UPPER QUARTER KINETIC CHAIN RESPONSE TO CERVICAL MANIPULATION: A CASE REPORT

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ABSTRACT

Objective: The purpose of this single subject case study is to examine the relationship between cervical spine manipulation and tender points located in the upper quarter.

Clinical Features: A 45-year-old female presented with cervical spine pain and corresponding pain points in the upper quarter following a motor vehicle collision occurring 7 months prior to testing. Inclusion criteria were 22 of 22 clinically significant pain points as measured by pressure algometry.

Intervention and Outcome: High velocity/low amplitude manual manipulation was administered to areas of joint restriction in the cervical spine. Pre- and post-treatment computerized algometry readings were taken in areas of the cervical spine and upper extremities to assess change in pain over time. Algometry points were chosen based on published upper quarter tender points associated with cervical joint fixation/immobilization.

Conclusion: Following a series of 15 cervical chiropractic manipulations, the patient demonstrated a significant increase in pain tolerance related to upper quarter pain points and demonstrated by pressure algometry. These findings correlate well with the literature, indicating that cervical spine joint dysfunction should be considered globally as part of a dynamic kinetic chain involving the upper quarter. Dysfunction in one part of the kinetic chain should direct treatment to other areas of the chain. (*J Chiropr Med* 2006;5:69–71)

Key Indexing Terms: Upper Extremity; Manipulation, Chiropractic; Myofascial Pain Syndrome

INTRODUCTION

It is apparent to practitioners of manual medicine that cervical spine dysfunction occurs in our patient

population and that zygapophyseal joint fixation negatively impacts the biomechanics of cervical motion segments as well as global ranges of motion. Several authors have proposed a connection between cervical spine dysfunction and upper quarter mechanics.^{1,2} This connection has developed into a theoretical basis for examination and treatment of upper quarter kinetic chain dysfunction. A kinetic chain consists of a series of joints, muscles and bones as well as their related connective tissues, including skin, fascia, neural and muscular sheaths. These connected elements tend to function together to achieve a particular task for the individual, such as prehension or walking. These same elements also tend to dysfunction together in predictable, although complicated, patterns throughout the locomotor system.

Muscular imbalances tend to be a hallmark of kinetic chain dysfunction. As such, the dysfunctional musculature is likely to develop symptoms associated with hyper or hypotonicity. Insertional tendinopathy of the involved muscles develops areas of tenderness that can readily be palpated. Tender points along the kinetic chain appear in predictable locations and can be correlated, in general, with areas of dysfunction in the cervical spine. For example, a tender point located at the posterior arch of the atlas is an indicator of suboccipital muscle dysfunction and a tender point located at the superior angle of the scapula may be indicative of levator scapulae dysfunction.

Site selection for algometry in this study was determined by the patient presentation of hypertonicity in several cervical, cervico-thoracic, and thoracic region muscles. Site selection correlating to muscle hypertonicity was described by Lewit¹ and essentially correlates with insertion points for involved muscles. Specifically related to this case were the sternocleidomastoid, suboccipital (rectus capitis posterior minor and major), scalenus anticus, trapezius, and pectoralis minor muscles.

The use of algometry in clinical practice is well established as a valid method of determining pain

TABLE 1
ALGOMETER READINGS BEFORE TREATMENT

CUSTOM BILATERAL TEST	LEFT AVE (LB/CM ²)	RIGHT AVE (LB/CM ²)	DIFFERENCE
2ND RIB	3.2	2.6	-0.6 R
TRANSVERSE PROCESS OF ATLAS	3.3	4.1	-0.8 L
LINEA NUCHAE	3.5	3.6	-0.1 L
MEDIAL END OF CLAVICLE	1.3	2.4	-1.1 L
SCAPULA	3.8	4.4	-0.6 L
1ST RIB	2.2	2.4	-0.2 L
MEDIAL EPICONDYLE	2.5	1.7	-0.8 R
LATERAL EPICONDYLE	2.0	2.9	-0.9 L
RADIAL STYLOID	2.7	3.6	-0.9 L
SUPRA/INFRASPINATUS INS.	3.1	3.1	0
CUSTOM MIDLINE TEST	AVE (LB/CM ²)		
POSTERIOR ARCH OF ATLAS	4.3		
SPINOUS PROCESS OF AXIS	2.1		

intensity and response to treatment. Protocols established by Andrew Fischer, MD were used in the outcomes determination in this case¹. Fischer's protocol holds that a difference exceeding 2 kg/cm² (4.4 lbs) from side to side is clinically significant and indicates pathology. Additionally, pressure thresholds less than 3 kg/cm² (6.6 lb) are clinically significant. Normative data are available for Fischer's protocol; however, the predicted upper quarter kinetic chain points are not part of the normative database. Custom bilateral and custom midline tests were created to correlate with the test points.

CASE REPORT

The patient was a 45-year-old Caucasian female presenting with neck pain, headaches and bilateral arm pain that remained after a rear-end motor vehicle collision 8 months prior. The patient was a mildly-obese, cooperative female in apparent good health. In the seated position, anterior head carriage and hypertonicity of the sternocleidomastoid, suboccipital, scalene, trapezii, and pectoralis minor muscles was noted. All muscles were tender to palpation and hypertonic bilaterally. Active ranges of motion in the cervical spine were limited in 3 cardinal planes. Jackson's, foraminal compression, Valsalva and Dejerine's (straining) tests were provocative for neck pain greater on the right. Magnetic resonance imaging revealed disc herniations at C3/4, C5/6, and C6/7. A neurologic exam demonstrated that she was grossly intact for the upper quarter. Pertinent diagnoses (ICD codes in parentheses) for

this case included late effects of MVA (E929.0), cervical segmental dysfunction (739.1), cervical myofascitis (729.1), and cervical disc syndrome without myelopathy (722.0).

A Tracker computerized algometry system (Jtech Medical, Salt Lake City, UT, USA) was used to monitor a series of pain points located in the cervical spine and bilateral arms of the patient. Using Fischer' criteria, the patient was tested for pain threshold at 10 bilateral and 2 unilateral sites related to upper quarter kinetic chain dysfunction. All tests were performed using a 1 cm² algometer tip and met the criteria for test validity of less than 14% coefficient of variability. Each of the tender points was tested by pressing down with the algometer tip at approximately one (1) kilogram (2.2 lbs) per second and having the patient respond with "stop" when pain was first perceived.

Diversified style high velocity low amplitude spinal manipulation was utilized to treat the patient's cervical spine over a period of 6 weeks at 3 times per week. A total of 15 manipulations were performed during the test period of 6 weeks and all treatments were performed by the same practitioner to maintain consistency.

Tables 1 and 2 show the initial and final algometry readings, respectively. A coefficient of variation of <14% indicates validity, reproducibility, and consistency of effort. All 22 algometry tests performed met

TABLE 2
ALGOMETER READINGS AFTER TREATMENT

CUSTOM BILATERAL TEST	LEFT AVE (LB/CM ²)	RIGHT AVE (LB/CM ²)	DIFFERENCE
2ND RIB	5.7	5.9	-0.2 L
TRANSVERSE PROCESS OF ATLAS	4.7	4.7	0
LINEA NUCHAE	5.7	5.5	-0.2 R
MEDIAL END OF CLAVICLE	4.5	4.5	0
SCAPULA	7.9	7.0	-0.9 R
1ST RIB	5.1	6.0	-0.9 L
MEDIAL EPICONDYLE	6.2	7.4	-1.2 L
LATERAL EPICONDYLE	9.4	7.4	-2.0 R
RADIAL STYLOID	9.1	6.7	-2.4 R
SUPRA/INFRASPINATUS INS.	9.2	7.6	-1.6 R
CUSTOM MIDLINE TEST	AVE (LB/CM ²)		
POSTERIOR ARCH OF ATLAS	4.4		
SPINOUS PROCESS OF AXIS	4.8		

TABLE 3
ALGOMETRY TESTING OVERALL CHANGE

LOCATION	INITIAL EXAM			POST-TREATMENT EXAM			% CHANGE	
	LEFT	RIGHT	% DIFF	LEFT	RIGHT	% DIFF	LEFT	RIGHT
2ND RIB	3	3	0	6	6	0	100	100
POSTERIOR ARCH OF ATLAS		4			4			0
TRANSVERSE PROCESS OF ATLAS	3	4	25	5	5	0	67	25
LINEA NUCHAE	4	4	0	6	6	0	50	50
SPINOUS PROCESS OF AXIS		2			5			150
MEDIAL END OF CLAVICLE	1	2	50	5	5	0	400	150
SCAPULA	4	4	0	8	7	13	100	75
1ST RIB	2	2	0	5	6	17	150	200
MEDIAL EPICONDYLE	3	2	33	6	7	14	100	250
LATERAL EPICONDYLE	2	3	33	9	7	22	350	133
RADIAL STYLOID	3	4	25	9	7	22	200	75
SUPRA/INFRASPINATUS INS.	3	3	0	9	8	11	200	167

the validity criterion. As shown in Table 3, the patient experienced an increase in pain threshold as measured by algometry in 11 of 12 test points. Estimated threshold increases ranged from 25% to 400% in positive test locations. A 0% change was noted at the posterior arch of the atlas.

DISCUSSION

Faulty joint centration and articular fixation are recognized as sequelae of biomechanical kinetic chain dysfunction. The art of spinal manipulation has existed for centuries as a method of patient care; however the biomechanical model of global kinetic chain dysfunction is a relatively recent paradigm in of musculoskeletal dysfunction. Further research is needed to delineate the causative factors or "key links" in the kinetic chain model. Integration of the kinetic chain model has shown to be beneficial in the assessment and treatment of our patient population. These methods may act to assist in clinical decision making for manual practitioners performing spinal manipulative care.

Overall, algometry testing has a high level of reproducibility and validity as a subjective outcomes tool. Some difficulties encountered in the algometry method include reproducing the exact test site during re-examinations and maintaining consistency in

line-of-drive with the algometer. As with any subjective measure, pain tolerance may change on a day to day basis and be affected by a variety of factors other than the proposed treatment.

A randomized controlled trial including a greater number of participants would be necessary to create a statistical database to correlate the above findings. Utilization of these findings may help in assessing the relationship between upper extremity dysfunction and cervical spine dysfunction.

CONCLUSIONS

Testing pain sites along a kinetic chain may provide the practitioner with a valuable tool in understanding kinetic chain dysfunction. This case demonstrated a reduction in algometer readings of specific tender sites in the upper quarter kinetic chain after a course of spinal manipulation.

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