>5 y	28(70%)	31(77.5%)

The results are summarized and presented as the mean (SD) in Tables 2 and 3. The general linear model with repeated measures indicated significant group × time effects in favor of the experimental group on the measures of anterior head translation (F=17.1 P<.0005), ARA (F= 3.6 P=.05), the three-dimensional postural parameters in terms of the trunk inclination (F= P=.01), lumbar lordosis (F=8.4 P=.005), thoracic kyphosis (F=11.6 P<.001), trunk imbalance (F=17.1 P<.0005), pelvic inclination (F=17.1 P<.0005), and surface rotation (F=18.1 P<.0005) (P<.0005), FIQ (F=1092.6 P<.0005), PCS (F=1340.8 P<.0005), Algometric score (F=575.8 P<.0005), PSQI (F=168.9 P<0.0005), MFI (F=474.9 P<0.0005), GHQ (F=1779.8 P<0.0005), BAI (F=2560.6 P<0.0005), BDI (F=872.964 P<0.0005), and VAS (F=140.3 P<0.0005).

After 12 weeks of treatment, the two arms of treatment appeared to be approximately equal in successfully improving the fibromyalgia management c unpaired t-test analysis insignificant difference b experimental and control gr previous variables including PCS(P=0.2), Algometric score ((P=0.8), MFI (P=0.1), BAI(P=0.09), BDI(P= 0.07) (P=0.3).

There were significan between the groups for the AHT 3D postural parameters in term inclination, lumbar lordosis, tho trunk imbalance, pelvic inc surface rotation (P<.0005). A follow-up, the analysis showed t significant differences b experimental and control groups measured variables including th translation, ARA, all the FM outcomes; FIQ, PCS, Algometri Fatigue, GHQ (F=72 P<0.000 VAS, and 3D posture parameters

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Table (2): The changes in postural parameters in experimental and control groups over ti

		Pre treatment	Post treatment	1-year follow up	P		
					Group	Time	Group Vs time
SR	E	5.8±.8	4.8±.9	4.8±1	<0.0005*	<0.0005*	<0.0005*
	C	6.4±1	6.3±1.1	6.7±1.3			
++			<0.0005[-1.3 -.82]	<0.0005[-1.98 -1.3]			
L.L	E	51.6±5.4	42.5±3.7	44.4±3.4	<0.0005*	.032	.005
	C	49.4±3.4	48.1±3.2	52.4±5.1			
++			<0.0005[-7.5 -5.13]	<0.0005*[-10.1 -6.9]			
T.K	E	66.5±3.8	56.1±4.3	57.2±4.1	<.0005*	.6	.001
	C	64.2±5.7	61.7±4.5	65.3±5.4			
++			<0.0005[-7.7 -4.5]	<0.0005[-10.5 -7.11]			
T.In	E	6.1±1.1	4.1±1.1	4.3±1.4	<.0005*	.001	.013
	C	6.7±1.2	6.5±1.2	7.2±1.4			
++			<0.0005*[-2.5 -1.8]	<0.0005*[-3.1 -2.1]			
T.Im	E	20.4±2.8	14.5±3.4	14.9±3.4	.000	.016	.000
	C	20.1±2.8	19.1±2.3	21.1±2.8			
++			<0.0005*[-5.9 -4.06]	<0.0005*[-7.5 -5.5]			
AHT	E	27.9±4.1	14.5±3.4	14.9±3.4	.000	.016	.000
	C	27±2.9	19.1±2.3	21.1±2.8			
++			.000[-5.9 -4.1]	.000[-7.6 -5.4]			
ARA	E	6.6±5.1	19.4±2.9	18.3±2.9	.000	.04	.05
	C	7.5±4.9	7.15±4.8	5.5±3.6			
++			.000[12.4 13.4]	.00[12.8 13.8]			

SR: surface rotation; L.L: lumbar lordosis; T.K: trunk kyphosis; T.In: trunk inclination; T.Im: trunk imbalance; P
++: scores of 10 weeks post-treatment and of 2-year follow-up were compared between two groups with indepen
[P value (95% convedince interval)]; E: experimental group; C: control group.

Table (3): The changes in fibromyalgia management outcomes in experimental and cont
time.

		Pre treatment	Post treatment	1-year follow up	P		
					Group	Time	Group Vs time
FIQ	E	70.9±4.4	44.1±7.2	9.3±3.4	.000	.002	.000
	C	71.3±5.8	43.6±7.4	47.9±7.7			
++			.4 [-1.2 2.9]	<.0005* [-40.6 -36.4]			
PCS	E	43.8±3.6	24.5±3.1	9.4±2.8	.000	.012	.000
	C	42.5±3	24.9±3.4	36.3±3.1			
++			.2[-1.851 .412]	.000[-27.9 -25.8]			
GHQ	E	2.2±.3	18.3±3.6	4.4±1.2	<.0005*	.0000	<.0005*
	C	2.1±.1	19.9±4.2	29.3±3.9			
++			.1 [-1.8 .19]	<.0005*[-25.4 -23.9]			
Algometric score	E	140.1±11.3	166.8±12	189.2±9.6	<.0005*	.000	<.0005*
	C	141.3±14.2	167.6±11.7	146.1±16.3			
++			.09 [-.5 .044]	<.0005*[-2.9 -2.1]			
PSQI	E	14±3.1	9.5±2	5.5±2.9	.000	.000	.000
	C	16.1±2.8	9.6±2.1	14.2±2.8			
++			.8 [-.8 .66]	<.0005*[-9.779 -7.721]			
MFI	E	77.7±8.4	50.9±6.4	24.4±9.4	<.0005*	.000	<.0005*
	C	74.8±5.7	52.6±6.4	61.5±6.2			
++			.14[-4.01 .61]	<.0005* [-39.9 -34.2]			
BAI	E	32.1±6	21.2500±4.30067	7.2500±3.34778	.000	.000	.000
	C	33.4±4.9	22.5833±3.64665	29.8333±2.24867			
++			.098[-.949 .081]	.000[-23.169 -21.338]			
BDI	E	19.3 ±3.7	11.5833±1.86213	4.5000±1.26892	.000	.635	.000
	C	20.1± 3.4	12.4167±2.34551	19.0000±2.21704			
++			.074[-1.2 .06]	.000[-14.8 -13.7]			
VAS	E	5.2±.8	3.2±1.2	2.9±1.6	<.0005*	.3	<.0005*
	C	4.6±1	3.1±1.3	4.7±1.5			
++			.3[-.57 .17]	<.0005*[-2.6 1.6]			

DISCUSSION

This randomized controlled trial compared the cervical sagittal alignment in terms of AHT distance and ARA, three-dimensional postural measures, and outcomes of FIQ, PCS, algometric score, PSQI, MFI, GHQ, BAI, BDI, VAS in a group receiving a Denneroll traction and a multi-component intervention program to a group receiving only a multi-component intervention program. The comparison between the experimental and control groups in the AHT, ARA and the three-dimensional posture parameters revealed significant differences at the two follow-up points. The results of the FM management outcomes such as FIQ, PCS, algometric score, PSQI, MFI, GHQ, BAI, BDI, and VAS after 12 weeks indicated that the positive changes are equally successful in both groups. At the 1-year follow-up, the statistically significant changes favoring the outcomes of the experimental group provide objective evidence that biomechanical dysfunction in terms of abnormal cervical sagittal configuration, influences the long-term outcome measures of FM.

The improvement in the forward head posture and cervical lordotic curve recorded by the study group is similar to that reported in a pilot study that showed the effectiveness of this type of traction on restoring sagittal spinal configuration[18]. Stretching of the viscous and plastic elements of the longitudinal ligament and intervertebral disc, in addition to an effective soft tissue stretch through the entire neck area in the direction of the normal head and neck posture, may be the possible explanation for restoring the normal cervical lordosis and reduction of AHT[19].

In the current study we found that the experimental group receiving the Deneroll cervical extension traction experienced significant changes in posture parameters occurring in sagittal, transverse, and coronal planes. These significant changes may suggest the important role of the cervical spine on global spinal posture. These results are conceptually in agreement with neurophysiological studies that l a neurological regulation of human posture that is largely head posture[30,25], and conseq afferentation process. Static pos compromised by dysaffernation region which results from lack and muscle fatigue in respons strain placed upon various sp such as the splenius capit sternocleidomastoid, and levat forward head posture[25,51].

These results are further those reported by Diab[13], who role of head posture on the thre spinal posture parameters and "forward head correction was improving the scoliotic posture coronal, and sagittal planes".

The application of a intervention program alone or i with Deneroll cervical exter appears to be approximate successfully improving the management outcomes after treatment. Following 12 weeks the marked improvement management outcomes may be the positive effects of the m intervention program. This e supported by a recent meta-ana showed that multi-component effective in the short term for i symptoms of FM including depression and quality o disappointingly without e continued effect other than m physical fitness. The significant control group may be attributed term effects of multi-compon Indeed, there is strong evide positive effects of multi-compon the key symptoms of FMS time[33,34,27,29].

After 10 weeks of treat surprising that the addition rehabilitation to a multi programme did not produce a (statistically) better effect tha

component programme across all FM management outcomes, given the preliminary evidence of significant role of normal posture in normalizing the afferentation process. There is no clear explanation for these findings, but we can speculate that a sustained postural imbalance can result in establishment of a state of continuous asymmetric loading. Once it is established and maintained beyond a critical threshold for weight and time, there will be increases in the degenerative changes in the muscles, ligaments, bony structures and neural elements[20,26]. Most important, when the asymmetry is reversed and the unbalanced loading is thereby corrected by restoring normal posture, the reversible of these degenerative changes or even its improvement will need some time. Although direct empirical support to this explanation is lacking, the delayed recovery after posture correction is in agreement with Diab and Moustafa who reported more decrease in pain intensity scale after 6 months follow up compared to 10-weeks post treatment[14]. Also of interest, Diab identified more decrease in functional index scale after 3 months follow up compared to 10-weeks post treatment[13].

At the 1-year follow-up, the significant changes favoring the outcomes of the experimental group for all FM management outcomes, suggest that addressing posture impairments may be essentially required for the long-term management. In general, these findings are highly supported by other studies that highlighted the role of abnormal, asymmetrical posture, which is considered by some to be an important etiological factor and or associated with FMS[36,39]. These findings concurred with those of Dolphens et al.,[15] who concluded that global spinal posture, especially of gross body segments, is required to achieve significant clinical improvement.

Normalizing the abnormal mechanical stresses and restoring the normal afferentation process are the possible explanations for the positive role of normal posture in management of FMS. More specifically, the continuous asymmetrical loading and muscle imbalance from biomechanical dysfunction represented by cervical sagittal configuration and sagittal, transverse and coronal abnormal spinal posture elicits abnormal stress and st structures, including bones, discs, facet joints, musculotenc and neural elements that a predisposing factors for pain[20,26]

Neurophysiologically, abn causing a barrage of nocice input[49], resulting in dysafferent that sensorimotor integratio dependent upon cerv mechanoreceptors and afferen ligament and musculotendinc correcting the postural distortio for this pathophysiologic proce possible explanation for th improvement of FMS. This expl fact, been confirmed by the fin studies that have reported correction is paramount to res afferent input to the CNS, anc body to correctly perceive i environment[3,28].

Our analysis has potenti each of which indicates directi study. The primary limitation w investigator blinding. W participants regarding the val treatment arms and informed t have a realistic potential f participants. We informed them existing evidence to suggest that approach is superior to the othe nature of radiological assessme the major limitations in this stu radiologists and x-ray technolog minimize the risk factor of x-ray high-frequency equipment to exposure times. Shielding anc block or reduce the x-ray beam sensitive tissues and areas of i interest, rare earth (intensifyin decrease x-ray exposure by collimation to narrow the x- include areas of interest only, kilo voltage and minimized mi further reduce the x-ray dosage.

Within these limitations contribution of our study is tha the independent effect c rehabilitation in form of c restoration and forward head pos

on long term global spinal posture in the transverse, coronal, and sagittal planes, in addition to other outcome measures related to FM including FIQ, PCS, Algometric score, PSQI, MFI, GHQ,BAI, BDI, and VAS which, to the best of our knowledge, has not been previously reported. We hypothesized that the results of this study introduce new guidelines in the treatment of FMS.

Conclusions

Adding Deneroll cervical extension traction to a multi-modal program has a short- and long-term positive effect on three-dimensional spinal posture in patients with FMS. After 12 weeks of treatment, the two treatment arms appear to be equally successful in improving the FM management outcomes including FIQ, PCS, Algometric score, PSQI, MFI, GHQ,BAI, BDI, and VAS. The long-term analysis, at the 1-year follow-up, revealed statistically significant changes favoring the FM management outcomes of the experimental group.

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Competing interests

None.

REFERENCES

1- Alter, M.J.: Science of flexibility. Champaign: Human Kinetics; 2nd ed. (Champaign, IL: Human Kinetics), 1996.
2- Bandak, E., Amris, K. and Bliddal, H.: Muscle fatigue in fibromyalgia is in the brain, not in the muscles: a case–control study of perceived versus objective muscle fatigue .Ann Rheum Dis. 72: 963-966, 2013.
3- Barge, F.H.: One Cause, One Cure. LaCrosse, WI, 1990.
4- Beck, A.K., Epstein, N. and Brown, G.: An inventory for measuring clinical anxiety: psychometrics properties. J Consult Clin Psychol. 56: 893-897, 1988.
5- Beck, A.T., Ward, C.H., Mendelson, M. and Erbaugh, J.: An inventory for measuring depression. Arch Gen Psychiat 1961.
6- Bennett, R.M., Bushmakir Cappelleri, J.C.: Minimal clini difference in the fibrom questionnaire. J Rheumatol. 2009.
7- Bennett, R.M., Jones, J. and internet survey of 2,596 fibromyalgia. BMC Musculosk 27, 2007.
8- Branco, J.C., Bannwarth, B. Prevalence of fibromyalgia: a European countries. Semin A 39: 448-453, 2010.
9- Busse, J.W., Ebrahim, S. an Systematic review and networ of interventions for fibromyal yst Rev. 13:2:18. doi: 10.118 18, 2013.
10- Buysse, D.J., Reynolds, C.F. a The Pittsburgh sleep quality instrument for psychiatric research. Psychiatry Res. 28: 1
11- Campbell, C.M., McCauley, I S.C.: Changes in pain catastro later changes in fibromyalgi experimental pain report: cros analyses of dispositional a catastrophizing. Arthritis Res T 2012.
12- Clauw, D.J., Arnold, L.M. an B.H.: The science of fibromya Proc.; 86: 907-911, 2011.
13- Diab, A.: The role of forward in management of adolesc scoliotic patients: a randomi trial. Clin Rehabil.; 26: 1123-1
14- Diab, A.A. and Moustafa, I.M.: forward head correction on ner and pain in cervical spondyloti a randomized trial. Clin Rehabi 2012.
15- Dolphens, M., Cagnie, B. and Sagittal standing posture and with spinal pain: a epidemiological study of adolescents before age at peak Spine (Phila Pa 1976); 37: 165
16- Elbers, R.G., van Wegen, E. a Reliability and structural v Multidimensional Fatigue Inve patients with idiopathic Parki Parkinsonism Relat Disord.; 2012.
17- Fernandez, R., Pen-arrubia, M. J.V.: Effectiveness of a psy

programme for improving quality of life of fibromyalgia patients. BMC Musculoskeletal Disord.; 9: 2, 2008.
18- Harriosn, D.D.: BioPhysics Insights: Determining the Appropriate Home Traction for Abnormalities of the Cervical Lordosis. AJCC. 2010.
19- Harrison, D.E., Harrison, D.D. and Betz, J.: Increasing the Cervical Lordosis with CBP Seated Combined Extension-Compression and Transverse Load Cervical Traction with Cervical Manipulation: Non-randomized Clinical Control Trial. J Manipulative Physiol Ther.; 26: 139-151, 2003.
20- Harrison, D.E., Harrison, D.D. and Janik, T.J.: Comparison of axial and flexural stresses in lordosis and three buckled configurations of the cervical spine. Clinical biomechanics; 16: 276-278, 2001.
21- Harrison, D.E.: A new cervical lordotic home traction device: The Denneroll—an initial case series. American J Clinical Chiropractic; 19: 18-22, 2009.
22- Hartz, A.J., Noyes, R. and Bentler, S.E.: Unexplained symptoms in primary care: perspectives of doctors and patients. Gen Hosp Psychiatry. 22: 144-152, 2000.
23- Häuser, W., Bernardy, K. and Arnold, B.: Efficacy of multicomponent treatment in fibromyalgia syndrome: a meta-analysis of randomized controlled clinical trials. Arthritis Rheum.; 61: 216-224, 2009.
24- Jackson, B.L., Harrison, D.D. and Robertson, G.A.: Chiropractic biophysics lateral cervical film analysis reliability. J Manipulative Physiol Ther.; 16: 384-391, 1993.
25- Karnath, H.O., Konczak, J. and Dichgans, J.: Effect of prolonged neck muscle vibration on lateral head tilt in severe spasmodic torticollis. J NeurolNeurosurg Psychiatry, 69: 658-660, 2000.
26- Keller, T.S., Colloca, C.J. and Harrison, D.E.: Morphological and Biomechanical Modeling of the Thoracoc-lumbar Spine: Implications for the Ideal Spine. Spine J.; 5: 297-305, 2005.
27- King, S.J., Wessel, J., Bhambhani, Y., Sholter, D. and Maksymowych, W.: The effects of exercise and education, individually or combined, in women with fibromyalgia. J Rheumatol.; 29: 2620-2627, 2002.
28- Knutson, G.A.: Dysafferentation: a novel term to describe the neuropathologic effects of joint complex dysfunction--a look at likely mechanisms of symptom generation. J Manipulative Physiol Ther.; 22: 45-48, 1999.
29- Koulil, S.V.: Cognitive-behav and exercise programmes fo fibromyalgia: state of the directions. Ann Rheum Dis.; 2007.
30- Ledin, T., Hafstrom, A. and Influence of neck proprioceptic induced postural sway. Acta Ot 594-599, 2003.
31- Lee, Y.C., Nassikas, N.J. and C role of the central nervous generation and maintenance of rheumatoid arthritis, oste fibromyalgia. Arthritis Res T 2011.
32- Lippold, C., Danesh, G. and H inclination, pelvic tilt and Pel relation to the craniofacial Adult. Angle Orthod.; 77: 29-3
33- Mannerkorpi, K., Ahlme Ekdahl, C.: Six- and 24-mont pool exercise therapy and patients with fibromyalg Rheumatol.; 31: 306-310, 2002
34- Mannerkorpi, K., Nyber Ekdahl, C.: Pool exercise com education program for fibromyalgia syndrome: a randomized study. J Rheuma 2481, 2000.
35- Mease, P.J., Arnold, L.M. and Identifying the clinical fibromyalgia: contributions fro patient delphi exercises. Arthri 952-960, 2008.
36- Mitani, Y., Fukunaga, M. an Evaluation of psychophysiolog in patients with fibromyalgia s Psychophysiol Biofeedback.; 2006.
37- Mork, P.J., Vasseljen, O. an Association between physical mass index, and risk of longitudinal data from the N Trondelag Health Study. Artl (Hoboken). 62: 611-617, 2010.
38- Morningstar, M.W., Pettibo Schlappi, H.: Reflex control o posture: a review of the lit chiropractic perspective. Chiro 16, 2005.
39- Müller, W., Kelemen, J. and S factors in the generation o syndrome. Z Rheumatol.; 57: 3
40- Nöller, V. and Sprott, H epidemiological observations c

the disease in fibromyalgia patients.J Negat Results Biomed. 2: 4-9, 2003.
41- Nüesch, E., Häuser, W. and Bernardy, K.: Comparative efficacy of pharmacological and non-pharmacological interventions in fibromyalgia syndrome: network meta-analysis. Ann Rheum Dis. 72: 955-962, 2013.
42- Ost, L.: Applied relaxation: description of a coping technique and review of controlled studies. Behav Res Ther.; 25: 397-409, 1987.
43- Pembroke, T.P., Rasul, F. and Hart, C.L.: Psychological distress and chronic obstructive pulmonary disease in the Renfrew and Paisley [MIDSPAN) study. J Epidemiol Community Health.; 60: 789-792, 2006.
44- Schaefer, C., Chandran, A. and Hufstader, M.: The comparative burden of mild, moderate and severe fibromyalgia: results from a cross-sectional survey in the United States. Health Qual Life Outcomes.; 9: 71, 2011.
45- Seaman, D.R. and Winterstein, J.F.: Dysafferentation: a novel term to describe the neuropathophysiological effects of joint complex dysfunction. A look at likely mechanisms of symptom generation. J Manipulative Physiol Ther.; 21: 267-280, 1998.
46- Smith, H.S., Harris, R. and Clauw, D.: Fibromyalgia: An Afferent Processing Disorder Leading to a Complex Pain Generalized Syndrome. Pa 14:E217-E245, 2011.
47- Srifi, N., Bahiri, R. and Rc validity and reliability of the M of the Revised Fibromy Questionnaire**.** Rheumatology 33: 179-183, 2013.
48- Tastekin, N., Uzunca, K. Discriminative value of ten fibromyalgia syndrome. Pain 471, 2010.
49- Travell, J.G. and Simons, D.: I and dysfunction: the trigger Williams & Wilkins; 1973.
50- Turk, D.C., Meichenbaum, D. Pain and Behavioral Medicine Behavioral Perspective. New 1983.
51- Vuillerme, N., Danion, F. and Postural sway under muscle muscle fatigue in humans. Neu 131-135, 2002.
52- Wilson, H.D., Robinson, J.P. Toward the identification of sy in people with fibromyalgia. A 61: 527-534, 2009.
53- Wolfe, F., Smythe, H.A. and Yu American College of Rheur criteria for the classification c Arthritis Rheum.; 33: 160-172,

الملخص العربي

هل التحسن نحو القوام العنقي الطبيعي يساعد في علاج حالات الألم العضلي الليفي : دراسة عشوائية

لأثار قصيرة وطويلة المدى لإضافة شد الدنى رول العنقي إلى برنامج متعدد الوسائط على نتائج علاج الألم العضلي قياسات القوام ثلاثية الأبعاد والقوام العنقي الجانبي . تم تقسيم80 مريضاً بين 40 ، 65 سنة من الذين عانوا من متلازمة مع وجود الرأس في الوضع الأمامي ونقص في تقعر الفقرات العنقية عشوائياً إلى المجموعة الضابطة أو المجموعة من المجموعتين برنامج متعدد الوسائط . بالإضافة إلى ذلك تلقت المجموعة التجريبية شد دنى رول العنقي ، وتم قياس متلازمة الألم العضلي الليفي ، قياس الألم البصري ، مقياس كارثية الألم ومجموع نقاط الألم نتيجة الضغط ، مؤشر المخزون متعددة الأبعاد ، استبيا الصحة العامة ، مقياس بيك للقلق ، مقياس بيك للإكتئاب ، قياسات القوام ثلاثية الأبعاد ي (تقعر الفقرات العنقية ومدى الأزاحة الأمامية للرأس) لكل المرضى في ثلاث فترات . وأظهرت النتائج وجود تأثير في صالح المجموعة التجريبية للقياسات التالية : مدى الإزاحة الأمامية للرأس (عند مستوى دلالة أقل من 0.0005) ، لقة (عند مستوى دلالة0.05) ، قياسات القوام ثلاثية الأبعاد (عند مستوى دلالة أقل من0.05) ، استبيان تأثير متلازمة (عند مستوى دلالة أقل من0.0005) ، قياس الألم البصري (عند مستوى دلالة أقل من0.0005) ، مقياس كارثية الألم ل من0.0005) ، مجموع نقاط الألم نتيجة الضغط (عند مستوى دلالة أقل من 0.0005) ، مؤشر نوعية النوم (عند 0.0005) ، التعب المخزون متعددة الأبعاد (عند مستوى دلالة أقل من 0.0005) ، استبيان الصحة العامة (عند 0.0005) ، مقياس بيك للقلق ومقياس بيك للأكتئاب (عند مستوى دلالة أقل من0.0005) . وقد دلت النتائج على أن العنقي إلى برنامج متعدد الوسائط مفيد في علاج المرضى الذين يعانون من متلازمة الألم العضلي الليفي .

زمة الألم العضلي الليفي ، العنق ، وضع الرأس ، الشد .