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Effect Of Cervical Collar On Proprioception In Patients With Non Traumatic Mechanical Neck Pain

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Abstract:Title: Effect of soft cervical collar on proprioception in patients with non traumatic mechanical neck pain
BACKGROUND: Cervical collar is commonly used by patients against non traumatic neck pain. Many studies report reduction of pain following the use of soft cervical collar. Proprioception is considered to make an essential contribution to functional stability of a joint. It is thought that pain can reduce proprioceptive acuity and that this may promote joint pathology in non traumatic neck pain. To date there are no studies that have investigated the immediate effect of soft cervical collar on proprioception in patients with non traumatic neck pain.
OBJECTIVE: Effect of soft cervical collar on proprioception in patients with non traumatic mechanical neck pain
MATERIALS AND METHODS: 36 subjects (age range, 20–60 years) with non traumatic neck pain were recruited in to the study. The subjects were measured for proprioception with and without soft cervical collar. Proprioceptive reposition errors in degrees were measured by the Cervicocephalic kinesthetic sensibility tests, which include Head-to-Neutral Head Position (NHP) repositioning tests and Head-to-Target repositioning tests with Cervical Range of Motion (CROM) Device.
RESULTS: The results of paired t test showed there is significant difference in proprioception with and without soft cervical collar ($P<0.001$) in both the Head to Neutral Head Position testing and Head to Target Repositioning tests. Cervical proprioception improved with the use of soft cervical collar.
CONCLUSION: Soft cervical collar improves cervical proprioception in subjects with non traumatic neck pain.

Keyword: proprioception; collar; neck pain.

INTRODUCTION:

Neck pain is still a major contributor to disability worldwide.1,2 About 70% of the population experiencing an episode of neck pain at some point in their live.1,2 Proprioception is a term commonly used to describe the complex interaction between afferent and efferent receptors that control the position and movement in space of the body or part of the body.3 A widely used measure of cervical proprioception is the joint position error (JPE) test, in which impaired ability to relocate neutral head position has been demonstrated in acute and chronic neck pain patients.4,5 Proprioception is considered to make an essential contribution to functional stability of a cervical joint. It is thought that pain can reduce proprioceptive acuity and that this may promote cervical pathology in non traumatic neck pain.4,5,6 Neck Pain is shown to have association with decreased proprioception.7

Soft cervical collar is commonly used by patients against neck pain. Soft Cervical collar is used for both immobilization and to reduce pain.8 It keeps the head in a comfortable gravity-aligned position, maintaining the normal cervical lordosis.8 The main goal of neck collars is to prevent or minimize motion in the cervical spine and reduce pain. The reduced pain may enhance the proprioception.8,9 Based on these findings, it has been suggested that proprioception may be improved with the application of soft cervical collar.

A larger body of research on proprioception in the knee and ankle joints suggests that positional sense indeed improves when a bandage, neoprene sleeve, or a brace is worn.10 The enhanced proprioception may stem from increased stimulation of skin afferents and/or compression of the soft tissues around the joint receptors.6 If cervical spine proprioception were similarly enhanced with a soft cervical collar, this may explain the subjective feeling of security expressed when such a device is worn. Till date there are no studies that have investigated the effect of soft cervical collar on proprioception in patients with non traumatic neck pain. Therefore the purpose of the study was to examine whether soft cervical collar can affect proprioception in patients with non traumatic mechanical neck pain

METHODS

Subjects

Thirty eight subjects (18 males and 20 females) were recruited for this study. Their age, body mass, and height were on average (standard deviation in parentheses) 46 (8) years, 73 (11) kg, and 173 (13) cm, respectively. At the beginning of the study, all subjects read and signed an informed consent form describing the experimental protocol

approved by the university ethical committee.

All the subjects were referred to physiotherapy from orthopedic or neuro surgeon. The current study focuses on mechanical neck pain as main playing-related musculoskeletal disorder. Mechanical neck pain was defined as generalized neck or shoulder pain of mechanical characteristics provoked by neck postures, neck movement, or palpation of the cervical muscles. Participants were excluded if exhibited any of the following criteria: 1, previous surgery and/or steroid injections in the upper quadrant; 2, whiplash cervical or neck surgery; 3, history of wrist or arm trauma; 4, symptoms in any different place than the neck-shoulder area, for instance, in the hand; or, 5, fibromyalgia syndrome.

Protocol

The study protocol required all subjects to wear a Soft cervical collar during the testing. This product provided similar amount of neck motion restriction and passive neck moment support as other comparable collars on the market. The back panel of each soft cervical collar was adjusted to fit the contour of the subjects' cervical lordosis as recommended by the manufacturer.

The measurement of proprioception was performed with and without wearing the soft cervical collar. Half of the subjects, randomly selected, began the testing sessions with the soft cervical collar, while the other half began without the soft cervical collar.

Measurement of cervical proprioception using Cervico-cephalic kinesthetic sensibility tests:

The subjects were asked to sit upright in a comfortable position and look straight ahead to be determined as the neutral head position (NHP). The CROM unit was placed on top of the head and attached posteriorly using the Velcro strap. The magnetic part of the unit was then placed so that it sat squarely over the shoulders. The investigator calibrated the CROM device to a neutral head position.

For the cervicocephalic kinaesthetic sensibility tests, subjects were required to keep the head in the NHP and were told to close their eyes throughout the subsequent tests. The first test was Head-to-Neutral Head Position (NHP) repositioning test.11 The subjects were instructed to turn the head fully to the left and back to what they considered the starting point in a controlled fashion without opening their eyes. When the subjects reached the reference position the subject's relocation accuracy was measured in degrees with the CROM device. In the second repositioning test is Head-to-Target repositioning tests.12 The investigator moved the subject's head slowly to the predetermined target position into extension, 65% of maximum range of motion. The speed of passive neck motion was very slow as higher speeds have been associated with significant differences in vestibular function according to age.13 The head was maintained in the target position for 3 seconds and the subject was asked to remember that position and the head was brought to neutral position and then the subject were asked to reposition actively by moving the head to the target position. When the subjects reached the reference position, the subject's relocation accuracy was measured in degrees with CROM device. The two repositioning tests were performed in the sagital, transverse, and frontal planes. Each test position was measured three times and the average of the three was taken for analysis.

Statistical Analysis

Parametric paired t test was used to compare joint reposition errors with and without the use of soft cervical collar. The statistical analysis was done using the SPSS 14.0 for windows software. The statistical significance value will be set at 0.05 with 95% confidence interval and a $p \leq 0.05$ will be considered to be significant.

RESULTS

The results showed that the use of soft cervical collar decreased the proprioceptive errors significantly in sagital ($p<0.001$), frontal ($p<0.05$) and transverse planes ($p<0.001$) in both the Head - to-neutral head position (table 1) and Head-to-target repositioning tests (table 2).

DISCUSSION

The result of the present study showed that the use of soft cervical collar enhances the proprioception. The proprioception reposition errors decreased in all planes in Head - to-neutral head position and Head-to-target repositioning tests. Soft cervical collar partially immobilize the neck mostly remind the patient of excessive motions. Since the collar is under the chin and supports the chin, it minimizes muscle contraction needed against the gravity forces to keep the head in a normal position and decrease pain in subjects with neck pain.

The effect of the soft cervical collar on cervical proprioception may have been mediated by the increased cutaneous sensory processing due to the enhanced muscle receptor feedback in repositioning tests. It is well documented that slow-adapting skin mechanoreceptors contribute significantly to the joint position and movement sense in the hand and the knee.14,15 Changes in the pressure on the skin due to tendon or muscle belly movement can be used in joint motion perception.16,17 Even passive skin stretching can generate the illusion of joint motion. However, the perception of cutaneous inputs appears to be functionally gated during voluntary muscle contractions.16,17,18 Therefore, in our study, it is possible that the perception of pressure and skin stretching due to the soft cervical collar played a role in enhanced proprioception.
A soft cervical collar around the neck improved the performance of patients with poor joint position sense. The collar provides mechanical support to the cervical spine, so the feeling of improved stability. Such findings have often been reported by those with arthritis and by sportsmen with ligament injuries. We now have objective evidence that wearing a bandage improves joint position sense in knees in which it is impaired.19, 20, 21

CONCLUSION

With the soft cervical collar on, there was significant reduction in joint position error and improved proprioception in subjects with non traumatic mechanical

neck pain than without the soft cervical collar.

TABLES

Table 1 Repositioning errors (degree) of head-to-neutral head position repositioning tests (n=25)

Movement	Head- to -Neutral head Position		95% Confidence Interval		p
	with collar	without collar	UPPER	LOWER	
Flexion	2.50±1.40	7.22±2.54	-1.19	-5.07	0.001
Extension	3.63±1.86	10.26±2.59	-6.66	-9.01	0.001
Left side flexed	2.33±2.20	5.32±2.01	-0.94	-3.63	0.043
Right side flexed	2.58±2.10	5.82±2.22	-1.04	-3.98	0.048
Left rotated	2.60±1.40	7.81±2.93	-1.29	-5.33	0.001
Right rotated	2.50±1.40	6.62±2.21	-1.89	-5.64	0.001

Table 2 Repositioning errors (degree) of head-to-target repositioning tests (n=25)

Movement	Head- to -target		95% Confidence Interval		p
	with collar	without collar	UPPER	LOWER	
Flexion	4.31±1.70	8.62±2.87	-2.26	-6.01	0.001
Extension	4.49±1.96	12.2±2.58	-5.66	-9.99	0.001
Left side flexed	2.81±2.57	5.22±2.01	-0.94	-3.63	0.056
Right side flexed	2.89±2.23	5.92±2.06	-1.04	-3.88	0.040
Left rotated	3.73±1.98	8.81±2.93	-1.29	-6.23	0.001
Right rotated	3.98±1.90	8.62±2.28	-1.89	-6.61	0.001

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