Using "chiropractic" in reducing the cervical and lumbar spine pain for those who wanting to apply for sport and military faculties

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Introduction

Athletic performance is affected by a complex variety of physiological elements, such as neuromuscular coordination, muscle strength and endurance. Neuromuscular weakness, decreased muscle strength and reduced power are all detrimental to athletic performance (Hong1 *et al.,* 2014).

Sports medicine clinicians with varied training consist of joint mobilization and manipulation among their therapeutic skills. Examples consist of chiropractors, physiotherapists, and osteopaths, not to mention the doctors and massage therapists who treat several joint pathologies (Ernst, 2003).

Chiropractic is the largest drugless health-care system in the world. Chiropractic centers its philosophy on the relationship of structure and function in the human body (Wyatt, 2005). The chiropractic therapy is effectiveness and costless, safe and function alone or in collaboration with other healthcare setting (Hartvigsen and French 2017).

There has been minimal documentation regarding the effect of chiropractic treatment on enhanced athlete's health, despite the significant increase in the demand and support for chiropractic care by athletes (Jarosz and Ellis 2010).

Chiropractic care, as spinal manipulation, may lead to deceased use of prescription drugs. Pain assistance afforded by chiropractic care may help patients to use lower or less doses of analgesics, leading to reduced risk of non-steroidal anti-inflammatory drugs (NSAIDs) induced bleeding, opioid overdoses, and other ADEs. However, evidence to support this hypothesis is sparse and conflicting (Chou *et al.,* 2017).

Pain is associated with function, physical movements triggering pain, while pain, in turn, causes limitations in physical function (Castrogiovanni and Musumeci 2017). Individuals with spinal pain have deficiencies in psychomotor speed, repositioning accuracy, and postural control. When carrying out motor tasks, they display abnormal patterns of muscle contraction. They take longer for localized spinal muscles to relax as well as to be activated, which can contribute to making their motions slower and their fear of causing further injury may lead to self-restraint on athletic performance (Wilks *et al.,* 2016).

Cervical spine pain is more likely to develop in individuals with high job demands, low social support at work, job insecurity, low physical capacity and sedentary work positions with poor work posture accentuated by poor ergonomic workplace design (Côté *et al.,* 2015).

The lumbosacral spine plays a central role in sustaining the stability of the body; however, the lumbar spine alone is not capable of supporting the normal loads that it carries daily. To stabilize the lumbar vertebrae on the sacral base needs the help of a complex myofascial and aponeurotic girdle surrounding the torso. On the posterior body wall, the central point of this girdling structure is the lumbar spine, a blending of aponeurotic and fascial planes that forms the retinaculum around the paraspinal muscles of the lower back and sacral region (Willard *et al.*, 2012).

The musculoskeletal disorders can be explained by an imbalance between physical stresses acting on the body and the capacity of physical and physiological responses of the body to these stresses. These stresses include kinetic (motion), kinematic (force), oscillatory (vibration), and thermal energy sources, which can originate from the external environment (such as vibrating tools), or from actions of the individual (such as lifting objects) (Reenen *et al.*, 2006).

The present study aimed to assessing the effect of using "chiropractic "in reducing the cervical and lumbar spine pain for those who wanting to apply for sport and military faculties.

2. Materials and methods

2.1. Study sample

The study sample comprised of one hundred and twenty men (17-22 years–old) diagnosed with cervical and lumbar spine pain. The sample was selected from students who wanting to apply for sport and military faculties.

2.2. Study domains

2.2.1. Study time

Period: From June 2015 to September 2017, Egypt.

2.2.2. Study place

Study was performed at health and sport scientific center Port Said.

2.2.2. Study approach

Study was performed using experimental approach.

2.3. Subjects

Subjects were asked if they had any limitations to SM (i.e. malignant cancer, metabolic disorders, inflammatory or infectious arthropathies), previously suffered from negative reactions to SM (i.e. alleged disc herniation, treatment-induced fracture, organ injuries or vascular issues), had a recent history of trauma or were currently undergoing treatment elsewhere at the time of their inclusion in the study.

2.4. Experimental setup and working

The sample was divided to four subsamples (each subsample was consists of 30 individual), sixty patients were diagnosed with segmental dysfunction of cervical region (30 considered as control group and 30 as an experimental group), this first part of the experiment was done from June 2015 to June 2016 while the second part of the experiment which followed the first and was done from June 2016 to September 2017, with sixty patients were diagnosed with segmental dysfunction of lumbar region (30 considered as control group and 30 as an experimental group). Cervical and thoracolumbar range of motion parameters were tested for each patient one test pre chiropractic session and three tests after the session: Immediately, after one day, after two days (the pre-test for the second session), repeated the same steps with the second and the third chiropractic sessions.

2.3.1. Chiropractic spinal manipulative therapy

The experimental group received spinal manipulative therapy using the Gonstead method, a specific contact, high-velocity, low-amplitude, short-lever spinal with no post-adjustment recoil that was directed to spinal biomechanical dysfunction (full spine approach) (Cooperstein, 2003).

2.3.2. Measuring tools

The tools used to assess the cervical and thoracolumbar spine range of motion (ROM) (Flexion/extension measures, left and right side flexion and rotation measures) were goniometer and clinometer application that used to measure the cervical and thoracolumbar spine (ROM).

2.3.2.1. A classic goniometer: Subjects were placed in a straight, high-backed chair with their feet flat on the floor and hands relaxed by their sides. They were then asked to sit up straight and position their head in neutral position to achieve neutral alignment. The lateral rotation was recorded (Reynolds *et al.,* 2009).

2.3.2.2. Clinometer application: This application used to measure the cervical and thoracolumbar spine (ROM) in frontal and sagittal planes (Peter Breitling, Version 3.3, http://www.plaincode.com/products),this application uses the internal three axes linear accelerometer to measure the direction of gravity's pull. For this, the gyroscope stays in one position, no matter the orientation. When placed against a solid surface, the clinometer compares the angle of the object to the gyroscope, and displays the results using the software interface. The following movements: flexion/extension and lateral flexion were recorded (Laflamme *et al.,* 2013).

3. Results and discussion

No study participant left the research project for any reason. No side effects or complications were observed during the treatment.

Data collected using different measuring tools, revealed that there were improvements in experimental groups cervical and thoracolumbar spine range of motion compared to the control with using three chiropractic successive sessions. The maximum improvement was detected with the third chiropractic session, compared to the first and the second sessions. Results were presented in **Tables 3.1- 3.3** and **Figure 3.1 and 3.2.**

Manual therapy (including joint mobilization, manipulation, or treatment of the soft tissues) and therapeutic exercises in physical therapy treatments have been progressively used by clinicians due to positive results, mainly for low back pain, neck pain, and related disorders. Manual therapy has been used to restore normal ROM, reduce local ischemia, stimulate proprioception, break fibrous adhesions, stimulate synovial fluid production, and reduce pain (Armijo-Olivo *et al.,* 2016).

Several studies have evaluated spinal manipulative therapy (SMT) as safety and efficacy technique for the treatment of musculoskeletal disorders in short-term as well as long-term results. Chiropractic therapy use spinal manipulative as a therapeutic option in their practices (Botelho *et al.,* 2017).

There is agreement between sports professionals and athletes about SMT and its effect on spinal column health and performance. Sandell *et al.,* (2008) reported an increase in hip extension after SMT. Costa *et al.,* (2009) reported an increased full-swing range in golfers, Botelho and Andrade (2012) reported increased grip strength in Judokas, and Deutschmann *et al,.* (2015) reported increased kicking speed after SMT in soccer players.

Gregoletto andMartínez (2014) study results demonstrated that, spinal manipulation of the cervical and thoracic regions with the Gonstead technique could reduce pain and produce considerable increase in cervical ROM in adults with mechanical neck pain.

Giles and Muller (2003) study results demonstrated that, compared the effectiveness of spinal manipulation, medications and acupuncture in patients with cervical and lumbar pain. Martínez *et al.* (2006) concluded that, the manipulation generates a greater reduction in pain and a greater increase in joint ROM.

Many hypotheses about how SMT work occur (Fryer, 2017). The modes of action may be unevenly divided into biomechanical and neurophysiological. The biomechanical approach suggests that SMT effect on a manipulable or functional spinal lesion; the treatment is designed to decrease internal mechanical stresses (Xia *et al.*, 2017). The neurophysiological approach suggests that SMT acts on the primary afferent neurons from paraspinal tissues, the motor control system, and pain processing (Randoll *et al.,* 2017).

Pickar (2002) study results demonstrated that, the biomechanical changes caused by spinal manipulation have physiological consequences, through their effects on sensory information to the neuron. The stimulations to the muscle spindles and the stimulations to the Golgi tendon organs are affected by spinal manipulation. Sensory nerve fibers of smaller diameter are expected to become active.

Pickar and Bolton (2012) study results demonstrated that, the reasons underlying the biomechanical changes in the spine affect the afferent neurons, with a subsequent change in central processing, and affecting the somato-motor efferences and the somato-visceral reflexes. Spinal manipulation causes changes in the musculoskeletal system. Experimental examinations show that the charge of the impulse of a spinal manipulation affects the proprioceptive primary afferent neurons in the paraspinal tissues.

Haavik and Murphy (2012) study results demonstrated that, the manipulation can affect the processing of pain, possibly by changing the central facilitated state of the spinal cord, and affect motor control system.

Table 3.1: Mean, standard deviation and t-test between control and experimental samples for cervical and thoracolumbar spine measurements.

Variables		Control		Experimental		t-value
		Mean	± SD	Mean	± SD	
Cervical spine	Extension /Flexion	27.40	6.55	25.90	3.30	-1.12
	Right/Left lateral flexion	20.77	5.09	19.72	3.51	-0.93
	Right/left rotation	43.75	6.10	43.28	3.42	-0.37
Thoracolumbar spine	Extension / Flexion	52.18	4.08	51.98	4.19	-0.19
	Right/Left lateral flexion	21.60	4.11	20.98	3.66	-0.61
	Right/Left rotation	21.07	4.15	20.25	3.65	-0.81

T critical at alpha 0.05= 1.67*

Table 3.2: Mean, standard deviation (±SD) and enhancing (%) with time for the control sample cervical and thoracolumbar spine measurements.

Variables		Statistical analysis	Time						
			Post test	After 1 day	After 2 days	After 3 days	After 4 days	After 5 days	After 6 days
Cervical spine	Extension / Flexion	Mean	27.40	29.67	33.85	36.72	40.83	42.22	43.45
		± SD	6.55	6.46	6.70	6.76	7.27	7.63	7.51
		(%)	-	8.27	14.10	8.47	11.21	3.39	2.92
	Right/Left lateral flexion	Mean	20.77	23.60	24.65	27.62	28.98	31.47	33.27
		± SD	5.09	5.03	5.21	5.44	5.57	5.44	5.13
		(%)	-	13.64	4.45	12.04	4.95	8.57	5.72
	Right/Left rotation	Mean	43.75	46.57	51.73	56.68	59.77	65.50	38.18
		± SD	6.10	6.39	6.38	6.77	6.86	6.72	6.66
		(%)	-	6.44	11.10	9.57	5.44	9.59	4.10

Thoracolumbar spine	extension / flexion	Mean	52.18	54.03	56.70	58.92	59.00	61.80	62.48
		± SD	4.08	4.52	4.10	4.18	3.87	3.85	4.40
		(%)	-	3.55	4.94	3.91	0.14	4.75	1.11
	Right/Left lateral flexion	Mean	21.60	22.20	22.28	23.43	24.00	25.27	25.50
		± SD	4.11	4.30	4.43	4.37	4.55	4.55	4.65
		(%)	-	2.78	0.38	5.16	2.42	5.28	0.92
	Right/Left rotation	Mean	21.07	22.20	22.63	24.73	25.72	26.78	27.12
		± SD	4.15	4.42	4.64	5.14	5.53	5.41	4.99
		(%)	-	5.38	1.95	9.28	3.98	4.15	1.24

Table 3.3: Mean, standard deviation (±SD) and enhancing (%) with time and three chiropractic sessions for the experimental sample cervical and thoracolumbar spine measurements.

Variables		Statistical analysis	Time									
				Session 1			Session 2			Session 3		
			Pre test	immediately	After 1 day	After 2 days	Immediately	After 3 days	After 4 days	Immediately	After 5 days	After 6 days
Cervical spine	Extension / Flexion	Mean	25.90	64.55	52.07	78.23	104.07	97.25	110.78	123.08	123.53	126.15
		± SD	3.30	3.68	3.45	4.38	5.47	4.63	4.24	5.72	5.04	4.70
		(%)	-	149.23	-19.34	50.26	33.02	-6.55	13.92	11.10	0.37	2.12
	Right/Left lateral flexion	Mean	19.72	43.22	33.45	50.42	67.88	63.33	74.57	82.87	86.60	88.25
		± SD	3.51	4.95	3.02	3.80	4.63	4.67	4.12	4.67	3.71	2.28
		(%)	-	119.19	-22.60	50.72	34.64	-6.70	17.74	11.13	4.51	1.91
	Right/Left rotation	Mean	43.28	84.78	70.35	97.50	123.67	110.50	137.83	150.42	153.80	156.33
		± SD	3.42	5.96	6.95	9.37	8.71	6.57	9.01	5.91	5.54	4.91
		(%)	-	95.88	-17.02	38.59	26.84	-10.65	24.74	9.13	2.25	1.65
Thoracolu	Extension / Flexion	Mean	51.98	69.83	64.92	75.77	92.57	90.08	94.73	110.88	112.88	114.47
		± SD	4.19	4.97	4.51	3.42	5.32	4.25	4.96	5.73	5.55	5.09
		(%)	-	34.34	-7.04	16.71	22.17	-2.68	5.16	17.05	1.80	1.40

	Right/Left lateral flexion	**Mean**	20.98	31.88	29.83	34.32	44.38	42.28	47.37	52.53	55.88	57.97
		± SD	3.66	3.11	2.70	2.77	3.14	3.20	3.41	3.58	2.33	2.00
		(%)	-	51.95	-6.43	15.03	29.33	-4.73	12.02	10.91	6.38	3.73
	Right/Left Rotation	**Mean**	20.25	33.15	30.55	35.52	46.57	43.78	49.85	55.22	56.23	58.20
		± SD	3.65	3.91	4.40	4.81	5.36	5.74	4.96	3.75	3.28	1.92
		(%)	-	63.70	-7.84	16.26	31.11	-5.98	13.86	10.77	1.84	3.50

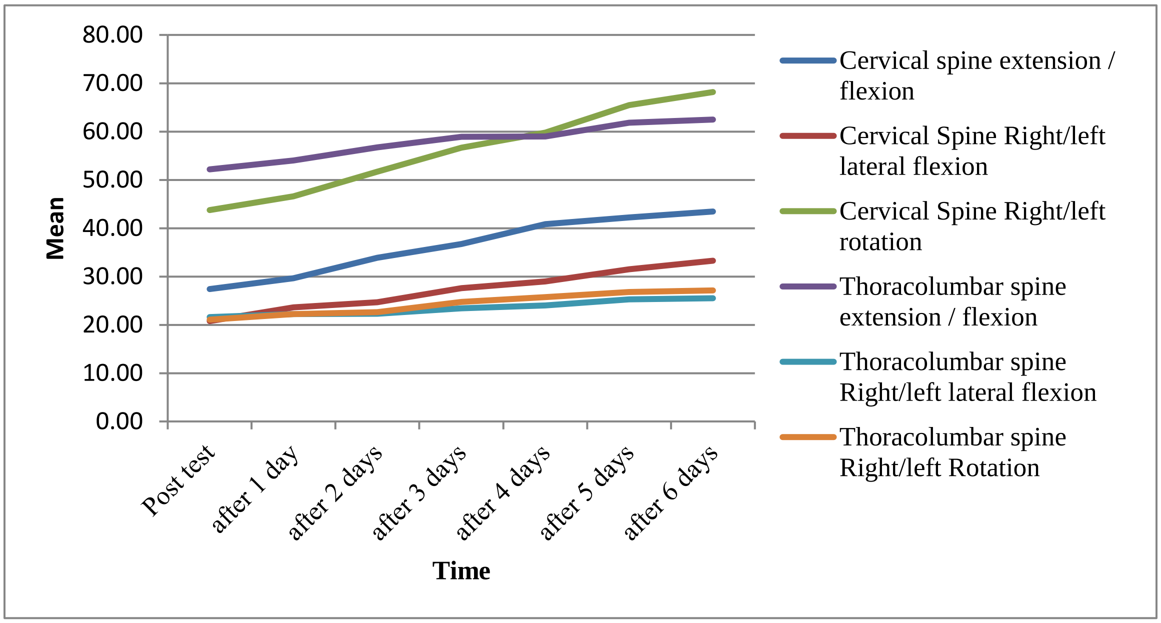

Figure 3.1. Mean of control sample cervical and thoracolumbar spine measurements with different time.

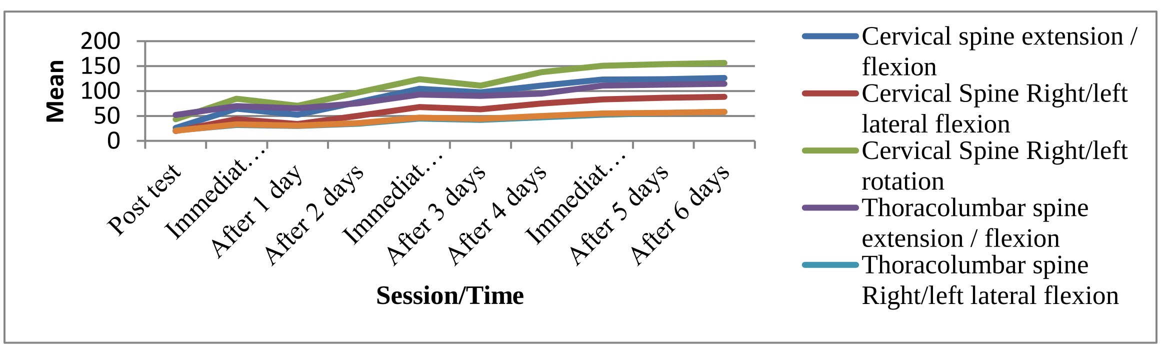

Figure3.2. Mean of experimental sample cervical and thoracolumbar spine measurements with different time and sessions.

Data analysis indicated significant variations (P<0.01) among the three chiropractic sessions **(Table 3.4 - 3.9)**.

The maximum improvement was detected with the third chiropractic session, compared with the first and the second session; the spinal manipulative therapy dose and spine-related pain comparing with previous studies remain limited. Study results are in line with Snodgrass *et al.* (2014); who reported that, a single treatment of manual therapy, may not be enough to demonstrate a significant change in spinal ROM. Because its data support a mechanism of action that might not be linked to immediate or early mechanical effects, but rather some other mechanism, for example, neurophysiological effects.

Wong *et al.* (2015) study results showed that, in participants with low back pain, a clinical improvement in disability following two treatment sessions is associated to an average decrease in spinal stiffness.

Table 3.4: ANOVA test for variation in cervical and thoracolumbar spine measurements among different days for control sample.

Variables		Source of variation	SS	df	MS	F
Cervical spine	Extension / Flexion	Between groups	7082.03	6.00	1180.34	24.11*
		Within groups	9937.97	203.00	48.96	
		Total	17020.00	209.00		
	Right/Left lateral flexion	Between groups	3576.38	6.00	596.06	21.41*
		Within groups	5652.56	203.00	27.85	
		Total	9228.94	209.00		
	Right/Left rotation	Between groups	15317.65	6.00	2552.94	59.35*
		Within groups	8731.96	203.00	43.01	
		Total	24049.61	209.00		
Thoracolumbar spine	Extension / Flexion	Between groups	2625.81	6.00	437.64	25.43*
		Within groups	3493.09	203.00	17.21	
		Total	6118.91	209.00		
	Right/Left lateral flexion	Between groups	424.47	6.00	70.75	3.61*
		Within groups	3975.08	203.00	19.58	
		Total	4399.55	209.00		
	Right/Left rotation	Between groups	1018.03	6.00	169.67	7.01*
		Within groups	4911.53	203.00	24.19	
		Total	5929.55	209.00		

F critical at alpha 0.05= 2.14
Sum of squares (SS), degree of freedom (df), mean sum of squares (MS) and F stat (F).

Table 3.5: ANOVA test for variation in cervical and thoracolumbar spine measurements among different time and sessions for experimental sample

Variables		Source of variation	SS	df	MS	F
Cervical spine	Extension / Flexion	Session	163607.82	2.00	81803.91	3792.28*
		Time	8989.02	2.00	4494.51	208.36*
		Interaction	4200.45	4.00	1050.11	48.68*

		Within groups	5630.08	261.00	21.57	
		Total	182427.37	269.00		
	Right/Left lateral flexion	Session	86519.43	2.00	43259.71	2611.21*
		Time	4580.78	2.00	2290.39	138.25*
		Interaction	2142.15	4.00	535.54	32.33*
		Within groups	4323.98	261.00	16.57	
		Total	97566.34	269.00		
	Right/Left rotation	Session	217729.48	2.00	108864.74	2123.00*
		Time	16377.29	2.00	8188.65	159.69*
		Interaction	6434.66	4.00	1608.67	31.37*
		Within groups	13383.76	261.00	51.28	
		Total	253925.19	269.00		
Thoracolumbar spine	**Extension / Flexion**	Session	81618.07	2.00	40809.03	1690.79*
		Time	1525.00	2.00	762.50	31.59*
		Interaction	764.31	4.00	191.08	7.92*
		Within groups	6299.50	261.00	24.14	
		Total	90206.89	269.00		
	Right/left lateral flexion	Session	24798.82	2.00	12399.41	1418.99*
		Time	846.95	2.00	423.47	48.46*
		Interaction	297.63	4.00	74.41	8.52*
		Within groups	2280.68	261.00	8.74	
		Total	28224.08	269.00		
	Right/left Rotation	Session	25025.97	2.00	12512.98	652.62*
		Time	875.34	2.00	437.67	22.83*
		Interaction	186.28	4.00	46.57	2.43*
		Within groups	5004.28	261.00	19.17	
		Total	31091.87	269.00		

F critical for sessions and time at alpha 0.05= 3.03
F critical for the interaction at alpha 0.05= 2.41
Sum of squares (SS), degree of freedom (df), mean sum of squares (MS) and F stat (F).

Table 3.6: Difference meaning level among mean cervical spine measurements with different days for control sample using L.S.D test

Variables		Control sample	Mean	Mean differences							L.S.D
				Pre test	after 1 day	after 2 days	after 3 days	after 4 days	after 5 days	after 6 days	
Cervical spine	**Extension /Flexion**	Pre test	27.40	-	-2.27	-6.45	-9.32*	-13.43*	-14.82*	-16.05*	6.9
		after 1 day	29.67		-	-4.18	-7.05*	-11.17*	-12.55*	-13.78*	
		after 2 days	33.85			-	-2.87	-6.98*	-8.37*	-9.60*	
		after 3 days	36.72				-	-4.12	-5.50	-6.73	
		after 4 days	40.83					-	-1.38	-2.62	
		after 5 days	42.22						-	-1.23	
		after 6 days	43.45							-	
	Right/Left lateral flexion	Pre test	20.77	-	-2.83	-3.88	-6.85*	-8.22*	-10.70*	-12.50*	5.20
		after 1 day	23.60		-	-1.05	-4.02	-5.38*	-7.87*	-9.67*	
		after 2 days	24.65			-	-2.97	-4.33	-6.82*	-8.62*	
		after 3 days	27.62				-	-1.37	-3.85	-5.65*	
		after 4 days	28.98					-	-2.48	-4.28	
		after 5 days	31.47						-	-1.80	
		after 6 days	33.27							-	
	Right/left rotation	Pre test	43.75	-	-2.82	-7.98*	-12.93*	-16.02*	-21.75*	-24.43*	6.47
		after 1 day	46.57		-	-5.17	-10.12*	-13.20*	-18.93*	-21.62*	
		after 2 days	51.73			-	-4.95	-8.03*	-13.77*	-16.45*	
		after 3 days	56.68				-	-3.08	-8.82*	-11.50*	
		after 4 days	59.77					-	-5.73	-8.42*	
		after 5 days	65.50						-	-2.68	
		after 6 days	68.18							-	

* Level of significance at 0.05

Table 3.7: Difference meaning level among mean thoracolumbar spine measurements with different days for control sample using L.S.D test

Variables		Control sample	Mean	Mean differences							L.S.D
				Pre test	after 1 day	after 2 days	after 3 days	after 4 days	after 5 days	after 6 days	
Thoracolumbar spine	Extension /Flexion	Pre test	52.18	-	-1.85	-4.52*	-6.73*	-6.82*	-9.62*	-10.30*	4.09
		after 1 day	54.03		-	-2.67	-4.88*	-4.97*	-7.77*	-8.45*	
		after 2 days	56.70			-	-2.22	-2.30	-5.10*	-5.78*	
		after 3 days	58.92				-	-0.08	-2.88	-3.57	
		after 4 days	59.00					-	-2.80	-3.48	
		after 5 days	61.80						-	-0.68	
		after 6 days	62.48							-	
	Right/Left lateral flexion	Pre test	21.60	-	-0.60	-0.68	-1.83	-2.40	-3.67	-3.90	4.36
		after 1 day	22.20		-	-0.08	-1.23	-1.80	-3.07	-3.30	
		after 2 days	22.28			-	-1.15	-1.72	-2.98	-3.22	
		after 3 days	23.43				-	-0.57	-1.83	-2.07	
		after 4 days	24.00					-	-1.27	-1.50	
		after 5 days	25.27						-	-0.23	
		after 6 days	25.50							-	
	Right/Left rotation	Pre test	21.07	-	-1.13	-1.57	-3.67	-4.65	-5.72*	-6.05*	4.85
		after 1 day	22.20		-	-0.43	-2.53	-3.52	-4.58	-4.92*	
		after 2 days	22.63			-	-2.10	-3.08	-4.15	-4.48	
		after 3 days	24.73				-	-0.98	-2.05	-2.38	
		after 4 days	25.72					-	-1.07	-1.40	
		after 5 days	26.78						-	-0.33	
		after 6 days	27.12							-	

Table 3.8: Difference meaning level among mean cervical spine measurements for different time and sessions for experimental sample using L.S.D test

Variables			Experimental sample	Mean		Mean differences			L.S.D
Cervical spine	Extension / Flexion	Session	Session 1	64.95		-	-39.08*	-59.31*	1.36
			Session 2	104.03			-	-20.22*	
			Session 3	124.26				-	
		Time	Immediately	97.23		-	6.28*	-7.82*	1.36
			After 1 day	90.95			-	-14.11*	
			After 2 days	105.06				-	
		Interaction		64.95	97.23	-32.28*	-26.00*	-40.11*	2.36
				104.03	90.95	6.80*	13.08*	-1.02	
				124.26	105.06	27.02*	33.31*	19.20*	
	Right/Left lateral flexion	Session	Session 1	42.36		-	-26.23*	-43.54*	1.19
			Session 2	68.59			-	-17.31*	
			Session 3	85.91				-	
		Time	Immediately	64.66		-	3.53*	-6.42*	1.19
			After 1 day	61.13			-	-9.95*	
			After 2 days	71.08				-	
		Interaction		42.36	64.66	-22.29*	-18.77*	-28.72*	2.07
				68.59	61.13	3.94*	7.47*	-2.48*	
				85.91	71.08	21.25*	24.78*	14.83*	
	Right/Left rotation	Session	Session 1	84.21		-	-39.79*	-69.31*	2.10
			Session 2	124.00			-	-29.52*	
			Session 3	153.52				-	
		Time	Immediately	119.62		-	8.07*	-10.93*	2.10
			After 1 day	111.55			-	-19.01*	
			After 2 days	130.56				-	
		Interaction		84.21	119.62	-35.41*	-27.34*	-46.34*	3.64
				124.00	111.55	4.38*	12.45*	-6.56*	
				153.52	130.56	33.89*	41.97*	22.96*	

Table 3.9: Difference meaning level among mean thoracolumbar spine measurements for different time and sessions for experimental sample using L.S.D test

Variables			Experimental sample	Mean		Mean differences			L.S.D
Thoracolumbar spine	Extension /Flexion	Session	Session 1	70.17		-	-22.29*	-42.57*	1.44
			Session 2	92.46			-	-20.28*	
			Session 3	112.74				-	
		Time	Immediately	91.09		-	1.80*	-3.89*	1.44
			After 1 day	89.29			-	-5.69*	
			After 2 days	94.99				-	
		Interaction		70.17	91.09	-20.92*	-19.12*	-24.82*	2.50
				92.46	89.29	1.37	3.17*	-2.53*	
				112.74	94.99	21.65*	23.45*	17.76*	
	Right/Left lateral flexion	Session	Session 1	32.01		-	-12.67*	-23.45*	0.87
			Session 2	44.68			-	-10.78*	
			Session 3	55.46				-	
		Time	Immediately	42.93		-	0.27	-3.62*	0.87
			After 1 day	42.67			-	-3.88*	

			After 2 days	46.55				-	
		Interaction		32.01	42.93	-10.92*	-10.66*	-14.54*	1.50
				44.68	42.67	1.749	2.01*	-1.87*	
				55.46	46.55	12.53*	12.79*	8.91*	
	Right/Left rotation	**Session**	Session 1	33.07		-	-13.66*	-23.48*	1.29
			Session 2	46.73			-	-9.82*	
			Session 3	56.55				-	
		Time	Immediately	44.98		-	1.46*	-2.88*	1.29
			After 1 day	43.52			-	-4.33*	
			After 2 days	47.86				-	
		Interaction		33.07	44.98	-11.91*	-10.45*	-14.78*	2.23
				46.73	43.52	1.76	3.21*	-1.12	
				56.55	47.86	11.57*	13.03*	8.69*	

Conclusion

Maximum improvement in cervical and thoracolumbar spine measurements was detected after the third chiropractic sessions compared with the first and the second session, also compared with the control sample. Therefore three chiropractic sessions have a beneficial successive effect in reducing cervical and lumbar spine pain for those who wanting to apply for sport and military faculties.

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