

Resolution of Cervical Complications
Secondary to Motor Vehicle Accidents
by the Application of Stereotactic Cervical
Alignment (SCALE) Methods:
Statistical Review of 54 Patients

Jack Carleton
Richard Hammond
Joseph O. Obebe
Scott Rosa
Roy Sweat
Matthew Sweat
Marty Moss

ABSTRACT. Introduction. Cervical complications secondary to motor vehicle accidents (MVA) continues to be an area where patients experience long-term complications despite having received therapy. Many of these problems relate to the delicate structures associated with the cervical spine and the precise alignment needed. We report on the findings of a specific cohort of patients from our larger multicenter study that presented

Jack Carleton, MD, is affiliated with Crystal Run Healthcare, Middletown, NY.

Richard Hammond, MD, is affiliated with Magic Valley Regional Medical Center, Twin Falls, ID.

Joseph O. Obebe, MD, FAC, is affiliated with Legacy Medical Center, Atlanta, GA and the Oconee Medical Center, Milledgeville, GA.

Scott Rosa, DC, BA, BCAA; Roy Sweat, DC, BA, BCAA; and Matthew Sweat, DC, BA, BCAA; are all on the Board of Directors of the R. W. Sweat Foundation, Atlanta, GA.

Marty Moss, PA, BS, is affiliated with MM Medical Consulting, West Monroe, LA.

Address correspondence to: Jack Carleton, MD, P.O. Box 437, Rock Hill, NY 12775 (E-mail: atlas55@hvc.rr.com).

Journal of Whiplash & Related Disorders, Vol. 5(1) 2006
Available online at <http://www.haworthpress.com/web/JWRD>

© 2006 by The Haworth Press, Inc. All rights reserved.

doi:10.1300/J180v05n01_03

specifically with MVA related complications and how these patients were successfully treated with what is defined as Stereotactic Cervical Alignment (SCALE) methods.

Method. A total of 221 patients were seen in private chiropractic practice. Inclusion criteria included existing head, neck, and shoulder pain caused by MVA. Patients who failed to complete treatment or study questionnaires were excluded. The equipment and techniques were consistent with standard SCALE methods. Patients received an average of 2.76 of treatment sessions over 11.1 weeks.

Results. Upon entry, patients had significant debilitating pain and complications from neck injuries secondary to MVA. After application of SCALE methods, 84% of the patients experienced complete or near complete resolution of their pain and other neck related complications. All patients reported significant improvements in their conditions with 53% of the patients experiencing complete recovery. Range of motion (ROM) and other measurements of cervical spine function also improved. These findings showed durability for the duration of the measured post-treatment period.

Conclusions. From these findings, it would appear that SCALE methods are a useful adjunct for treating specific types of neck injuries that are secondary to MVA. Further testing of this technique is currently underway to further determine its use in treating MVA and other spinal injuries. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2006 by The Haworth Press, Inc. All rights reserved]

KEYWORDS. Cervical complications, motor vehicle accidents (MVA), Stereotactic Cervical Alignment methods, Atlas orthogonal chiropractic therapeutics, whiplash, Clinical Study, neck pain, non-surgical treatment, Alternative Medicine

INTRODUCTION

In 2001, there were over 6,323,000 motor vehicle accidents (MVA) in the United States. These accidents resulted in 3,033,000 (1) individuals being injured. Though information pertaining to specific neck injuries is not available directly, it can be extrapolated from reports that involve smaller cohorts of accident victims in which such information was monitored. From these numbers, it can be estimated that over 1,000,000 (2) accidents involving acceleration/deceleration of the spine (whiplash

injury) are likely to occur. Other authors have made comment on the growing impact that neck related injuries associated with MVA can have on long-term patient care (3).

In recent years, progress has been made in attempting to understand the complex effect that the physical forces experienced in a MVA have on the cervical spine (4, 5). An effort to qualify these cases was the goal of the whiplash-associated disorders (WAD) classification presented by the Quebec Task Force. Additional research into the injuries of the cervical spine and their long-term complications has helped many in the medical field to have a better understanding of the pain and suffering being experienced by these patients (6, 7).

The rapid acceleration-deceleration injuries typically seen in MVA cases may cause misalignment of the cervical vertebra. The mechanisms that may cause this are easy to understand when considering the complex nature of the cervical spine. The cervical vertebral column functions as a tension (muscle contraction/tendon force)/compression (bone/cartilage) structure with each of the facets of the vertebra aligning with structures both above and below. Such alignment is in multiple linear axes as well as rotational displacement. The combination of tension forces acting in conjunction with vertebral facets and cartilage along with some degree of inertial force, create the alignment seen in the patient. However, the extreme kinetic energies [11-15 times gravity (8)] unleashed in a MVA, in both low- (9-11) and high-speed (12) accidents, may cause the individual vertebra to shift by overcoming the innate forces at rest in this tension/compression structure and thereby greatly altering the cervical alignment (13). These high G-forces (14) experienced during the accident phase (15) may injure spinal structures (16-18), leading to strains and tears of delicate spinal ligaments and tendons (19) along with displacement of individual vertebra (20). Further shifting of vertebral structures is now more likely to occur with possible impairment of tendons and ligaments (21, 22).

Patients who experience this type of cervical spine injury are likely to have significant sequella and long-term complications. The types of complaints vary, though the most common are localized and radiating neck pain, and headache (23). Other types of complications include injury to the spinal cord and vertebrae, vertebral arteries (24), neurological impairment (25), brainstem damage (26, 27), and more (28-31). Many of these patients do not return to their normal level of productivity (32) for many years (33) and a number of them later become permanently disabled (34).

Treating whiplash involves many different medical specialties. For most patients, the initial treatment contact is in the Emergency Department. Later, additional therapies may be applied at the hands of other specialists, such as Internal Medicine, Orthopedics, Neurology, and others. The most common therapeutic modalities used include NSAIDS, muscle relaxants, physical therapy, immobilization, and surgery. However, a significant number of these patients do not respond and have long-term complications and disabilities.

Much discussion has appeared in medical text in the last three decades concerning the use of general chiropractic care for patients in the clinical setting (35). A review of published reports that have been catalogued on Medline reveals numerous established trends. A number of reports involved comparison studies (36-38), carried out in various countries. These have provided positive feedback into the use of this treatment modality. Some of these reports have focused on the effectiveness of chiropractic treatment in various scenarios such as low back pain (39-42), neck pain (43), migraines (44), MVA (45), and others (46). These positive outcomes (47) along with high levels of patient satisfaction (48, 49), have lead to this treatment option being the preferred choice by many patients (50). This, in turn, has created an increased demand for chiropractic services (51, 52). Other reports have noted the cost effectiveness (53-55) of using chiropractic techniques to treat a number of clinical conditions. Elderly patients with chronic pain have benefited from this treatment modality (56).

We would like to report the findings of a specific cohort of patients that were part of our larger study to establish the clinical efficacy of using the SCALE methods of Atlas Orthogonal chiropractic therapeutics. This cohort involved patients who presented with neck and shoulder pain, along with headaches and other clinical conditions that occurred secondary to MVA.

RESULTS

A smaller cohort of patients, isolated from a larger national group, who were involved in motor vehicle accidents, was analyzed. There were 54 patients in this group. Reviewing a patient questionnaire that was used to gather subjective patient information in the pre- and post-treatment periods was inclusion criteria for this group. This included patient perceptions of pain severity and locality as well as origin and length of time from injury to time of recovery.

Objective information was obtained in both the pre- and post-treatment periods. This information consisted of a number of practitioner findings, cervical ROM measurements, and X-ray readings including a detailed calculation of spinal curvature and misalignment. The X-ray measurements were used to make the needed SCALE measurement calculations.

After the necessary treatment goals were identified, the appropriate SCALE techniques were applied with the standard Stereotactic Gantry assembly. Patients then received the necessary number of treatments over time until they completed therapy and spinal realignment was obtained as determined by X-ray verification. After completion of therapy, the patients' subjective outcomes were again recorded via questionnaire. All of the final results were sent for compilation and calculation by a third party.

The most profound finding in this focused cohort was the severity of pain perceived by the patient before entry. This was done by using a sliding scale of 1 to 10, with one representing pain free and 10 the highest level of pain. The pain scale at entry averaged 7.22 with a standard deviation of 2.4. This level of pain was considered severe and debilitating to the patient. A perception scale was generated, further delineating these findings into Mild, Moderate, and Severe pain categories. Over half (55%) presented with severe pain and, overall, 84.4% expressed having moderate or severe pain.

Objective findings were consistent for patients with cervical misalignment and reporting significant neck pain. The pre- and post-scanning palpation measurements showed the same trends as seen in the general study. In this scale, 0 is normal position of the cervical vertebrae while 3 is maximal displacement. The pre-treatment average cervical displacement was 2.8 (SD .05) and post-treatment was 0.36 (SD 0.08). These numbers represent normal to near-normal alignment. An average of 2.76 (SD 2.11) treatments were needed to achieve the desired therapeutic response in the non-chronic patient. Additional treatments were necessary in the chronic group or those that had more severe displacement.

A main component of the SCALE methods is a number of precise angular measurements that are obtained from the pre-treatment X-rays taken of the head and neck region. A number of alignment reference lines are calculated based on anatomical landmarks of the spine and head. With these reference lines in place, careful angular measurements are taken and then used to calculate current alignment status of the cervical vertebrae and their relationship to the cranium.

The five main measurements taken were the Atlas Cephalic Displacement (ACD), Atlas Horizontal Rotation (AHR), Axis Spinous angle (AxSp), Cervical Spine angle (CSz), and the Atlas Frontal Plane Line (AFP). Each of these measurements showed marked improvement from the pre- to post-treatment periods with one-third of all patients returning to full normal position. These measurements were then used to calculate the settings in the Stereotactic Gantry used to apply the SCALE treatments.

The final post-treatment measurement of patient response to therapy was expressed in the Patient Response (PR) scale. In a follow-up questionnaire, patients were asked to rate their response to therapy and alleviation of pain on a scale of 1-10, with 1 being no response and 10 being a complete return to normal and full relief from symptoms. In this cohort, the average PR scale was 9.31 with a standard deviation of 0.88.

In summary, the vast majority of patients presented with significant pain and disability. After receiving 1-4 treatments, each patient's alignment was improved as based on objective measurements. Also, patients reported significant improvement in their conditions and near complete resolution of their neck pain. A small group (14%) of patients presented as chronic types required 10 or more treatment sessions to achieve relief.

DISCUSSION

An individual cervical vertebra that is misaligned due to MVA injury may begin a process of local soft tissue inflammation that, for many, may become a chronic condition (57, 58). Tendons and muscles that are stretched beyond normal limits along with regions of cartilage that are eroded from abnormal localized compression may begin to exhibit an inflammatory reaction. The release of inflammation mediators at the cellular level causes destructive tissue reactions and, over time, severe damage. Swelling, stiffness, and calcification can become significant problems. Chronic inflammation can lead to compression of delicate nerve tissues associated with both the spinal cord and the sympathetic and parasympathetic nerve pathways and ganglion. Vertebral artery blood flow may also be altered, leading to changes in brain blood flow patterns and tissue compromise.

Current clinical treatments concentrate on two aspects of this scenario. One is palliative, treating both muscle and tendon injury with muscle relaxants and physical therapy, and the other is attempting to alter the inflammatory process and stop tissue destruction with NSAIDS and

corticosteroids. In some instances this has had success while in other instances there has been limited positive outcomes. More recent reports have shown that direct procedures aimed at correcting the misalignment through exogenous techniques can prove beneficial to patient outcome (59).

For many patients, recovery from injuries sustained during the MVA is long, tortuous, and fraught with complications. Clinicians may have difficulty in identifying those patients in the Emergency Department setting who will later be in need of additional therapy and who will not (60). The findings reported here appear to show the effectiveness of SCALE methods for treating patients with MVA-associated neck pain. The main focus of this technique is to directly restore any misalignment that has occurred during the initial accident injury phase and thereby halting the inflammatory response. With chronic inflammation halted, secondary injury may be averted and long-term sequela ameliorated.

CONCLUSION

This report of the early findings of the SCALE techniques of the Atlas Orthogonal Chiropractic specialists in treating neck injury has shown promise. Patients presenting with head, neck, and shoulder pain secondary to MVA achieved significant relief when treated over a short period of time. These same patients showed marked improvement in their symptoms and, some of them had complete resolution of their pain. Additional studies are needed to further add weight to this treatment modality as a possible method in relieving long-term sequela secondary to MVA.

REFERENCES

1. The National Highway Traffic Safety Administration is pleased to present its Traffic Safety Facts 2001: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System.
2. Sterner Y, Toolanen G, Gerdle B, Hildingsson C: The incidence of whiplash trauma and the effects of different factors on recovery, *J Spinal Disord Tech*, 2003; 16(2):195-199.
3. Larsen LB, Holm R: Prolonged neck pain following automobile accidents. Gender and age related risk calculated on basis of data from an emergency department, *Ugeskr Laeger*, 2000;162(11):1580.
4. Stemper BD, Yoganandan N, Pintar FA: Kinetics of the head-neck complex in low-speed rear impact, *Biomed Sci Instrum*, 2003;39:245-250.

5. Tencer AF, Mirza S, Bense K: Internal loads in the cervical spine during motor vehicle rear-end impacts: the effect of acceleration and head-to-head restraint proximity, *Spine*, 2002;27(1):34-42.
6. Virani SN, Ferrari R, Russell AS: Physician resistance to the late whiplash syndrome, *J Rheumatol*, 2001;28(9):2096-2099.
7. Schmidt G: Biomechanics of whiplash injuries of the cervical spine, *Versicherungsmedizin*, 1989;41(4):121-126.
8. Kallieris D, Mattern R, Wismans J: Stress and kinematic analysis of the head and neck in frontal collision. A comparison of voluntary probands and postmortem human test cadavers, *Beitr Gerichl Med*, 1989;47:235-241.
9. Castro WH, Schilgen M, Meyer S, Weber M, Peuker C, Wortler K: Do "whiplash injuries" occur in low-speed rear impacts?, *Eur Spine J*, 1997;6(6):366-375.
10. Walz F: Biomechanical aspects of injuries of the cervical vertebrae, *Orthopade*, 1994;23(4):262-267.
11. Walz F, Meine J: Biomechanical aspects of cervical trauma, *Z Unfallchir Versicherungsmed*, 1994;87(2):71-85.
12. Maeda H, Higuchi T, Imura M, Noguchi K, Yokota M: Ring fracture of the base of the skull and atlanto-occipital avulsion due to anteroflexion on motorcycle riders in a head-on collision accident, *Med Sci Law*, 1993;33(3):266-269.
13. Shkrum MJ, Green RN, Nowak ES: Upper cervical trauma in motor vehicle collisions, *J Forensic Sci*, 1989;34(2):381-390.
14. Ullrich D: Physical and biomechanical aspects of cervical vertebrae dislocation syndrome, *Laryngorhinootologie*, 2001;80(8):478-482.
15. Gentle CR, Golinski WZ, Heitplatz F: Computational studies of 'whiplash' injuries, *Proc Inst Mech Eng [H]*, 2001;215(2):181-189.
16. Bogduk N, Yoganandan N: Biomechanics of the cervical spine Part 3: minor injuries, *Clin Biomech (Bristol, Avon)*, 2001;16(10):930-933.
17. Lonnberg F: Whiplash. Epidemiology, diagnosis and treatment, *Ugeskr Laeger*, 2001;163(16):2231-2236.
18. Kaneoka K, Ono K, Inami S, Hayashi K: Motion analysis of cervical vertebrae during whiplash loading, *Spine*, 1999;24(8):763-769; discussion 770.
19. Brault JR, Siegmund GP, Wheeler JB: Cervical muscle response during whiplash: evidence of a lengthening muscle contraction, *Clin Biomech (Bristol, Avon)*, 2000;15(6):426-435.
20. Yoshida H, Tsutsumi S: Experimental analysis of a new flexible neck model for low-speed rear-end collisions, *Accid Anal Prev*, 2001;33(3):305-312.
21. Grob D, Panjabi M, et al.: The unstable spine—an "in vitro" and "in vivo study" on better understanding of clinical instability, *Orthopade*, 1994;23(4):291-298.
22. Davis CG: Rear-end impacts: vehicle and occupant response, *J Manipulative Physiol Ther*, 2000;23(1):62-64.
23. Bunkertorp L, Nordholm L, Carlsson J: A descriptive analysis of disorders in patients 17 years following motor vehicle accidents, *Eur Spine J*, 2002;11(3):227-234. Epub 2002 Apr 05.
24. Wiesner H, Mumenthaler M: Whiplash injuries of the cervical spine. A catamnestic study, *Arch Orthop Unfallchir* 1975;81(1):13-36.

25. Keidel M, Yaguez L, Wilhelm H, Diener HC: Prospective follow-up of neuro-psychological deficits after cervicocephalic acceleration trauma, *Nervenarzt*, 1992; 63(12):731-740.
26. Bamford CR, Pond GD: Brainstem infarct following cervical hyperextension and axial loading sustained in an automobile accident, *Ariz Med*, 1982;39(2):105-106.
27. Narakas AO: Injuries of the brachial plexus and neighboring peripheral nerves in vertebral fractures and other trauma of the cervical spine, *Orthopade*, 1987; 16(1):81-86.
28. Fisher CM: Whiplash amnesia, *Neurology*, 1982;32(6):667-668.
29. Helliwell M, Robertson JC, Todd GB, Lobb M: Bilateral vocal cord paralysis due to whiplash injury, *Br Med J (Clin Res Ed)*, 1984;288(6434):1876-1877.
30. Burke JP, Orton HP, West J, Strachan IM, Hockey MS, Ferguson DG: Whiplash and its effect on the visual system, *Graefes Arch Clin Exp Ophthalmol*, 1992;230(4): 335-339.
31. Capurso U, Perillo L, Ferro A: Cervical trauma in the pathogenesis of craniocervico-mandibular dysfunctions, *Minerva Stomatol*, 1992;41(1-2):5-12.
32. Selecki BR: Whiplash. A specialist's view, *Aust Fam Physician*, 1984;13(4): 243-247.
33. Radanov BP, Sturzenegger M, Di Stefano G: Long-term outcome after whiplash injury. A 2-year follow-up considering features of injury mechanism and somatic, radiologic, and psychosocial findings, *Medicine (Baltimore)*, 1995;74(5):281-297.
34. Norris SH, Watt I: The prognosis of neck injuries resulting from rear-end vehicle collisions, *J Bone Joint Surg Br*, 1983;65(5):608-611.
35. Hurwitz EL, Coulter ID, Adams AH, Genovese BJ, Shekelle PG: Use of chiropractic services from 1985 through 1991 in the United States and Canada, *Am J Public Health*. 1998;88(5):771-776.
36. Hurwitz EL, Morgenstern H, et al.: A randomized trial of chiropractic manipulation and mobilization for patients with neck pain: clinical outcomes from the UCLA neck-pain study, *Am J Public Health*, 2002;92(10):1634-1641.
37. Harvey E, Burton AK, Moffett JK, Breen A: UK BEAM trial team., Spinal manipulation for low-back pain: a treatment package agreed to by the UK chiropractic, osteopathy and physiotherapy professional associations, *Man Ther*, 2003;8(1):46-51.
38. Hurwitz EL, Morgenstern H, et al.: A randomized trial of medical care with and without physical therapy and chiropractic care with and without physical modalities for patients with low back pain: 6-month follow-up outcomes from the UCLA low back pain study, *Spine*, 2002;27(20):2193-2204.
39. Skargren EL, Oberg BE, Carlsson PG, Gade M: Cost and effectiveness analysis of chiropractic and physiotherapy treatment for low back and neck pain. Six-month follow-up, *Spine*, 1997;22(18):2167-2177.
40. Meade TW, Dyer S, Browne W, Townsend J, Frank AO: Low back pain of mechanical origin: randomised comparison of chiropractic and hospital outpatient treatment, *BMJ*, 1990;300(6737):1431-1437.
41. Lall M: Chiropractic management of back pain, *Aust Fam Physician*, 1983;12(5):355-358.

42. Meade TW, Dyer S, Browne W, Frank AO: Randomised comparison of chiropractic and hospital outpatient management for low back pain: results from extended follow up, *BMJ*, 1995;311(7001):349-351.
43. Jordan A, Bendix T, Nielsen H, Hansen FR, Host D, Winkel A: Intensive training, physiotherapy, or manipulation for patients with chronic neck pain. A prospective, single-blinded, randomized clinical trial, *Spine*, 1998;23(3):311-318; discussion 319.
44. Parker GB, Tupling H, Pryor DS: A controlled trial of cervical manipulation of migraine, *Aust N Z J Med*, 1978;8(6):589-593.
45. Woodward MN, Cook JC, Gargan MF, Bannister GC: Chiropractic treatment of chronic 'whiplash' injuries, *Injury*, 1996;27(9):643-645.
46. Moser MH, Ranacher GR: Medical fitness examination of commercial pilots: new criteria for evaluation of vestibular tests, *Aviat Space Environ Med*, 1982;53(12):1215-1219.
47. Nyiendo J, Haldeman S: A prospective study of 2,000 patients attending a chiropractic college teaching clinic, *Med Care*, 1987;25(6):516-527.
48. Hansen JP, Futch DB: Chiropractic services in a staff model HMO: utilization and satisfaction, *HMO Pract*, 1997;11(1):39-42.
49. Parker G, Tupling H: The chiropractic patient: psychosocial aspects, *Med J Aust*, 1976;2(10):373-378.
50. Northcott HC, Bachynsky JA: Concurrent utilization of chiropractic, prescription medicines, nonprescription medicines and alternative health care, *Soc Sci Med*, 1993;37(3):431-435.
51. Stano M, Ehrhart J, Allenburg TJ: The growing role of chiropractic in health care delivery, *J Am Health Policy*, 1992;2(6):39-45.
52. Shekelle PG, Brook RH: A community-based study of the use of chiropractic services, *Am J Public Health*, 1991;81(4):439-442.
53. Stano M, Smith M: Chiropractic and medical costs of low back care, *Med Care*, 1996;34(3):191-204.
54. Jarvis KB, Phillips RB, Morris EK: Cost per case comparison of back injury claims of chiropractic versus medical management for conditions with identical diagnostic codes, *J Occup Med*, 1991;33(8):847-852.
55. Jay TC, Jones SL, Coe N, Breen AC: A chiropractic service arrangement for musculoskeletal complaints in industry: a pilot study, *Occup Med (Lond)*, 1998;48(6):389-395.
56. Hawk C, Long CR, Boulanger KT, Morschhauser E, Fuhr AW: Chiropractic care for patients aged 55 years and older: report from a practice-based research program, *J Am Geriatr Soc*, 2000;48(5):534-545.
57. Hohl M: Soft tissue injuries of the neck, *Clin Orthop*, 1975;(109):42-49.
58. Maimaris C, Barnes MR, Allen MI: 'Whiplash injuries' of the neck: a retrospective study, *Injury*, 1988;19(6):393-396.
59. Kessinger RC, Boneva DV: Case study: acceleration/deceleration injury with angular Kyphosis, *J Manipulative Physiol Ther*, 2000;23(4):279-287.
60. Suissa S, Harder S, Veilleux M: The relation between initial symptoms and signs and the prognosis of whiplash, *Eur Spine J*, 2001;10(1):44-49.