A Comparison of Neck Movement in the Soft Cervical Collar and Rigid Cervical Brace in Healthy Subjects

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Abstract

Objective: The soft cervical collar has been prescribed for whiplash injury but has been shown to be clinically ineffective. As some authors report superior results for managing whiplash injury with a cervical brace, we were interested in comparing the mechanical effectiveness of the soft collar with a rigid cervical brace. Therefore, the purpose of this study was to measure ranges of motion in subjects without neck pain using a soft cervical collar and a rigid brace compared with no orthosis.

Methods: Fifty healthy subjects (no neck or shoulder pain) aged 22 to 67 years were recruited for this study. Neck movement was measured using a cervical range of motion goniometer. Active flexion, extension, right and left lateral flexion, and right and left rotation were assessed in each subject under 3 conditions: no collar, a soft collar, and a rigid cervical brace.

Results: The soft collar and rigid brace reduced neck movement compared with no brace or collar, but the cervical brace was more effective at reducing motion. The soft collar reduced movement on average by 17.4%; and the cervical brace, by 62.9%. The effect of the orthoses was not affected by age, although older subjects had stiffer necks.

Conclusion: Based on the data of the 50 subjects presented in this study, the soft cervical collar did not adequately immobilize the cervical spine. (J Manipulative Physiol Ther 2011;34:119-122)

Key Indexing Terms: *Whiplash Injuries; Spine; Orthotic Devices*

Whiplash injury has increased in prevalence since the introduction of seatbelt legislation.[1] Some 5% of the population[2] are affected, of whom 40% remain symptomatic after 2 years.[3] Of the treatments for whiplash injury, evidence from randomized controlled trials supports nonsteroidal anti-inflammatory drugs,[4] manipulation,[5-12] supervised exercise,[13] and self-mobilization.[14-18] Although the soft cervical collar is inferior to all other treatments and may produce harm, it is still prescribed regularly.[9,16,19]

Soft cervical collars fail to restrict movement in 3 of the 6 planes of neck movement[20] but seem to be effective in doing so in most acts of daily living. Two older studies suggest that a rigid cervical brace is effective for severe cervical injuries,[21,22] but more recent work suggests that cervical collars are no more effective than acting as usual or active mobilization.[23] Other studies have shown that using cervical collars produce more harm than help and that active mobilization is superior to the cervical collars in reducing pain and disability for whiplash injury especially in the long term.[9,13,14]

Because soft cervical collars have been prescribed for whiplash injury but have been proven ineffective and as some authors report superior results for whiplash injury with a cervical brace, we were interested in comparing the mechanical effects of the soft collar with a rigid cervical brace on ranges of motion. Therefore, the purpose of this study was to measure ranges of motion in subjects without neck pain using a soft cervical collar or a rigid brace compared with no orthosis.

Materials and Methods

Approval for this study was obtained from the local Research Ethics Committee at the University of Bristol.

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Subjects

Fifty subjects were recruited from outpatient clinics of a variety of specialities that they were attending for reasons other than neck, shoulder, or spinal disorder. All subjects gave consent to participate in this study; 20 were male, and 30 were female. Subjects were excluded from this study if they had shoulder or neck pain or pathology but not for neck stiffness. The range of neck movement was measured first without any orthosis and acted as the baseline. Their range of neck movement was then measured wearing first a soft cervical collar and then a cervical brace.

Instrumentation and Training

Neck movement was measured with the "cervical range of motion (CROM) goniometer." The CROM goniometer is a reliable CROM measurement device and, compared with radiographic, computerized tracking and optoelectronic measurement methods, has "good to excellent" criterion validity.[16-22]

The CROM goniometer measures CROM in the coronal, sagittal, and transverse planes using separate orthogonally positioned inclinometers. The coronal and sagittal inclinometers, which measure lateral flexion and flexion/extension, respectively, are gravity dependent. The transverse inclinometer works as a compass goniometer and measures axial rotation. Participants were therefore required to wear a magnetic yoke mounted on their shoulders. The CROM goniometer sits on the head like a pair of glasses and is held in place with straps behind over the occipital region.

The orthoses used included a soft cervical collar (Vulkan Medicollar; Mobilis Healthcare Group Ltd, 100 Shaw Rd, Oldham, Lancashire, OL1 4AY) and a cervical brace (Combi Collar; RSL Steeper, Hugh Steeper Ltd, Leeds Manufacturing Centre, Unit 17, Hunsleet Trading Estate, Severn Rd, Leeds LS10 1BL).

Data were collected by the first 2 authors who were trained to use of the orthoses by the resident hospital orthotist and the CROM goniometer by the senior author before undertaking the study.

Validation of Procedure

To validate the study procedure, the effects of "warm-up" and "fatigue" on CROM and the degree of interobserver variation were first assessed.

Warm-Up and Fatigue

The effect of "warm-up" and "fatigue" was established by measuring 20 consecutive neck movements in flexion and extension in 5 participants with the CROM goniometer.

Interobserver Error. To assess interobserver error, one subject was asked to perform 10 full cycles of active cervical movements. These included maximal flexion, extension, right and left lateral flexion, and right and left axial rotation. Range of motion was measured using the CROM goniometer, from which the 2 investigators took recordings simultaneously. Therefore, 60 measurements per investigator were obtained from the same subject for comparison.

Method

Each subject sat on a metal-framed chair with a backrest that provided support for the thoracic spine but with no arm supports. Their feet were flat on the floor, and their arms were positioned comfortably by their side. They were asked to sit upright and to maintain this posture throughout the procedure.

Using the CROM goniometer, through one cycle of movement, maximal active cervical flexion, extension, right and left lateral flexion, and right and left axial rotation were measured with no collar (control), a soft collar, and the rigid brace. Data were collected by the first 2 authors, each of whom took measurements from 25 alternate subjects.

Statistical Analysis

Data were analyzed using the SPSS 13.0 (SPSS Inc, Chicago, IL).

The Kolmogorov-Smirnov test was used to establish data normality. Interobserver variance was assessed by calculating intraclass correlation coefficients.

The degree of immobilization provided by each collar was calculated using the general linear model. Bivariate analysis was used to determine whether age affected the proportion of restriction caused by the 2 collars. Finally, the effect of age on CROM was determined by calculating the Pearson correlation coefficient.

Results

Subjects

Ages ranged from 22 to 67 (mean, 43) years. There were 10 subjects in each age range from 20 to 29, 30 to 39, 40 to 49, 50 to 59, and 60 to 69. Data were normally distributed.

Effect of Warm-Up

There was no "warm-up" or "fatigue" effect ($P = .494$).

Interobserver Agreement

There was a high level of interobserver agreement. Extension showed the strongest agreement; and lateral flexion, the weakest (intraclass correlation coefficients of 0.93 and 0.66, respectively).

Effect of Control, Soft Collar, and Cervical Brace. Compared with no orthoses, the soft collar produced a mean reduction of neck movement of 17.4% ($P < .001$); and the cervical brace,