

GONIOMETRIC ANALYSIS OF CERVICAL AND CERVICOTHORACIC ORTHOSES IN RESTRICTING NECK MOTION

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Scientific Exhibit: SOCIETY OF TRAUMA NURSES, 5th Annual Conference
Las Vegas, Nevada; March 24, 2002

BACKGROUND: The cervical region of the spine is a very mobile area, and thus is a common site for injury. Cervical collars play a vital role in the stabilization of the neck during emergency situations and as components of long-term rehabilitation programs. To improve the cervical immobilization offered by the collar and to reduce motions of the upper thoracic spine, cervicothoracic orthoses (CTO's) are used in conjunction with cervical collars. A thoracic extension is attached to the anterior portion of the collar and secured via straps above the waist and at the shoulders. While the immobilization capabilities of cervical collars have been well documented in the literature, the reduction in cervical motion offered by CTO's has not been thoroughly studied.

PURPOSE: The purpose of this study was to determine the reduction in normal cervical range of motion (ROM) provided by cervical and cervicothoracic orthoses using goniometric analyses.

METHODS: Forty-two volunteers, twenty-one males and twenty-one females, representing a broad range of ages (average age 37.5, SD 10.5 years; height 67.0, SD 3.9 inches) and anatomical phenotypes were studied. No subjects with prior history of cervical injury or surgery were included. The subjects normal cervical ranges of motion in flexion, extension, lateral bending and axial rotation were measured using a CROM (cervical range of motion) goniometer and compared with the motion restriction provided by the following orthoses: *Miami J*[®] cervical collar, *Miami J*[®] cervical collar with thoracic orthosis (*Miami JTO*[™]) (Jerome Medical), Aspen[®] Cervical Collar and Aspen[®] Cervical Thoracic Orthosis (Aspen CTO[®]) (Aspen Medical Products Inc.). Each measurement was taken three times consecutively and then averaged. Each subject served as her or her own control.

RESULTS: The mean unrestricted range of motion for the forty-two subjects was 59.6 degrees of flexion, 60.0 degrees of extension, 91.4 degrees of total lateral bending (right plus left bending) and 138 degrees of total axial rotation (right plus left rotation). The unrestricted motions are considered as 100 percent of normal range of motion, and the percentages of unrestricted motion allowed by each orthosis are given in Table 1 [Figure 1].

	Flexion	Extension	Combined Flexion/Extension	Total Axial Rotation	Total Lateral Bending
Unrestricted	100	100	100	100	100
Aspen Collar	38.4	39.6	38.7	39.0	62.8
Aspen CTO	21.8	31.2	26.3	33.9*	49.5
<i>Miami J Collar</i>	14.4	27.0*	20.9	23.2	44.3
<i>Miami JTO</i>	10.2	20.7*	15.5	20.6*	39.3*

Table 1: Mean Percentages of Unrestricted Motion Allowed

Paired z-tests were used to determine statistical differences between collars for each direction of motion. Statistical significance of p<0.05 is reported for each orthosis compared to the orthosis listed directly above, except where indicated by an *, which indicates that there was no statistical difference compared to the measure above.

CONCLUSIONS: Cervical orthoses are vital components of pre-hospital emergency care and post-operative management. This study demonstrated that the cervical collar with thoracic extension enhances the immobilization of the cervical spine as compared with the cervical collar alone. The *Miami JTO*[™] was superior to the *Miami J*[®] cervical collar alone and to the Aspen[®] Cervical Collar and Aspen[®] Cervical Thoracic Orthosis (Aspen CTO[®]). The *Miami JTO*[™] demonstrated statistically superior immobilization in flexion, combined flexion/extension, total axial rotation and total lateral bending as compared to the Aspen CTO[®].

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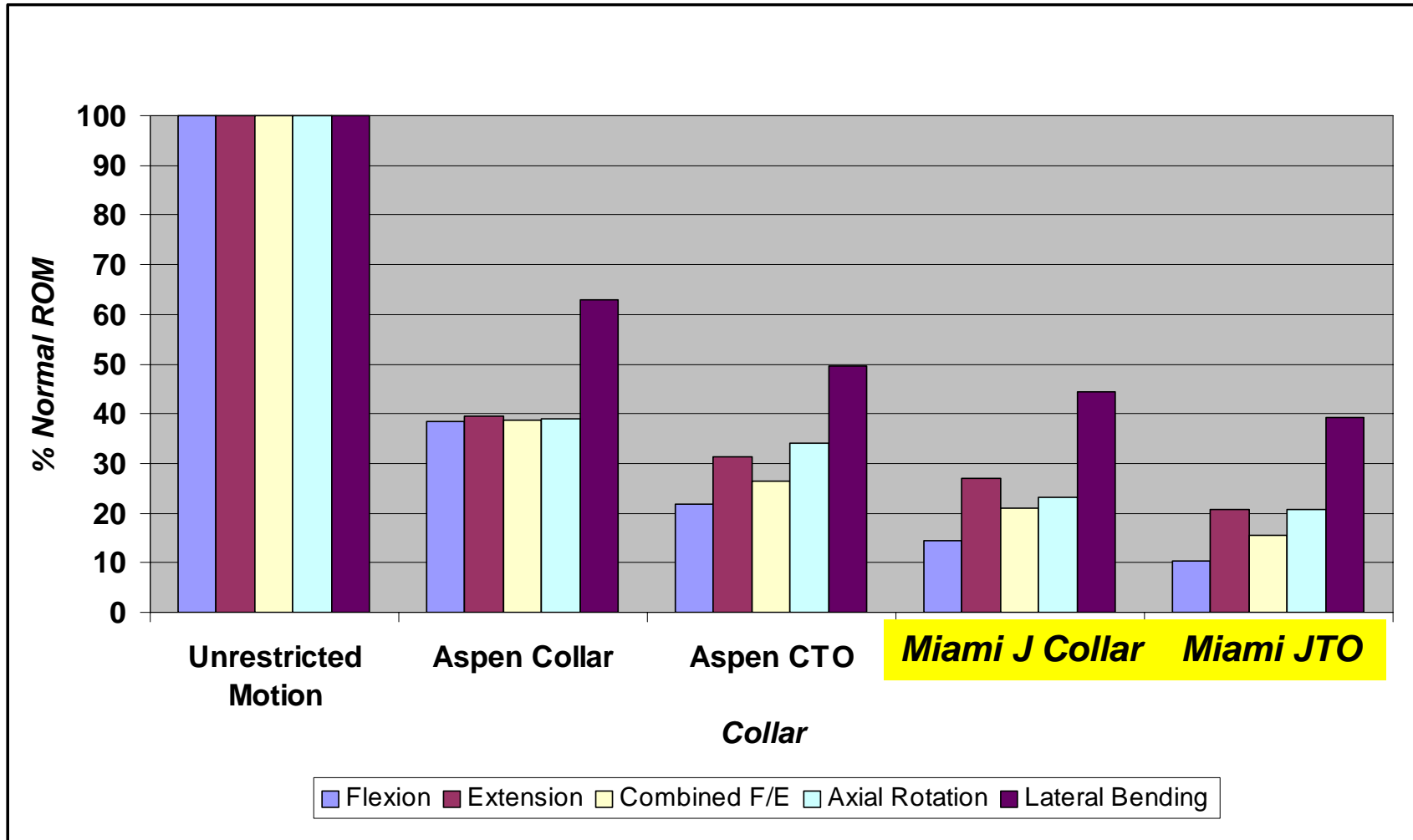


Figure 1: Mean Percentages of Unrestricted Motion Allowed (N=42)

This research has been supported in part by Jerome Medical