

The Effect of a New Neck Support Tying Method Using Thera-Band on Cervical ROM and Shoulder Muscle Pain after Overhead Work

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Abstract. [Purpose] This study proposed a new neck support tying (NST) method using Thera-Band for the prevention of neck and shoulder pain in workers doing overhead work. The purpose of this study was to investigate the effect of the new NST method using Thera-Band on cervical ROM and shoulder pain after overhead work. [Subjects] Fourteen male subjects were recruited. [Methods] This study measured the cervical ROM and pressure pain threshold (PPT) of the upper and middle trapezius (UT and MT) muscles after the control and NST groups had performed overhead work. [Results] The cervical flexion, extension, and lateral flexion angles of the NST group were significantly larger than those of the control group. The PPTs of UT and MT of the NST group were significantly higher than those of the control group [Conclusion] The NST prevented ROM reduction and pain in the cervical and shoulder regions.

Key words: Neck supporter, Overhead work, Thera-Band

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INTRODUCTION

The head and neck posture of an individual can influence soft-tissue relationships in the cervical and shoulder region^{1, 2)}. A common concern in the modern workplace is upper extremity disorders arising from overhead work, which is associated with neck and shoulder disorders and pain³⁾. Long-term overhead working postures result in strain and fatigue of the shoulder muscles because arm elevation is associated with shoulder muscle fatigue^{4, 5)}. Previous studies have focused on risk factor analysis and the development of therapeutic exercises for overhead work-related disorders rather than prevention^{6, 7)}. Some studies have been performed on postural ergonomic interventions including working techniques for overhead work^{6, 7)}. However, we found that few studies have focused on protective ergonomic devices for overhead workers. Therefore, this study investigated a new neck support tying (NST) method that used a Thera-Band for the prevention of neck and shoulder pain in workers performing overhead work. The new NST method supports the neck during hyperextension and prevents excessive upward rotation of the scapula during overhead work. The purpose of the present study was to investigate the effect of this NST method on cervical ROM and shoulder pain after overhead work.

SUBJECTS AND METHODS

The subjects were divided into two groups as follows: a control group consisting of 7 males without NST, and a NST group consisting of 7 males with NST. The initial cervical ROM and initial PPTs of the UT and MT were not significantly different between the two groups. The initial values of cervical flexion, extension, and right and left lateral flexion in the control group were 63.4±4.2, 72.8±6.0, 53.9±2.9, and 51.3±5.6 degrees, respectively. The initial values for cervical flexion, extension, and right and left lateral flexion in the NST group were 62.3±5.1, 72.5±3.9, 53.3±3.0, and 52.2±2.4 degrees, respectively. All participants gave their informed, written consent according to the protocol approved by the Human Ethics Committee of the Yonsei University Faculty of Health Science. This study examined a new NST method that uses a Thera-Band for the prevention of neck and shoulder pain in workers performing overhead work. For the NST method, we used the grey Thera-Band (60 cm length) which was applied as follows. The midpoint of the Thera-Band supported the posterior aspect of the neck, and both ends of the Thera-Band were passed under both axillae, and tied behind the back. The NST provided support for neck hyperextension and prevented excessive upward scapular rotation during overhead work. Cervical flexion, extension, and right and left lateral flexion were measured with a Cervical Range of Motion (CROM) instrument (Performance Attainment Associates, St. Paul, MN, USA) before and after the overhead work. A dolorimeter pressure algometer (Fabrication Enterprises, White Plains, NY, USA) was used to

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measure the pressure pain threshold (PPT) of the right side upper trapezius (UT) and the lower trapezius (LT) muscles. A 1-cm² rubber plate delivers pressure from the probe to the body, and the pressure is read from a needle gauge. The clinical reliability of the measurements is greater than 80%. All subjects performed one trial of overhead work with their arms over their heads for 15 min. The overhead work was performed at a height of 25 cm above each subject's head. The overhead work was a bolt and nut assembly task. Differences in cervical ROM and PPT between the NST and control groups after the overhead work were tested with the independent t-test using the SPSS statistical package (version 18.0; SPSS, Chicago, IL, USA). Significance was accepted for values of $p < 0.05$.

RESULTS

The cervical flexion, extension, and lateral flexion angles of the NST group were significantly larger than those of the control group ($p < 0.05$). The cervical flexion, extension, and right and left lateral flexion of control group were 50.4 ± 8.2 , 64.7 ± 11.3 , 41.7 ± 7.9 , 43.2 ± 9.2 degrees, respectively. The cervical flexion, extension, and right and left lateral flexion of NST group were 61.5 ± 11.2 , 69.4 ± 6.9 , 48.7 ± 5.6 , 49.8 ± 6.7 degrees, respectively. The PPT of UT of the NST group (7.2 ± 1.8 lb) was significantly higher than those of the control group (6.3 ± 2.0 lb) ($p < 0.05$). The PPT of MT of the NST group (5.8 ± 1.4 lb) was significantly higher than those of the control group (5.0 ± 1.2 lb) ($p < 0.05$).

DISCUSSION

Repeated and sustained working with elevated arms is known to lead to neck and shoulder pain⁸). This study proposed a new neck support tying method using Thera-Band and investigated its effect on cervical ROM and shoulder pain after overhead work. Reductions in ROM have implications for the safety and efficiency of functional activities, and lead to a loss of corrective or protective reactions^{1, 9}). ROM losses can occur from inactivity and structural changes of the tissues in the cervical spine, and result in an increase in connective-tissue density, shortening of collagen tissue, and muscle fibrosis^{1, 9}). In this study, the cervical flexion, extension, and lateral flexion angles of the NST group were significantly larger than those of the control group. Shoulder forward flexion is associated with the trapezius

muscles. Shoulder forward flexion with scapular upward rotation requires the activation of the upper trapezius, and overstretches the middle trapezius through scapular protraction^{3, 5, 7}). The PPTs of the UT and MT were significantly lower in the NST group than those of the control group. These results indicate that the NST supported the neck and prevented excessive scapular elevation and upward rotation during overhead work. The Thera-Band, which provides varied resistance through the range of movement, has been used for rehabilitation in combination with therapeutic exercise¹⁰). It is light and portable, has low resistance, and can be adjusted to accommodate various situations¹¹). The NST method prevented ROM reduction and pain in the cervical and shoulder regions. The NST method can be easily and simply applied using a Thera-Band and is also inexpensive. We suggest that industrial workers could use the NST method when performing overhead work.

REFERENCES

- 1) Fernández-de-las-Peñas C, Alonso-Blanco C, Cuadrado ML, et al.: Forward head posture and neck mobility in chronic tension-type headache: a blinded, controlled study. *Cephalalgia*, 2006, 26: 314–319. [[Medline](#)] [[CrossRef](#)]
- 2) Szeto GP, Straker L, Raine S: A field comparison of neck and shoulder postures in symptomatic and asymptomatic office workers. *Appl Ergon*, 2002, 33: 75–84. [[Medline](#)] [[CrossRef](#)]
- 3) Grieve JR, Dickerson CR: Overhead work: identification of evidence-based exposure guideline. *Occup Ergon*, 2008, 8: 53–66.
- 4) Herbets P, Kadefors R: A study of painful shoulder in welders. *Acta Orthop Scand*, 1976, 47: 381–387. [[Medline](#)] [[CrossRef](#)]
- 5) Herbets P, Kadefors R, Broman H: Arm positioning in manual tasks: an electromyographic study of localized muscle fatigue. *Ergonomics*, 1980, 23: 655–665. [[Medline](#)] [[CrossRef](#)]
- 6) Sood D, Nussbaum MA, Hager K: Fatigue during prolonged intermittent overhead work: reliability of measures and effects of working height. *Ergonomics*, 2007, 50: 497–513. [[Medline](#)] [[CrossRef](#)]
- 7) Chopp JN, Fischer SL, Dickerson CR: The impact of work configuration, target angle and hand force direction on upper extremity muscle activity during sub-maximal overhead work. *Ergonomics*, 2010, 53: 83–91. [[Medline](#)] [[CrossRef](#)]
- 8) Viikari-Juntura E, Martikainen R, Luukkonen R, et al.: Longitudinal study on work related and individual risk factors affecting radiating neck pain. *Occup Environ Med*, 2001, 58: 345–352. [[Medline](#)] [[CrossRef](#)]
- 9) Tousignant M, Duclos E, Lafleche S, et al.: Validity study for the cervical range of motion device used for lateral flexion in patients with neck pain. *Spine*, 2002, 27: 812–817. [[Medline](#)] [[CrossRef](#)]
- 10) Youdas JW, Garrett TR, Suman VJ, et al.: Normal range of motion of the cervical spine: an initial goniometric study. *Phys Ther*, 1992, 72: 770–780. [[Medline](#)]
- 11) Findley BW: Training with rubber bands. *Strength Condit J*, 2004, 26: 68–69. [[CrossRef](#)]