

■ Comparison of Three Cervical Collars in Restricting Cervical Spine Motion

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Summary

CITECH compared the immobilization effectiveness of three brands of cervical collars on 20 healthy adult volunteers. The Miami J[®] (Jerome Medical, Moorestown, New Jersey), Aspen[®] (Aspen Medical Products, Long Beach, California), and Philadelphia Original[®] (Philadelphia Cervical Collar Company, Westville, New Jersey) cervical collars were compared with respect to flexion, extension, lateral tilt and rotation of the cervical spine.

Cervical spine motion was measured with a CROM Goniometer (Performance Attainment Associates, Roseville, Minnesota), which registers the angular motion in each of three planes. Baseline range of motion was recorded for each subject with no collar. Then, the appropriate size of each collar was selected and applied, in turn, by a consultant skilled in their use. Therefore, each subject served as his/her own control. Each motion was repeated three times, and the goniometer readings were recorded and averaged. The resultant percentage of unrestricted motion was determined. The readings for all 20 subjects were compiled and the mean and standard deviations were calculated.

Results

The results show that the Miami J collar was significantly more effective than the Aspen and/or Philadelphia collar in restricting cervical spine motion in every direction. Results are summarized in Table 1 below.

Table 1: Mean Percentages of Unrestricted Motion

	Miami J	Aspen	Philadelphia
Flexion	16	33	26
Extension	27	40	40
Combined Flexion-Extension	22	37	33
Lateral Tilt	38	54	53
Rotation	19	29	32
P*	<0.001	<0.001	<0.001

*Probability that the values differ by chance (Hotellings T²)

CITECH draws no conclusions regarding the clinical application of these results.

Purpose

The purpose of this study was to goniometrically evaluate the effectiveness of three cervical orthoses in restricting cervical flexion, extension, lateral tilt and rotatory motion.

Test Methods

Twenty volunteers (7 male, 13 female, ages 19 to 64) with clinically normal cervical spines were studied. The volunteers were unaware of the identity of the sponsor (Jerome Medical). The normal and unrestricted ranges of active motion in flexion, extension, lateral tilt and rotation were measured goniometrically using a CROM Goniometer (Performance Attainment Associates, Roseville, Minnesota) in each subject and compared to the motion permitted in each of three cervical orthoses: Miami J[®] (Jerome Medical, Moorestown, New Jersey), Aspen[®] (Aspen Medical Products, Long Beach, California), and Philadelphia Original[®] (Philadelphia Collar Company, Westfield, New Jersey). Each subject served as his/her own control for the measurements. The subject was seated upright in a chair, without leaning against the seat back, arms at the sides, feet flat on floor and asked to move his/her head as far as he/she comfortably could (without moving the shoulders, thoracic and/or lumbar spine) in each direction. The average of three consecutive measurements of each individual motion was recorded for flexion, extension, lateral tilt and rotation and compared to normal values to establish efficacy of each device in restricting overall cervical spine motion. All collars were sized and applied according to manufacturer's written and videotaped instructions by a consultant skilled in their use. The largest collar that maintained neutral alignment was used. The same consultant, as observed by a CITECH investigator, took all measurements.

Study results are presented as the percentage of normal/unrestricted motion allowed by each collar in Flexion, Extension, combined Flexion/Extension, Lateral Tilt and Rotation. Descriptive statistics and multivariate analyses were performed on the data to determine if the differences in the means among the Miami J, Aspen and Philadelphia Collar were statistically significant. A Hotelling's T² value (the probability that the values differ by chance) was derived to demonstrate that mean values differed significantly at a value of P<0.001. Paired t-tests were computed to determine if there is a statistically significant difference between the means of the Aspen and Philadelphia collars. The data included all five different measures of motion.

Results

The mean range of motion for the 20 volunteers is presented in terms of degrees and percentage of normal motion in Table 2. The mean normal range of motion

for the 20 subjects is 58.5 degrees Flexion, 62.3 degrees Extension, 120.7 degrees combined Flexion/Extension, 94.2 degrees Lateral Tilt and 138.8 degrees Rotation. If these are considered 100% of normal motion, cervical collar efficacy is presented in Figure 1 in terms of percentage of normal motion allowed.

The multivariate repeated measures test revealed that the observed differences in the means of the three collars are indeed statistically significant (p<0.001) on all five measures of motion (Flexion, Extension, Combined Flexion/Extension, Lateral Tilt and Rotation). The Miami J was superior in controlling all parameters of motion when compared with the Aspen and Philadelphia orthoses. The results of the Paired Samples t-test indicate that the means for the Aspen and Philadelphia collars only differ significantly on the measure of Flexion, t=2.289. Thus, any differences in the means between these two collars is not statistically significant on the four other measures (alpha = .05).

Figure 1: Percentage of Normal Motion

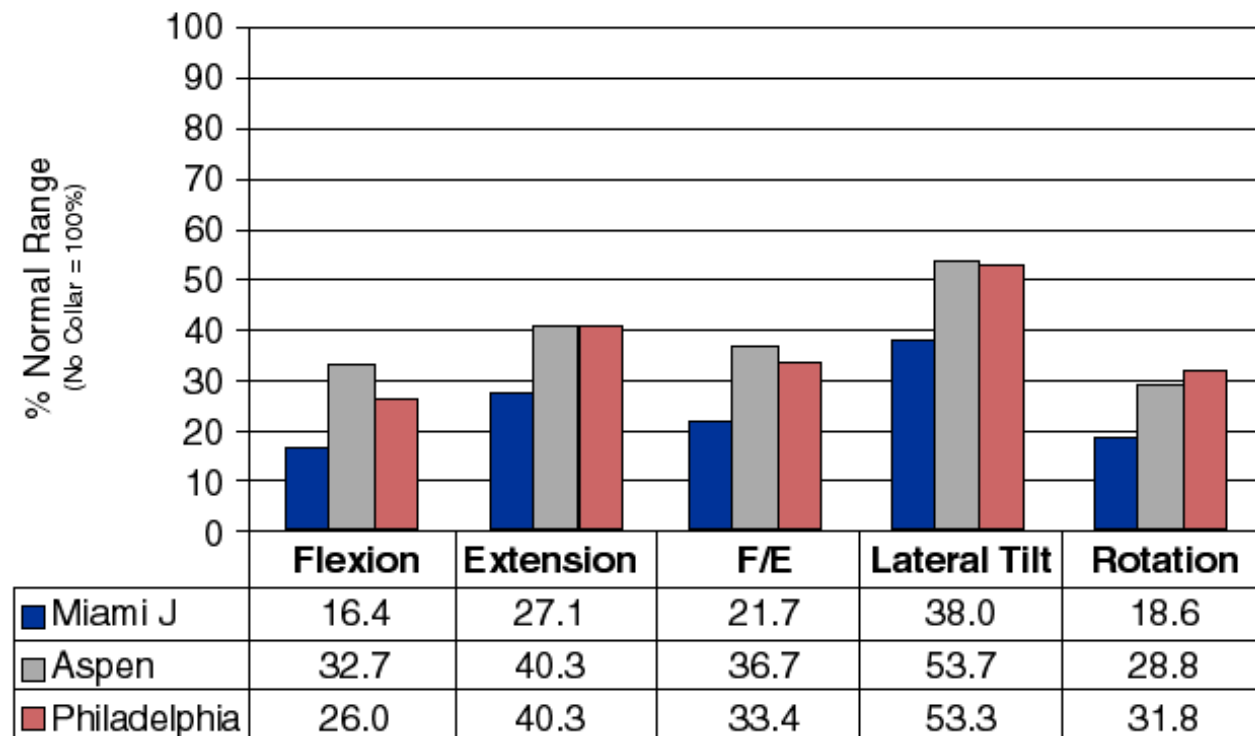


Table 2: Results (N=20)

	No Collar		Miami J		Aspen		Philadelphia	
	Mean ROM (°)	% Normal Motion	Mean ROM (°)	% Normal Motion	Mean ROM (°)	% Normal Motion	Mean ROM (°)	% Normal Motion
Flexion	58.5	100.0	9.5	16.4	18.9	32.7	15.4	26.0
Extension	62.3	100.0	16.7	27.1	25.1	40.3	25.0	40.3
Comb. Flex.-Ext.	120.7	100.0	26.2	21.7	44.0	36.7	40.4	33.4
Lateral Tilt	94.2	100.0	34.9	38.0	49.7	53.7	49.7	53.3
Rotation	138.8	100.0	25.7	18.6	39.9	28.8	43.5	31.8

Conclusion

The results show that Miami J collar provided significantly greater restriction than the other two collars in every plane of motion. They also show that the Aspen and Philadelphia collars were very similar to each other with respect to degree of restriction in every plane. Mean Extension was 27% of normal for the Miami J collar and 40% of normal for both the Aspen and Philadelphia collar. Flexion was 16% for the Miami J collar, 33% for the Aspen collar and 26% for the Philadelphia collar. Lateral Tilt was 38% of normal for the Miami J collar, compared with 54% for the Aspen and 53% for the Philadelphia collars. Mean Rotation was 19% of normal for the Miami J, 29% for the Aspen and 32% for the Philadelphia collar.

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Report approved by Robert Mosenkis, P.E., President, April 4, 2001

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