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Effectiveness of Using Pilates Exercises and Some Types of Traction to Prevent Early Erosion of Cervical Cartilages.

Dr. Abd El-Halim Mostafa Okasha
Assisstant Professor, Sports Health Dept – Faculty of Physical Education – Kafr Al-Shaikh University. Egypt.

Abstract

The current research aims at designing a recommended program with Pilates exercises and some traction types and identifying the effects of the recommended program on preventing symptoms of early erosion of cervical cartilages through increasing the muscular strength of cervical muscles and hand grip and the rang of motion of cervical joints and decreasing cervical spin pain. The researcher used the quasi-experimental approach (one group design) with pre-, intermediate and post-measurements. Sample included (12) male patients (30-50 years) with cervical spondylosis after physical examination that confirmed their injuries. Sample was recruited from patients of Sports Medicine Center – Kafr Al-Shaikh Directorate of Youth and Rehabilitation Center – Faculty of Physical Education - Kafr Al-Shaikh University. The researcher concludes that using Pilates exercises in rehabilitation with electric traction (continuous and intermittent) had positive effects on the agonist muscles of the neck. These effects are better than any other regular thermal methods. The recommended program decreases intensity of pain resulting from weak agonist muscles of the neck as it decreases the pressure over cartilages of this area. Balanced improvement of muscular power, joint flexibility and muscle stretching has positive effects on increasing functional effectiveness of cervical vertebrae.

Introduction:

Spin pain is a common problem in most societies as 80% of adults get treatment for it at least once during their life time and 4% suffer from spin pain due to various reasons like wrong use of the spin, incorrect posture, improper sitting and motor behavior, weight increase and obesity, in addition to trauma and accidents and muscular weakness and limpness as all these reasons may cause health problems for the spin.

Early or acute erosion of cervical cartilages (neck stiffness), sledded disc, and inflammation of vertebrae cartilages or its surrounding soft tissues, and strain and torn muscles or ligaments are the most important reasons for pain in this area.

Cartilage tissue is responsible for joint inflammation as the function of a joint cartilage is to prevent friction between the two bones of the joint, to absorb shocks during movement and to gain easy movement. Any disorder to this tissue leads to complains of movement stiffness. These injuries are common in all body parts, including the cervical area as it is called cervical spondylosis.

Atrophy and dissolution of cartilages turn them into fibrous tissues that lose its leanness and basic function as cushions among vertebrae. This also decreases spaces among vertebrae and increases pressure and friction, which in turn leads to the appearance of micro protrusions at its ends. The same thing can happen at the small lateral joints of the

spin (8) (10)

Accordingly, the functional efficiency, size and rang of motion of cartilages decrease significantly. Cervical area is the most movable area of the spin as it carries nearly 15% of body weight. But it is less protected than other parts of the spin and its rang of motion is greater. As it is not fixed to rip cage, as thoracic vertebrae, it is more vulnerable to pain (6)

The ratio of cartilage discs to bone tissue forming cervical vertebrae is 1 : 4 (1). In addition, the spin is more vulnerable to strain, especially in its most movable parts (cervical and lumbar areas) (5).

Rehabilitation means restoration and maintenance of normal functions of the injured part. It basically depends on identifying the causes of injury, correct evaluation of it and ways of treating it. Injured persons undergo rehabilitation to perform necessary functions of every day tasks without disturbance (15).

Exercises play a major role in rehabilitation as it is useful in general. But there should be enough information about the health condition of the individual to determine exercises intensity and repetitions (12).

Pilates exercises are rehabilitation exercises performed on a regular basis as a type of aerobic exercises with regulation of breathing. It depends on various muscle groups to restore balance to normal posture of the body. These exercises relieve the body of stress, strain and pain in addition to improving flexibility, strength, muscle tune and body balance. It also improves breathing and blood circulation. It can be performed daily without any additional load over muscles and joints (18).

Rehabilitation exercises are positions and movements that aim at restoring normal condition of the injured part before injury (3). Traction is an effective means for pain relief in the cervical area as it has positive effects on the relative positions of the vertebrae and cartilages. Traction decreases pressure on cartilages that may move and pressure over the neural roots. Traction also decreases cervical muscles spasms and separates vertebrae that pressure over cartilages. Traction can be manual or mechanical, continuous or intermittent (7).

According to the researcher's expertise in this field, he noticed that most are treated with thermal (electric) treatment. This led the researcher to perform this study with the aim of improving the functional ability of the cervical area through improving muscular strength and rang of motion and decreasing pain.

Aims:

The current research aims at:

1. Designing a recommended program with Pilates exercises and some traction types
2. Identifying the effects of the recommended program on preventing symptoms of early erosion of cervical cartilages through:

- Increasing the muscular strength of cervical muscles and hand grip
- Improving the rang of motion of cervical joints
- Decreasing cervical spin pain

Hypotheses:

1. Exercises and traction types have positive effects on improving the functional ability of cervical muscles and grip strength

2. Exercises and traction types have positive effects on improving the rang of motion of the cervical area
3. Exercises and traction types have positive effects on decreasing cervical spin pain

Methods:

Approach:

The researcher used the quasi-experimental approach (one group design) with pre-, intermediate and post-measurements.

Subjects:

Sample included (12) male patients (30-50 years) with cervical spondylosis after physical examination that confirmed their injuries. Sample was recruited from patients of Sports Medicine Center – Kafr Al-Shaikh Directorate of Youth and Rehabilitation Center – Faculty of Physical Education - Kafr Al-Shaikh University.

Instruments:

- Medical examination for sample member at osteology dept – General Hospital of Kafr Al-Shaikh
- A digital dynamometer for measuring muscular strength during forward, backward bending and bending towards both sides
- A digital goniometer for measuring the rang of motion during forward, backward bending and bending towards both sides
- Visual Analogue Scale (VAS) for measuring pain
- A grip dynamometer for measuring grip strength
- Electronic traction device for vertebrae traction
- Data collection form

Experiment:

Pre-measurements were taken before applying the recommended program. The recommended program was applied for (8) weeks. After one month of application, intermediate measurements were taken. Post-measurements were taken at the end of the program. The researcher considered the following standard protocol for all measurements and all sample members.

Components of the recommended program:

The program included a group of static (Pilates) and dynamic exercises for improving muscular strength. Dynamic traction was used for improving passive and active stretching to increase the rang of motion and relief pain. The program was divided into two phases (4 weeks each) with three units per week. Exercises for each phase were chosen according to its nature and the degree of pain and functional ability. Each unit was divided into a preliminary part (warm-up), a min part (exercises and traction) and conclusion (cool-down).

Statistical treatment:

The research calculated mean, standard deviation, skewness, F value, LSD and improvement percentage.

Results:

Table (1)
Descriptive data of sample members (n=12)

Variables	Mean	Median	SD	Kurtosis	skewness
Growth factors					
Age (year)	41.66	41.50	4.71	4.71	-1.52
Height (cm)	172.08	172.00	2.71	2.71	-0.68
Weight (kg)	88.5	87.00	6.36	6.36	-0.65
Cervical muscles strength					
Bending forwards (deg)	12.67	13.00	1.72	1.72	-0.91
Bending backwards (deg)	12.50	12.00	1.83	1.83	-1.5
Bending to the right (deg)	14.67	14.50	1.44	1.44	-0.83
Bending to the left (deg)	14.42	14.00	1.08	1.08	1.36
Rang of motion					
Bending forwards (deg)	47.17	48.00	3.76	3.76	-0.08
Bending backwards(deg)	46.75	46.50	4.33	4.33	-1.44
Bending to the right (deg)	21.67	21.00	3.8	3.8	1.26
Bending to the left	21.92	21.00	4.56	4.56	1.82
Grip strength (kg)	32.67	32.00	2.93	2.93	-0.73
Degree of pain (deg)	7.75	8.00	0.62	0.62	-0.09

Table (1) indicates that skewness values for physiological variables were between (3±). This indicates normality of data.

Table (2)
Variance Analysis among the three measurements (pre-, intermediate and post-) for basic variables

Variables	Source of variance	Degree of freedom	Sum of squares	Means squares	F
Cervical muscles strength					
Bending forwards (deg)	Pre-	2	48.222	24.111	10.515
	Intermediate	33	75.667	2.293	
	Post-	35	123.889		
Bending backwards (deg)	Pre-	2	32.889	16.444	5.040
	Intermediate	33	107.667	3.263	
	Post-	35	140.556		
Bending to the right (deg)	Pre-	2	38.389	19.194	
	Intermediate	33	43.250	1.311	
	Post-	35	81.639		
Bending to the left (deg)	Pre-	2	51.056	25.528	
	Intermediate	33	44.500	1.348	
	Post-	35	95.556		
Rang of motion					
Bending forwards (deg)	Pre-	2	170.667	3.76	5.192
	Intermediate	33	542.333	85.333	
	Post-	35	713.000	16.434	
Bending backwards(deg)	Pre-	2	253.722		7.070
	Intermediate	33	592.167	126.861	

Variables	Source of variance	Degree of freedom	Sum of squares	Means squares	F
	Post-	35	845.889	17.944	
Bending to the right (deg)	Pre-	2	214.056		
	Intermediate	33	492.500	107.028	
	Post-	35	706.556	14.924	
Bending to the left	Pre-	2	274.500		
	Intermediate	33	678.500	137.250	7.171
	Post-	35	953.000	20.561	
Grip strength (kg)	Pre-	2	324.667		
	Intermediate	33	252.333	162.333	
	Post-	35	577.000	7.646	
Degree of pain (deg)	Pre-	2	117.722		
	Intermediate	33	29.167	58.861	6.675
	Post-	35	146.889	0.884	

F table values on freedom degrees of 2 & 32 and P≤0.05 = 3.29

Table (2) indicates statistically significant differences among the three measurements. This led the researcher to perform LSD test to identify variance significance.

Table (3)
LSD test for variance significance among the three measurements on basic variables

Variables	Measurements	Means	Means differences			LSD
			Pre-	Intermediate	Post-	
Cervical muscles strength						
Bending forwards (deg)	Pre-	12.67		1.33*↑	2.33*↑	10.515
	Intermediate	14.00			1.00	
	Post-	15.00				
Bending backwards (deg)	Pre-	12.50		1.00	2.33*↑	5.040
	Intermediate	13.50			1.33	
	Post-	14.83				
Bending to the right (deg)	Pre-	14.67		0.91	2.50*↑	14.645
	Intermediate	15.58			1.59*↑	
	Post-	17.17				
Bending to the left (deg)	Pre-	14.42		1.50*↑	2.91*↑	18.931
	Intermediate	15.92			1.41*↑	
	Post-	17.33				
Rang of motion						
Bending forwards (deg)	Pre-	47.17		2.66	5.33*↑	3.36
	Intermediate	49.83			2.67	
	Post-	52.50				
Bending backwards(deg)	Pre-	46.75		3.42	6.50*↑	3.51
	Intermediate	50.17			3.08	

Variables	Measurements	Means	Means differences			LSD
			Pre-	Intermediate	Post-	
	Post-	53.25				
Bending to the right (deg)	Pre-	21.67		2.25	5.91*↑	
	Intermediate	23.92			3.66*↑	3.20
	Post-	27.58				
Bending to the left	Pre-	21.92		3.00	6.74*↑	
	Intermediate	24.92			3.74	3.76
	Post-	28.66				
Grip strength (kg)	Pre-	32.67		3.16*↑	7.33*↑	
	Intermediate	35.83			4.17*↑	2.29
	Post-	40.00				
Degree of pain (deg)	Pre-	7.75		2.50*↑	4.42*↑	
	Intermediate	5.25			1.92*↑	0.78
	Post-	3.33				

Table (3) indicates LSD values of the three measurements for basic research variables.

Table (4)
Percentage of Improvement among the three measurements on basic research variables

Variables	Measurements	Means	Means differences		
			Pre-	Intermediate	Post-
Cervical muscles strength					
Bending forwards (deg)	Pre-	12.67		10.50	18.39
	Intermediate	14.00			7.14
	Post-	15.00			
Bending backwards (deg)	Pre-	12.50		8.00	18.64
	Intermediate	13.50			9.85
	Post-	14.83			
Bending to the right (deg)	Pre-	14.67		6.20	17.04
	Intermediate	15.58			10.21
	Post-	17.17			
Bending to the left (deg)	Pre-	14.42		10.40	20.18
	Intermediate	15.92			8.86
	Post-	17.33			
Rang of motion					
Bending forwards (deg)	Pre-	47.17		5.64	11.30
	Intermediate	49.83			5.36
	Post-	52.50			
Bending backwards(deg)	Pre-	46.75		7.32	13.90
	Intermediate	50.17			6.14

Variables	Measurements	Means	Means differences		
			Pre-	Intermediate	Post-
	Post-	53.25			
Bending to the right (deg)	Pre-	21.67		10.38	27.27
	Intermediate	23.92			15.30
	Post-	27.58			
Bending to the left	Pre-	21.92		13.69	30.75
	Intermediate	24.92			15.01
	Post-	28.66			
Grip strength (kg)	Pre-	32.67		9.67	22.44
	Intermediate	35.83			11.64
	Post-	40.00			
Degree of pain (deg)	Pre-	7.75		32.26	57.03
	Intermediate	5.25			36.57
	Post-	3.33			

Table (4) indicates percentages of improvement among the three measurements on basic research variables.

Table (2) indicates statistically significant differences among the pre-, intermediate and post-measurements for cervical muscles strength during bending forward, backward, to the right and to the left as (F) calculated values were 10.5, 5.04, 14.6 and 18.9. These values are higher than (F) table values on degrees of freedom of 2 & 33 and $P \leq 0.05$. This indicates statistically significant differences among the measurements. Tables (3&4) indicate the least significance of differences as LSD value was higher than differences among measurements in favor of the intermediate and post-measurements on bending forward and bending backward for cervical muscles strength. Improvement percentages between pre- and intermediate measurements, pre- and post-measurements and between intermediate and post-measurements were 10.5%, 18.39% and 7.14% respectively. This is due to the effectiveness of Pilates exercises and some traction types for preventing symptoms of early erosion of cervical cartilages and relieving pressure over the eroded cartilage through improving the agonist muscles of the cervical area. This helped achieving thorough and balanced development of these muscles through the phases and duration of the program. These exercises vary between static and dynamic muscular work, in addition to gradual increase of the workload using various resistances during the program. This led to improving measurements of the muscular strength in the post-measurement, compared with pre0measurement. This is consistent with previous studies indicating that rehabilitation exercises and various types of traction have positive effects on cervical muscles as concentrating on improving static strength for the muscle group surrounding the injured joint with variations of muscular work positively affects the restoration of efficiency of the cervical area (10) (11) (2) (17)

Table (2) indicates statistically significant differences among the pre-, intermediate and

post-measurements for rang of motion during bending forward, backward, to the right and to the left as (F) calculated values were 5.19, 7.07, 7.17 and 6.67. These values are higher than (F) table values on degrees of freedom of 2 & 33 and P≤0.05. This indicates statistically significant differences among the measurements. Tables (3&4) indicate the least significance of differences as LSD value was higher than differences among measurements in favor of the intermediate and post-measurements on bending forward and bending backward for rang of motion. Improvement percentages between pre- and intermediate measurements, pre- and post-measurements and between intermediate and post-measurements were 5.64%, 5.36% and 11.30% respectively. This is due to the effectiveness of Pilates exercises and some traction types (continuous and intermittent) in addition to flexibility and stretching exercises for the muscle group of this area. This is consistent with previous studies indicating that integrated treatment improves the rang of motion and flexibility of cervical vertebrae (16) (3) (7).

Table (2) indicates statistically significant differences among the pre-, intermediate and post-measurements for hand grip strength as (F) calculated values were 21.23 and 66.59. These values are higher than (F) table values on degrees of freedom of 2 & 33 and P≤0.05. This indicates statistically significant differences among the measurements. Table (4) indicates the least significance of differences as LSD value was higher than differences among measurements in favor of the intermediate and post-measurements on hand grip strength. Improvement percentages between pre- and intermediate measurements, pre- and post-measurements and between intermediate and post-measurements were 9.67%, 11.64% and 22.44% respectively. This is due to the effectiveness of Pilates exercises and some traction types as these techniques use static/dynamic exercises and resistance exercises. This is consistent with results of several previous studies (11) (14) (9)

Table (4) indicates that improvement percentages between pre- and intermediate measurements, pre- and post-measurements and between intermediate and post-measurements on degree of pain were 32.26%, 36.57% and 57.03% respectively in favor of the post-test. This increase in the rang of motion for cervical vertebrae helps decreasing muscle tension and pain as neck traction separates the cervical vertebrae and moves joint surfaces. This increases the distances among vertebrae and relieves tension and pain through decreasing pressure over muscles. This facilitates the movement of cervical area (4)

Conclusions:

The researcher concludes that:

1. Using Pilates exercises in rehabilitation with electric traction (continuous and intermittent) had positive effects on the agonist muscles of the neck. These effects are better than any other regular thermal methods.
2. The recommended program decreases intensity of pain resulting from weak agonist muscles of the neck as it decreases the pressure over cartilages of this area.
3. Balanced improvement of muscular power, joint flexibility and muscle stretching has positive effects on increasing functional effectiveness of cervical vertebrae.

Recommendations:

1. Using the recommended program in rehabilitation for individuals with cervical spondylosis.
2. Continuing rehabilitation methods and traction event after pain, resulting from muscle weakness, is stopped, with aim of preventing pain in the future.
3. Concentrating on health awareness for all members of the society so they take all precautions in their daily activities. These activities include sitting posture, standing posture, usage posture and sleep posture.
4. Performing more studies on rehabilitation and injury prevention for various parts of the spin.

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