Efficacy of Stretching Exercises Versus Postisometric Relaxation Technique on Pain, Functional Disability and Range of Motion in Patients with Cervical Spondylosis. A Randomized controlled trial

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ABSTRACT

Objectives: *To compare between the effectiveness of the post isometric relaxation technique and the stretching exercises on pain intensity, functional disability and range of motion in patients with cervical spondylosis.* ***Patients and methods:*** *Thirty male and female patients diagnosed with chronic cervical spondylosis were participated in the study. They were randomly assigned into two groups. Group (A) received infrared, isometric exercises, and post isometric relaxation technique. Group (B) received infrared, isometric exercises and passive stretching exercises for the upper trapezius and sternocleidomastoid muscles for 4 weeks, three times per week. Assessment was conducted at the beginning of the first session and after the last session. Pain intensity was assessed using visual analogue scale, Neck disability index was used to assess functional neck disability and OB goniometer was used to assess neck range of motion.* ***Results:*** *There was no significant difference between the post isometric relaxation and the stretching exercises in decreasing pain intensity, functional disability and improving neck range of motion. Stretching exercises were more effective in increasing range of motion of cervical flexion and right side bending with P<0.05.* ***Conclusion:*** *Both post isometric relaxation technique and stretching exercises are effective in decreasing pain intensity, functional disability and improving neck range of motion in patients with chronic cervical spondylosis.*

Key words: *Cervical spondylosis, stretching exercises, post isometric relaxation technique.*

INTRODUCTION

Cervical spondylosis (CS) is a degenerative disorder of the cervical spine characterized by disc degeneration with disc space narrowing, bone overgrowth producing spurs and ridges and hypertrophy of the facet joints and ligaments[27]. Neck muscles show a strong tendency to develop spasm and alter proprioceptive input[15]. Therefore, common cause of neck pain is muscle tightness. Clinically, positive signs include tenderness in the posterior neck region, asymmetry, increased tension and restriction of movements[13].

Stretching exercises are used by physical therapists as a conventional physical therapy treatment to treat chronic neck pain. It consists of stretching a muscle up to a tolerable point and sustaining the position for a certain period of time usually lasts for 30 seconds[4]. Stretching exercises had been found to be effective in treating neck pain and muscular tightness in several studies[7,16,34,35].

Muscle energy techniques (MET) has been shown to improve muscle extensibility more effectively than passive, static stretching both in the short and long term[10,23]. Moreover, studies offer support for the hypoalgesic effects of muscle energy technique for example, in relation to spinal pain[3,4,33]. In addition, myofascial trigger point deactivation has been shown to be enhanced by use of MET[5].

Post isometric relaxation technique is a type of muscle energy techniques which utilizes the contract-relax technique with an added gentle stretch. Contraction activates GTO which in turn inhibits target muscle[9]. Through the post isometric relaxation technique (PIR), an over active muscle is positioned at the pathological barrier and then resisting it to achieve a very gentle isometric contraction. It was found that this technique produces excellent relaxation and an improved resting length of the hyperactive muscle[21]. It is seen as an effective, non –traumatic therapeutic approach by practitioners of many disciplines and is a credit to the osteopaths pioneered its development[12]. A growing number of studies showed an increase in the

extensibility of muscles following the post isometric relaxation technique[4,12,28].

Regarding the efficacy of PIR on pain modulation, authors[3,4,33] have reported that there is a reduction in spinal pain, following application of MET. Degenhardt et al.,[8] reported that the concentrations of several circulatory pain biomarkers (including endocannabinoids and endorphins) were altered following osteopathic manipulative treatment incorporating muscle energy, and other soft tissue techniques. The degree and duration of these changes were greater in subjects with chronic LBP than in control subjects.

The studies that compared the efficacy of post isometric relaxation technique to the usual passive stretching exercises are lacking. Thus, this study aims to find out if there is an advantage of the use of the post isometric relaxation technique to the passive stretching exercises on pain, disability and range of motion in patients with cervical spondylosis.

PATIENTS AND METHODS

Design of Study

Pre-test post-test design.

Subjects

Thirty patients with cervical spondylosis participated in this study. All patients were referred by an orthopedic surgeon who was responsible for the diagnosis based on clinical and radiological examinations. Patients who have CS for at least three months with moderate disability of (20-40%) determined through the Neck Disability Index scale were enrolled in the study. They had signed a consent form before enrollment. Patients were distributed into two groups. Group (A) consisted of 15 patients who received postisometric relaxation technique (PIR), infrared and isometric exercises for the same muscles, and group (B) who received passive stretching exercises plus the infrared and the isometric exercises. Patients in each group received treatment for 12 sessions (3sessions/week) over four week's period.

Patients were excluded if they have any of the following: Pregnant women, history of previous cervical surgery, vertebral compression fracture, neurological deficit, current upper extremity symptoms and symptoms of vertigo or dizziness.

Assessment procedures

Patients were assessed just before and after the treatment sessions.

Pain was assessed by visual analog scale (VAS). It gives a valid data for chronic pain[30]. Functional disability was assessed by neck disability index. Reliability and validity of the neck disability index have been well established[31,36]. Myrin OB Goniometer was used to measure flexion, extension, lateral neck flexion and neck rotation. (OB Rehab Co S-171 83 Solna, Swedan). It was found that it is valid, and has a moderate to good reliability for measuring cervical spine range of motion[2].

Treatment procedures

All the patients received an infrared radiation for 15 minutes/session at distance of 60 cm from cervical region, while patients in prone lying position for 9 sessions 3/week every other day[30].

Isometric exercises

Isometric exercises were conducted for neck flexors, extensors, side bending and rotators for 10 seconds contraction followed by 5 seconds relaxation, repeated 3times for each direction.

Group (A) received post isometric relaxation technique for the upper fibers of the trapezius muscle and the sternocleidomastoid muscle according to Chaitow[6].

PIR for upper trapezius

With the patient's supine, the therapist placed one hand on the point of the shoulder on the involved side. The other arm cradled the patients head and the head is flexed, laterally flexed away, and rotated toward the side of the involvement.

The ipsilateral hand was used to push the shoulder inferiorly to lengthen the muscle until the restrictive barrier is met, then we ask the patients to raise his shoulder against the hand isometrically for 15 seconds then gently

lengthened the muscle until meeting a new barrier[6].

PIR for sternocliedomastoid

The patients was supine with his or her head off the end of the table. The patients was instructed to place his middle finger opposite the side of involvement under the occipital ridge the head then moved into lateral flexion away from the side of involvement, rotation of the side of involvement, extension of the lower cervical spine and flexion of upper cervical spine to meet the restrictive barrier the thumb of the hand on the involved side is then placed onto the forehead. The patient instructed to push upward against the thump isometricaly for 15 seconds. We waited to fell the release of the barrier then gently guided the muscle to lengthen toward the floor[6].

Group (B) received passive stretching exercises for the upper fibers of trapezius muscle and sternocleidomastoid muscle according to Kinser and Colby[18].

RESULTS

Graph pad prism software was used for the purpose of data analysis.

General Characteristics of the Subjects:

In this study, 30 patients with CS were assigned randomly into two groups.

The mean age of group (A) was 42.33(±5.38) years while the mean age of group (B) was 42.33(±5.38). There was no significant difference between both groups in their ages with t= 0.76 and P= 0.44 as shown in table (1).

Table (1): General characteristics of patients in both groups.

General characteristics	Group A	Group B	Comparison		S
	Mean (±SD)	Mean (±SD)	t-value	P-value	
Age (yrs)	43.66(±4.02)	42.33(±5.38)	0.76	0.44	NS

*SD: standard deviation P: probability S: significance NS: non-significant.

Within group differences of stretching group:

Paired t-test was used to find out within groups differences.

Group (A) who received the Post-isometric relaxation technique.

The results showed that the pre treatment mean of pain intensity was 7.40(±0.91) while the post treatment mean of pain intensity was 3.87(±1.06). There was a significant difference between the pre treatment and the post treatment mean values with t=12.16 and P<0.0001. For cervical flexion ROM, the pre treatment mean was 41.73(±10.63) while the post treatment mean was 44.53(±8.67). There was no significant difference between the pre treatment and the post treatment mean values with t=1.84 and P=0.0871. For cervical extension ROM, the pre treatment mean was 52.80(±9.99) while the post treatment mean was 59.87(±9.08). There was a significant difference between the pretreatment and the post treatment mean values with t=2.63 and P=0.0199. For cervical right side bending ROM, the pre treatment mean was 32.80(±6.40) while the post treatment mean was 36.53(±6.16). There was a significant difference between the pre treatment and the post treatment mean values with t=2.339 and P=0.0347. For cervical left side bending ROM, the pretreatment mean was 35.87(±7.94) while the post treatment mean was 42.93(±6.23). There was a significant difference between the pre treatment and the post treatment mean values with t=3.95 and P=0.0014. For cervical right rotation ROM, the pretreatment mean was 56.27(±7.17) while the post treatment mean was 60.53(±6.57). There was no significant difference between the pre treatment and the post treatment mean values with t=2.12 and P=0.0529. For cervical left rotation ROM, the pre treatment mean was 53.07(±7.36) while the post treatment mean was 60.00(±6.27). There was a significant difference between the pre treatment and the post treatment mean values with t=3.83 and P=0.0018. And finally the Neck Disability Index, the pre treatment mean was 28.07(±7.66) while the post treatment mean was 17.97(±7.17). There was a significant difference between the pre treatment and the post treatment mean values with t=7.22 and P<0.0001 as shown in table (2).

Table (2): Group A: Within group differences.

Variable	Pre treatment Mean ±SD	Post treatment Mean±SD	Mean difference	t-value	P value	Sig.
Pain intensity	7.40(±0.91)	3.87±(1.06)	3.53	12.16	P<0.0001	Sig.
Flexion ROM	41.73±10.63	44.53(±8.66)	2.80	1.84	P=0.0871	NS
Extension ROM	52.80(± 9.99)	59.87(±9.08)	7.07	2.63	P=0.0199	Sig.
Rt SB ROM	32.80(± 6.40)	36.53(±6.16)	3.73	2.34	P=0.0347	Sig.
Lt SB ROM	35.87(± 7.94)	42.93(±6.22)	7.07	3.95	P=0.0014	Sig.
Rt Rot ROM	56.27(± 7.16)	60.53(±6.56)	4.267	2.12	P=0.0529	NS
Lt Rot ROM	53.07(± 7.36)	60.00(±6.27)	6.93	3.83	P=0.0018	Sig.
Functional disability	28.07(±7.66)	17.97(± 7.17)	10.10	7.22	P<0.0001	Sig.

ROM: Range of motion Rt: right SB: Side bending Lt: left Rot: Rotation
Sig.: significant SD: Standard deviation.

Group (B) who received the stretching exercises.

The results showed that the pre treatment mean of pain intensity was 6.80(±1.66) while the post treatment mean of pain intensity was 4.33(±1.88). There was a significant difference between the pre treatment and the post treatment mean values with t=5.98 and P<0.0001. For cervical flexion ROM, the pre treatment mean was 48.00(±16.92) while the post treatment mean was 55.07(±13.47). There was a significant difference between the pre treatment and the post treatment mean values with t=4.17 and P<0.0009. For cervical extension ROM, the pre treatment mean was 41.87(±7.34) while the post treatment mean was 53.20(±9.26). There was a significant difference between the pre treatment and the post treatment mean values with t=5.11 and P<0.0002. For cervical right side bending ROM, the pretreatment mean was 39.67(±11.54) while the post treatment mean was 50.13(±9.40). There was a significant difference between the pre treatment and the post treatment mean values with t=6.05 and P<0.0001. For cervical left side bending ROM, the pre treatment mean was 39.53(±6.86) while the post treatment mean was 46.80(±5.25). There was a significant difference between the pre treatment and the post treatment mean values with t=6.93 and P<0.0001. For cervical right rotation ROM, the pre treatment mean was 71.87(±10.56) while the post treatment mean was 75.13(±8.55). There was a significant difference between the pre treatment and the post treatment mean values with t=3.52 and P<0.003. For cervical left rotation ROM, the pre treatment mean was 70.33(±8.05) while the post treatment mean was 74.60(±7.46). There was a significant difference between the pre treatment and the post treatment mean values with t=5.62 and P<0.0001. Finally the Neck Disability Index, the pre treatment mean was 28.20(±7.89) while the post treatment mean was 19.33(±6.62). There was a significant difference between the pre treatment and the post treatment mean values with t=6.02 and P<0.0001 as shown in table (3).

Table (3): Group B: Within group differences.

Variable	Pre treatment Mean(±SD)	Post treatment Mean(±SD)	Mean difference	t-value	P value	Sig.
Pain intensity	6.80(±1.66)	4.33(±1.88)	2.47	5.98	P<0.0001	Sig.
Flexion ROM	48.00(±16.92)	55.07(±13.47)	7.07	4.17	P<0.0009	Sig.
Extension ROM	41.87(±7.34)	53.20(±9.26)	11.33	5.11	P<0.0002	Sig.
Rt SB ROM	39.67(±11.54)	50.13(±9.40)	10.46	6.05	P<0.0001	Sig.
Lt SB ROM	39.53(±6.86)	46.80(±5.25)	7.27	6.93	P<0.0001	Sig.
Rt Rot ROM	71.87(±10.56)	75.13(±8.55)	3.26	3.52	P<0.003	Sig.
Lt Rot ROM	70.33(±8.05)	74.60(±7.46)	4.27	5.62	P<0.0001	Sig.
Functional disability	28.20(±7.89)	19.33(±6.62)	8.87	6.02	P<0.0001	Sig.

ROM: Range of motion Rt: right SB: Side bending Lt: left Rot: Rotation
Sig.: significant SD: Standard deviation.

Unpaired t-test was used to compare between the mean differences of both groups for all variables.

The mean difference of pain intensity was 3.53(±1.13) in group (A) while it was 2.73(±1.67) for group (B). There was no significant difference between groups with t=1.54 and P=0.1348. The mean difference of range of motion of cervical flexion was 3.33(±5.59) in group (A) while it was 7.07(±6.56) for group (B). There was no significant difference between groups with t=1.68 and P=0.1046. The mean difference of range of motion of cervical extension was 7.20 (±10.25) in group (A) while it was 10.25(±2.65) for group (B). There was no significant difference between groups with t=1.07 and P=0.2935. The mean difference of range of motion of cervical side bending to the right side was 3.73 (±5.75) in group (A) while it was 10.40 (±6.76) for group (B). There was a significant difference between groups in favor of group B who received stretching exercises with t=2.91and P=0.0070. The mean difference of range of motion of cervical side bending to the left side was 7.06(±6.92) in group (A) while it was 7.26(±4.06) for group (B). There was no significant difference between groups with t=0.09and P=0.9233. The mean difference of range of motion of cervical right rotation was 4.27(±7.81) in group (A) while it was 3.27(±3.59) for group (B). There was no significant difference between groups with t=0.45 and P=0.6560. The mean difference of range of motion of cervical left rotation was 6.80(±6.84) in group (A) while it was 4.27(±2.94) for group (B). There was no significant difference between groups with t=1.31and P=0.1980. The mean difference of functional disability was 10.17(±5.49) in group (A) while it was 8.87(±5.71) for group (B). There was no significant difference between groups with t=0.63 and P=0.5301 as shown in table (4).

Table (4): Between group differences of the mean difference of variables for both groups.

Variable	Group A Mean(±SD)	Group B Mean(±SD)	t-value	P value	significance
Pain intensity	3.53(±1.13)	2.73(±1.67)	1.54	0.1348	NS
Flexion ROM	3.33(±5.59)	7.07(±6.56)	1.68	0.1046	NS
Extension ROM	7.20(±10.25)	10.25(±2.65)	1.07	0.2935	NS
Rt SB ROM	3.73(±5.75)	10.40(±6.76)	2.91	0.0070	Sig.
Lt SB ROM	7.06(±6.92)	7.26(±4.06)	0.09	0.9233	NS
Rt Rot ROM	4.27(±7.81)	3.27(±3.59)	0.45	0.6560	NS
Lt Rot ROM	6.80(±6.84)	4.27(±2.94)	1.31	0.1980	NS
Functional disability	10.17(±5.49)	8.87(±5.71)	0.63	0.5301	NS

ROM: Range of motion Rt: right SB: Side bending Lt: left Rot: Rotation
Sig.: significant SD: Standard deviation.

DISCUSSION

The results of this study revealed that both passive stretching exercises and post isometric relaxation technique are effective in relieving pain and disability and improving range of motion of the cervical spine. The post isometric relaxation technique was not effective in improving the range of motion of cervical flexion and right side bending. The stretching exercises were more effective in improving the range of motion of cervical right side bending than the post isometric relaxation technique.

The results of the stretching exercises' group were supported by Hakkinen et al.,[16] who found that the stretching exercises alone were effective as well as the stretching plus the strengthening exercises in relieving neck pain and disability and improving the range of motion of the cervical spine even on the long term of one year follow up. The results also came in agreement with Cunha et al.,[7] who said that there was significant pain relief and improvement in range of motion of the cervical spine as well as better quality of life following the use of stretching exercises in treatment of chronic neck pain. Also came in agreement with Ylinen et al.,[35] who mentioned that stretching exercises were such effective as the manual therapy in relieving neck pain and disability. They concluded that low cost

stretching exercises can be recommended as an early treatment of neck pain. And finally the results of this study came in agreement with Ylinen et al.,[34] who said that combined stretching and strengthening exercises for the neck muscles were effective on the long term in relieving knee pain and disability than stretching alone after one year follow up.

The results of the post isometric relaxation group came in agreement with Gupta et al.,[15] who evaluated the efficacy of post isometric relaxation (PIR) in patients with non –specific neck pain and they concluded that PIR may be more effective in decreasing pain and disability and increasing cervical range of motion in patients with non –specific neck pains and Shlenk et al.,[28] and Cassidy[4] who found that muscle energy techniques were effective in increasing range of motion of cervical spine. Lewit and Simons[20] reported that PIR technique was applied to tight, tender muscles that are commonly associated with musculoskeletal pain and they found that the method produced immediate pain relief in 94%, lasting pain relief in 63%, as well as lasting relief of point tenderness in 23% of the sites treated.

May be the post isometric relaxation technique was not effective in improving the range of motion of the neck flexion and right side bending in this group because most of the affection in this group was in the right side. In addition, may be the stretching maneuvers of the upper trapezius muscle from the distal attachments were not effective as from the proximal attachments of the upper trapezius muscle as the later acts on the neck directly.

The analgesic effect of post isometric relaxation technique could be attributed to the hypothesis that activation of muscle and joint mechanoreceptors occurs, during an isometric contraction. This leads to sympatho-excitation evoked by somatic efferents and localized activation of the periaqueductal grey that plays a role in descending modulation of pain. Nociceptive inhibition then occurs at the dorsal horn of the spinal cord, as simultaneous gating takes place of nociceptive impulses in the dorsal horn, due to mechano-receptor stimulation[11]. Hamilton et al.,[17] suggested that MET that stimulate joint proprioceptors, via the production of joint movement, or the stretching of a joint capsule, may be capable of reducing pain by inhibiting the smaller diameter nociceptive neuronal input at the spinal cord level.

The results of this study showed that there were no advantage of the use of post-isometric technique on the passive stretching as both were effective in relieving pain and disability. But, it seems that the passive stretching exercises are more effective in improving cervical range of motion, may be, because of its direct effect on the neck muscles.

Conclusion

Post-isometric relaxation technique is effective as well as passive stretching exercises in relieving neck pain and disability and improving neck range of motion in patients with cervical spondylosis.

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الملخص العربي

فاعلية تمرينات الاستطالة مقابل تقنية الارتخاء بعد الانقباض الثابت على شدة الألم والعجز الوظيفي ومدى الحركة في مرضى خشونة الفقرات العنقية. محاولة عشوائية محكمة

الأهداف : تهدف الدراسة للمقارنة بين فاعلية تقنية الارتخاء بعد الانقباض الثابت وتمرينات الاستطالة على شدة الألم و العجز الوظيفي ومدى الحركة في مرضى خشونة الفقرات العنقية . **المرضى والطرق :** ثلاثون مريضا بخشونة الفقرات العنقية (ذكورا وإناثا) تم توزيعهم عشوائيا على مجموعتين . تلقت المجموعة الأولي الأشعة تحت الحمراء و تمرينات تقوية ثباتية وتقنية الارتخاء بعد الانقباض الثباتي في حين تلقت المجموعة الثانية الأولي الأشعة تحت الحمراء و تمرينات تقوية ثباتية وتمرينات استطالة لمدة أربعة أسابيع ، ثلاث مرات بالأسبوع . تم التقييم في بداية الجلسة الأولي وبعد الجلسة الأخيرة. تم تقييم شدة الألم ب استخدام المقياس البصري و مقياس العجز الرقب ي لتقييم العجز الوظيفي للرقبة ومنقلة ميرين لقياس مدى حركة الرقبة . **النتيجة :** لم يكن هناك فرق فعال بين تقنية الارتخاء بعد الانقباض الثابت و تمرينات الاستطالة على شدة الألم والعجز الوظيفي ومدى الحركة في مرضى خشونة الفقرات العنقية . وكانت تمرينات الاستطالة أكثر فاعلية في زيادة مدى حركة ثني الرقبة للأمام وللجانب الأيمن . **الاستنتاج :** كل من تقنية الارتخاء بعد الانقباض الثابت و تمرينات الاستطالة فعال في تقليل شدة الألم والعجز الوظيفي وتحسن مدى الحركة في مرضى خشونة الفقرات العنقية .

الكلمات الدالة : خشونة الفقرات العنقية ، تمرينات الاستطالة من تقنية الارتخاء بعد الانقباض الثابت .