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Original Article

Physiotherapy Section

Effects of Kinesiotaping on the Improvement of Sensorimotor Function along with Disability in Chronic Mechanical Neck Pain

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ABSTRACT

Introduction: Mechanical neck pain is a significant societal burden and may include symptoms in the neck and upper extremity. It has been reported that the lifetime and point prevalence of neck pain are almost as high as those of low back pain. It appears to run a chronic episodic course, which is characterised by episodes of persistent, recurrent, or fluctuating pain and disability. It has been found that an altered muscle activity in the Trapezius and the Serratus anterior muscles can be associated with the presence of pain in the neck during functional activities.

Aim: To find out the effects of Kinesiotaping on the improvement of sensorimotor function and neck disability in patients with chronic neck pain.

Materials and Methods: This was a pre-test, post-test control group design with 30 subjects randomly selected and divided into two groups, an experimental group (Group A) and a control group (Group B) with 15 subjects in each. Experimental group received Kinesio Tape (KT) for 1 week whereas control group received Sham tape. Measurements were taken on the first day and 1 week after the intervention for Cervical Joint Position Sense (CJPE), range of motion and neck disability using an inclinometer instrument, universal goniometer, Neck Disability Index (NDI) questionnaire, respectively. The data was analysed using SPSS 17 software package. Independent t-test was done to find effect between the groups and paired t-test was done to find out the effect within the group.

Results: The study clearly demonstrated a significant improvement in CJPE, Cervical Range of Motion (CROM) and NDI within group A ($p<0.05$) whereas improvement showed significance in CROM and NDI for group B. While comparing both the groups, significant improvement in proprioception and NDI was shown but not in CROM.

Conclusion: The study concludes that patients with chronic mechanical neck pain can be benefitted by the use of Kinesiotaping with improvement of sensorimotor function.

Keywords: Cervical joint position sense, Neck disability, Range of motion

INTRODUCTION

Chronic Neck pain is a common musculoskeletal condition, which people experience at some point in their daily life and in most cases; it appears to run a chronic episodic course characterised by episodes of persistent, recurrent or fluctuating pain and disability [1,2]. Most commonly, it is seen in elderly population (38%), while lifetime prevalence ranges from 14.2-71%. Neck pain is defined as generalised neck pain provoked by sustained neck postures, neck movement, and pain on palpation of cervical musculature without pathologies [3].

Neck pain may arise from any of the innervated structures in the neck such as intervertebral discs, muscles, ligaments, zygapophyseal joints, and duramater and nerve roots [4]. Several different factors may be responsible for neck pain in workers which include age, previous musculoskeletal pain, job demands, weak social support at work, job insecurity, low physical capacity, work posture, sedentary work position, repetitive work and meticulous work [1,5].

The muscles involved in the formation of various force couples, when involved, leads to faulty biomechanics and a resultant neck pain. Such a force couple is seen in Trapezius and Serratus anterior and it has been found that an altered muscle activity in the Trapezius and the Serratus anterior muscles can be associated with the presence of pain in the neck during functional activities [6].

One such condition is Scapular dyskinesis which impairs the scapular humeral rhythm and may contribute to the presence of shoulder and neck pain conditions [6]. The term sensorimotor describes all the afferent, efferent and central integration and processing components involved in maintaining stability in the postural control system through intrinsic motor-control properties [7].

The CJPE is impaired in patients with neck pain and neck pain is shown to have an association with decreased proprioception. Proprioception or the orientation of the head on the trunk is vital to the performance of many everyday tasks. Position sense of the head and neck is mediated by cervical proprioceptors, visual and vestibular systems [8].

The application of tape has been widely used for many years by physiotherapists as a useful adjunct to prophylactic or rehabilitation programs in the management of a wide variety of neuron-musculoskeletal disorders. In many studies, KT has showed beneficial effects, including pain reduction, muscle strengthening [9] and increased active range of motion [10]. The KT provides benefit to the patients including proprioceptive facilitation, muscle facilitation, reduced muscle fatigue, reduced delayed-onset muscle soreness, and pain inhibition [11,12]. To ease a muscle spasm, the tape is applied from the muscle's insertion to origin with 15-25% tension [13]. Many disorders arise as a sequel of failure of scapular muscle to maintain the scapula neutral position, which results in a disorder like neck pain, altered scapula humeral rhythm causes shoulder impingement, hypertrophy of upper trapezius, and the other, related biomechanical problems. This study therefore, aims to find out the effect of KT on the improvement of CJPE, cervical joint range of motion and neck disability in patients with neck pain.

MATERIALS AND METHODS

This was a pre-test, post-test control group design with 30 subjects randomly selected and divided into two groups, an experimental group (Group A) and a control group (Group B) with 15 subjects in each. The study was carried out in Sardar Bhagwan Singh PG Institute of Biomedical Sciences, Dehradun, from November 2014

to April 2015. Randomisation was done using lottery method and ethical approval was taken from the Institutional Ethical Review Committee. The total duration of the study was one week and prior to the study, the subjects signed the informed consent form to approve their voluntary participation.

Inclusion criteria: All the subjects between 30-50 years of age and presenting with main complaint of neck pain were included in the study.

Exclusion criteria: Subjects with any inflammatory, infective or neoplastic pathology or with history of recent trauma, vertebrobasilar insufficiency or congenital anomalies were excluded from the study. Patients were prescribed medications in case of severe pain and they were asked to report to the hospital on that day itself and then those patients were excluded.

Sensorimotor functions were measured by measuring CJPE and cervical joint range of motion. Disability was measured by NDI. Experimental group received KT for 1 week whereas control group received Sham tape for 1 week. Readings and measurements were taken on the first day before the intervention and 1 weeks after the intervention for CJPE, range of motion and neck disability using an inclinometer instrument, universal goniometer and NDI questionnaire, respectively [14].

Measurement of Cervical Joint Position Sense (CJPE)

In supine position, a magnetic inclinometer affixed to the patient's forehead such, that the centre of the inclinometer was in alignment with the tip of the nose [Table/Fig-1a] [15]. All the patients were instructed to close their eyes, nod a few times and then return their head to a comfortable resting position. They were allowed to choose any position for ease of their head. This became the neutral head position. Their head was then positioned at 30° of rotation and then returned to 0° with eyes closed [Table/Fig-1b]. The patient was then asked to reproduce the angle three times with the eyes closed within a 60 seconds period. Three angles were recorded for right and left side rotation separately. The absolute difference in the target angle was calculated and used for statistical analysis [16].

Measurement of Cervical Joint Range of Motion

The patient was positioned in the seated position looking directly forward. The axis of a long arm goniometer centered over the apex of the cranium [Table/Fig-1c]. The inactive arm of the goniometer was associated with the acromion process and the transportable arm bisecting the patient's nose. The patient was asked to turn around toward each side as far as achievable. The amount of motion in degrees recorded along with the most appropriate descriptor [17,18].

Scoring of Neck Disability

The NDI is a widely used survey for evaluation of neck disability. The test-retest reliability (ICC) of the questionnaire is 0.94-0.99 [19]. NDI scores vary from zero (most desirable state of health) to 50 (least desirable state of health). Each of the 10 items is scored from 0-5. The maximum score is therefore 50. The subject was asked to tick or circle the one choice from the given sections, which most closely describe their problem [20].

Application of Kinesio Tape (KT)

The subject was asked to sit comfortably on a chair. The part to be treated was exposed, i.e., the upper Trapezius, and Serratus anterior. The KT applied to the patient in the form of "I-strap" over the upper Trapezius for inhibition [Table/Fig-1d]. The tape was applied in the direction from insertion to origin, and Serratus anterior of the same side was for facilitation, but the direction from origin to insertion [21].

Application of Sham Tape

The subject was asked to sit comfortably on a chair. The part to be treated was exposed for upper Trapezius, and Serratus anterior muscle. The KT was applied to the patient using sham maneuver, i.e., there was no direction of application of KT.

[Table/Fig-1]: a) Neutral Head Position for CJPE; b) Observed Target Head Position for CJPE; c) Measurement of cervical range of motion; d) Application of kinesio Tapeover upper trapezius muscle.

STATISTICAL ANALYSIS

The data were analysed using SPSS Software Version 17.0. The paired t-test was used to compare the effects of training within the group A and B. The unpaired t-test was used for comparing the effect of proprioception, CROM and NDI in between the group A and B. Level of significance was set at 95%. A p-value less than 0.05 was considered statistically significant.

RESULTS

The mean age of the population in group A and B was 35.93±10.89 and 26.26±6.50 years, respectively. There were 15 participants in each group and all were males. Unpaired t-test was performed between group A and B. The results showed significant difference ($p<0.05$) at week one (post intervention) of proprioception and NDI variables whereas CROM was non significant [Table/Fig-2].

Variables	Groups	Mean±SD	t value	Sig. (2-tailed)
Proprioception Pre	Group A	6.37±2.63	1.503	0.144
	Group B	4.71±3.37		
Proprioception Post	Group A	1.57±0.92	6.571	**0.0001**
	Group B	5.58±2.17		
CROM Pre	Group A	55.06±11.47	2.060	0.049
	Group B	62.46±7.86		
CROM Post	Group A	66.00±8.141	0.671	0.508
	Group B	64.06±7.63		
NDI Pre	Group A	15.066±2.840	0.687	**0.001**
	Group B	11.266±2.491		
NDI Post	Group A	5.066±3.283	0.915	**0.001**
	Group B	12.600±2.898		

[Table/Fig-2]: Comparison of Proprioception, CROM and NDI between two groups. Unpaired t-test was used

Paired t-test was used within group A to compare the pre and post values for proprioception, CROM, NDI and the results were found to be significant [Table/Fig-3].

Variables		Mean±SD	t value	Sig. (2-tailed)
Proprioception	1st Day	6.37±2.63	7.85	**0.001**
	7th Day	1.57±0.92		
CROM	1st Day	55.06±11.47	5.03	**0.001**
	7th Day	66.00±8.14		
NDI	1st Day	15.06±2.84	13.57	**0.001**
	7th Day	5.06±3.28		

[Table/Fig-3]: Comparison of Proprioception, CROM and NDI within Group A. Paired t-test

Paired t-test was used within Group B to compare the pre and post values for proprioception, CROM, NDI and the results were found to be significant for CROM but were non significant for proprioception and NDI [Table/Fig-4].

Variables		Mean±SD	t value	Sig. (2-tailed)
Proprioception	1st Day	4.71±3.37	1.23	0.23
	7th Day	5.58±2.17		
CROM	1st Day	62.46±7.8	3.29	**0.001**
	7th Day	64.06±7.63		
NDI	1st Day	11.26±2.49	1.90	0.07
	7th Day	12.60±2.89		

[Table/Fig-4]: Comparison of Proprioception, CROM and NDI within Group B. Paired t-test

In present study, no patients had reported severe pain and nobody was required to take medications.

DISCUSSION

The study clearly demonstrated a significant improvement in CJPE, CROM and NDI within group A [Table/Fig-3] ($p<0.05$), whereas significant improvement was shown in CROM for group B [Table/Fig-4]. While comparing both the groups significant improvement in proprioception and NDI were shown but not in CROM [Table/Fig-2].

Previous studies have suggested that KT enhances proprioceptive afferent feedback thus enhances the proprioception and supports the present study [3,22,23]. It is believed that KT effects on pain scores are related to produce benefits such as muscle facilitation or inhibition, joint realignment, as well as increasing proprioception by stimulating skin mechanoceptors which may contribute to proprioception improvement [6]. Some other studies demonstrated that an application of KT showed a reduction in neck pain and disability and changes in active CROM over a 7-Day period [20]. The present study showed a significant improvement in CROM within the group A and group B. KT has improved CROM by reducing the tone of the muscles, which may have increased due to sustained contraction of the muscles for long hours. KT application provides positional stimulus through the skin, which improves kinesthetic awareness of neck position, holding the neck in normal posture without putting tension on muscles and tissues thus increase ROM [24].

Another component of the present study was disability, which showed significant differences within the group. Present study has demonstrated that an application of KT showed a reduction in disability over a 7-day period. KT applied to the muscles could have caused the stimulation of mechanoreceptors causing an inhibition of transmission of pain impulses via the pain gate theory, thereby improving the NDI scores [21].

In continuation of the study, when comparison was done between groups, the analyses revealed a significant difference in the CJPE, and neck disability post intervention ($p>0.05$). Since the Sham tape was applied over the skin it would have exerted a pull over of the muscle through the skin. This would have resulted in a decrease in excitability because of inhibitory signal sent from the Golgi Tendon Organ (GTOs) of the same muscle [25]. This tension causes activation of Ib afferent fibers within the GTOs. Afferent fibres send signals to the spinal cord where the stimulus causes the activation of inhibitory interneurons within the spinal cord. These interneurons place an inhibitory stimulus upon the alpha motoneuron, decreasing the nerves excitability and decreasing the muscle efferent motor drive [25,26]. Therefore, the hypertonic muscle would have been inhibited leading an improvement in the faulty muscle mechanics producing an equally significant improvement in the results with the sham tape.

On the other hand, Kaya E et al., compared the effects of Kinesiotaping against traditional physical therapy modalities in patients with shoulder impingement syndrome for two weeks [27]. They found significant decrease in pain intensity and disability scores of arm, shoulder and hand scale in the kinesiotaping group in comparison with the other group. Another study by Hernández S et al., observed relief in pain after application of KT along with cervical thrust manipulation [20].

Limitation(s)

In this study, minor adverse events that resolved within 24 hours were observed in patients. After that the study investigated the short-term effects (7 days) of KT application. Hence, cannot predict the long-term effects of the procedure. In addition, therapists usually use a multimodal approach for the management of patients with neck pain and do not solely use KT as an isolated intervention. We suggest that future studies investigate whether the inclusion of either procedure may enhance the outcomes when added to interventions already proven effective, such as active exercises and stretching exercises.

CONCLUSION(S)

The study concludes that there was a significant effect of KT on the improvement of CJPE and neck disability in patients with neck pain. The study can be conducted on various other muscles which are likely to get weak and tight. The study can be carried out for female population also. Further studies may explore for more specific neck pain conditions, longer follow-up periods should be implemented in future research.

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