Original Article

Neck Pain, Neck Mobility and Alignment of Cervical Spine in 30 Patients with Cervical Strain

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ABSTRACT

Background: Neck pain due to acute and repetitive neck injuries is a common complaint in the general population. Functional assessment of cervical spine by measurement of cervical range of movements (CROM) is informative and beneficial for planning proper treatment of patients with cervical strain. Muscle spasm is the widely used explanation for straightening and reversal of cervical lordosis commonly seen after trauma, but more specific interpretation is not supported in the literature.

Objective: To evaluate the intensity of neck pain, the mobility of cervical spine and the cervical curve in patients with chronic cervical strain.

Methods: Semiquantitative ordinal scale was used for evaluation of the severity of neck pain. Assessment of cervical movements was performed using cervical gonimeter with three separate inclinometers, measuring the movements in frontal, sagittal and horizontal planes. Two line Cobb method was used to determine the angle of cervical curve on lateral cervical radiographs.

Results: Significant reduction of total active CROM was found in patients with cervical strain with predominantly restricted neck extension followed by neck flexion, lateral flexion and to a lesser extent rotation. No significant difference was found in the prevalence of lordotic, straight and kyphotic curves in the group of patients with cervical strain compared to those in the control group.

Conclusion: In our study, the existence of CROM limitation in cervical strain patients did not show a different than normal distribution of lordotic, straight and kyphotic cervical spine on radiographic images established by Cobb method.

KEYWORDS: alignment of cervical spine, cervical range of movements, neck injuries

INTRODUCTION

Neck pain is common in the general population. Almost 85 % of neck pain results from acute or repetitive neck injuries or chronic stress and strain[1]. Most patients with acute neck pain in the absence of fracture or radicular symptoms are thought to have sprains and strains of the cervical tissues. A sprain is an indirect injury to the ligament, whereas a strain is an indirect injury to a muscle. In most instances, it is very difficult to distinguish whether muscles or ligaments are injured even with the use of MRI. However, treatment approach in the early period is similar for both sprains and strains, and it is therefore, not critical to make the distinction between the two diagnoses early in the course of the disease.

A cervical strain is produced by an overload injury to the muscle-tendon unit by forces on the cervical spine with lesser intensity when compared to the major force in whiplash injury. Along with elongation and minor tearing of muscles or ligaments, secondary edema, hemorrhage and inflammation may occur. Many cervical muscles do not terminate in tendons, but instead attach directly to bone by myofacial tissue that blends into the periosteum[2]. The response of the muscle to injury is contraction with recruitment of secondary muscles in an attempt to splint the injured muscle. Myofacial pain syndrome may develop when unproven primary myofacial trigger points begin after a muscular strain, which becomes a primary site of sensitized nerves with altered metabolism. Active trigger points are believed to cause pain whereas latent trigger points are said to restrict range of motion and produce weakness of the affected muscle with the patient unaware of the tender area until the examination. Latent trigger points may persist for years after patient recovers from injury and may become active and create acute pain in response to minor overstretching, overuse or chilling of the muscle[3,4].

With the current scientific trend toward evidence based health care practice, it is essential that reliable and valid methods are used to evaluate the cervical spine and measure the outcome of treatment[5]. Cervical range of motion (CROM) is a useful parameter to determine the level of function, establish treatment plan, monitor the patient's progress and provide feedback on the effectiveness of therapeutic interventions[6-11].

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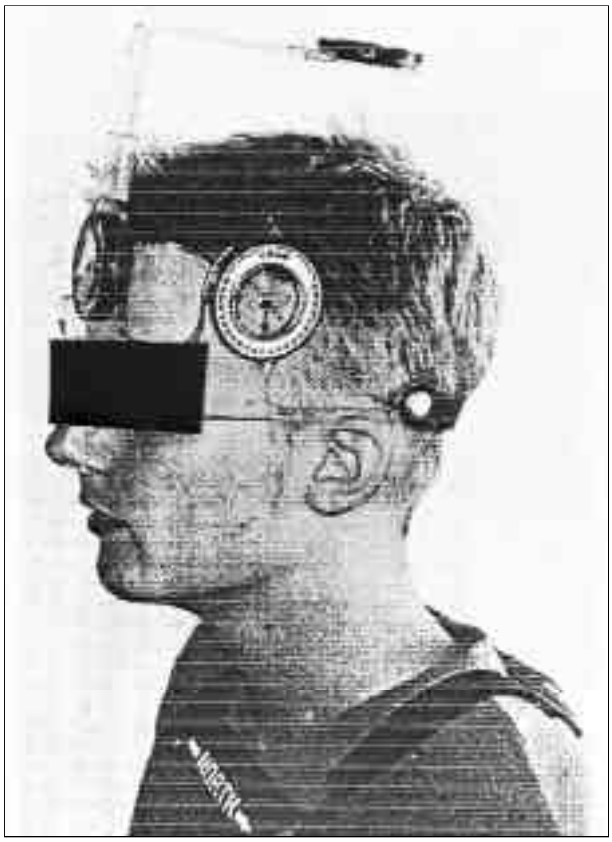

Fig. 1: Cervical range of motion (CROM) Goniometer

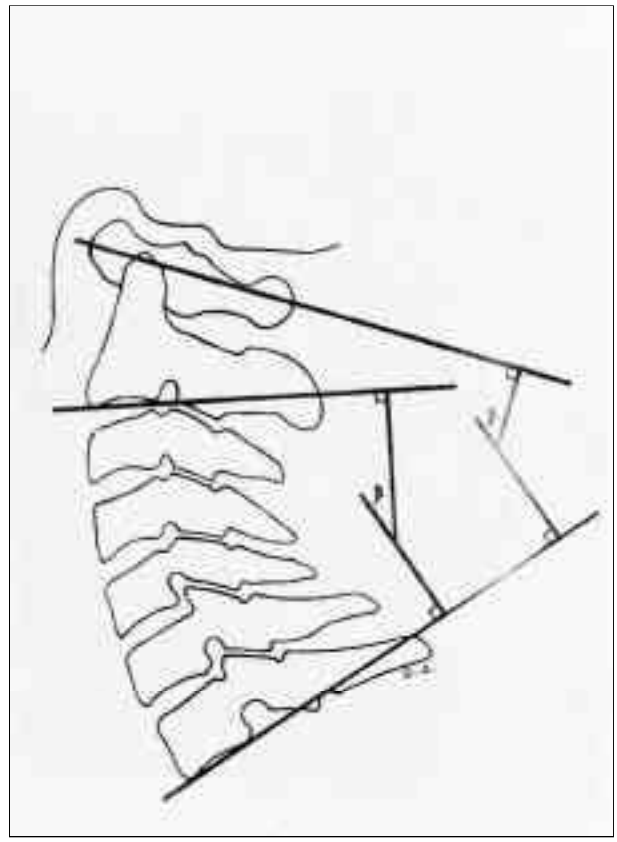

Fig. 2: Method of measurement for the sagittal curve angle (β) from C1 to C7 and from C2 to C7

Recently, configuration of the sagittal spinal curve has re-emerged as an important outcome measure of healthcare[12,13]. Some authors report that loss of cervical lordosis and angular kyphosis seen in patients with whiplash injury suggests pathological muscle spasm and/or disco-ligamentous injury and these factors indicate a poor prognosis[13,14], while others suggest that these findings are normal variations with no pathological significance[15,16]

The aim of the current study was to:

1) evaluate the mobility of cervical spine in patients with cervical strains.
2) evaluate the intensity of neck pain
3) measure the cervical curve on lateral cervical spine radiographs.

PATIENTS AND METHODS

Thirty patients with cervical strain attending the out-patient clinic of the Physical Medicine and Rehabilitation Hospital were enrolled in the study. Entry criteria were: neck pain following indirect trauma, duration of neck pain more than one month, and adult patients aged 40 years or below. Patients with fractures and or dislocation of cervical spine, advanced spondylotic changes on radiographs (grade 3 & grade 4 according to Kellgren and Lawrence classification)[17], patients with inflammatory disorders affecting the cervical spine (eg. Rheumatoid arthritis), patients with radicular symptoms, postoperative pain and tumors were excluded from the study. Instability of cervical spine and disc herniations were ruled out by dynamic cervical radiographs and MRI study. Eighteen patients were female and 12 were male with ages ranging from 22 to 51 years (mean age 32.5 years). The duration of neck pain was one to six months (mean pain duration 2.6 months). Most patients related an activity that they think precipitated the onset of pain (lifting or pulling heavy objects, unusual upper extremity work such as painting a room, an awkward sleeping position, prolonged static postures and an increased time working on computer. Seven patients had automobile associated injury in the past. Control group consisted of 30 subjects (16 females and 14 males) with a mean age of 30 years (range 20 to 48 years). They were attending OPD for knee pain (meniscal injuries, strain of collateral ligaments, osteoarthritis of the knee joint) and had no history or present complaint of neck pain.

CROM was measured using cervical goniometer. (Performance Attainment Associates Roseville, MN) (Fig. 1) with three separate inclinometers. These inclinometers are attached to a frame resembling eye glasses: one in the frontal

plane for flexion and extension, a second in the frontal plane for lateral flexion, and a third in the horizontal plane for rotation. Two of these inclinometer have gravity- dependent needle (for the sagittal and frontal planes respectively), and the other has a magnetic needle (for the horizontal plane). The inclinometer is marked in 2º increments.

Assessment of active CROM was performed by one and the same physiatrist (specialist in physical medicine and rehabilitation) with the subject occupying a comfortable chair in a room kept at a temperature between 20 and 27º C. Neck flexion and extension were performed as forward-backward movements with the temporo-mandibular joint in the neutral position. During lateral flexion participants were instructed to look at a particular spot situated in front of them while bending the neck successively to the right and left. They were instructed to follow a horizontal line in front of them from a neutral position to the right and then left.

The overall cervical lordosis was measured on cervical radiographs by the same experienced radiologist and physiatrist using standard procedure[18,19]. C2- C7 measurement was obtained by joining perpendiculars to lines drawn parallel to the inferior end plates of C2 and C7 (Fig. 2). The angle between them was measured using a standard protractor. If the C7 vertebra was not well visualized on the lateral film, inferior plate of C6 was used. The curve pattern was classified into three categories, namely, lordotic, straight and kyphotic.

Patients were asked to move their head in the most affected direction and score the intensity of pain. Motion related pain was scored using semiquantitative ordinal scale: (1) absence of pain (2) light pain (3) moderate pain and (4) severe pain.

Mean and standard deviations of the measured cervical flexion, extension, lateral flexion and rotation were calculated for each group. The significance of the difference in the percentages of patients with lordotic, straight and kyphotic cervical curve in the two groups was determined by two-tailed Student's Z-test. Differences in the percentages of patients with lordotic, straight and kyphotic cervical curve in the two groups were calculated using z-test. Significance was accepted for both methods at $p < 0.05$ levels.

RESULTS

The intensity of the motion related pain in patients with cervical strain was three and four indicating moderate to severe pain. Physical examination revealed myofacial trigger points mainly in trapezius (30 patients), splenius capitis (12 patients), sternocleidomastoideus muscle (10 patients), paravertebral (28 patients) and scaleni muscles (four patients). Five patients gave history of automobile associated injury, describing an accident in which they were either the driver or front seat passenger in a vehicle stopped in traffic when their vehicle was unexpectedly struck from the rear by another vehicle travelling at low to moderate speed. Two patients had a history of car accident in the past.

Table 1
Neck mobility in patients with cervical strain and patients with knee pain (Control group)

	Cervical strain	Knee pain (control)	Mean difference	P value
Total CROM	319. 9 ± 60.8	357.9 ± 71.7	- 35.0	0.002
Extension	62.9 ± 15.8	70.8 ± 17.0	- 7.9	0.009
Flexion	49.2 ± 11.8	57.1 ± 10.3	- 4.9	0.04
Lateral flexion	40.2 ± 10.2	43.9 ± 7.0	- 3.7	0.002
Rotation	63.7 ± 12.5	70.8 ± 9.9	- 7.7	0.002

Table 2
Mean angle of cervical curve (in degrees) for lordotic, straight and kyphotic curves in the group with cervical strain and the control group.

	Cervical strain	Knee pain (control group)
Lordotic	22.3 ± 4.5	24.8 ± 5.5
Straight	6.8 ± 5.4	7.9 ± 4.0
Kyphotic	-9.2 ± 3.8	-10.2 ± 2.8

Table 3
Number (percentage) of patients with lordotic, straight and kyphotic curves in the groups with cervical strain and the control group

	Cervical strain n(%)	Knee pain (control group) n(%)	p-Value
Lordotic	16 (53)	19 (63)	P> 0.05
Straight	10 (34)	9 (30)	P> 0.05
Kyphotic	4 (13)	2 (7)	P> 0.05

The total active CROM was significantly lower in the group of patients with cervical strain (Table 1). The most restricted movement was neck extension, which was reduced by 2.9º, followed by neck flexion reduced by 4.9º. Combined left and right lateral flexion was restricted by 3.7º and combined left and right rotation by 7.4º.

The results from the measurements of cervical curve Cobb angles are shown in Table 2. No difference was found between the prevalence of lordotic, straight and kyphotic curves in the both groups (p value > 0.05) (Table 3).

DISCUSSION

In most cases, cervical disorders alter the normal range of motion (ROM)[20]. The techniques available for the analysis of cervical spine motion include radiographic methods as well as external measuring devices. Various external measurement devices have been developed for spine motion evaluation. These tools range from simple devices that measure maximal motion range in one plane to much more complex machines that provide almost continuous monitoring of three dimensional motion of the spine. Previous studies proved very good validity and intra and inter-rater reliability of the device used in this study for measurement of cervical movements[6,20,21,22].

We found significant reduction of total ROM in patients with cervical strain and greater reduction of movements in the sagittal plane as compared to movements in horizontal and frontal plane. The findings are similar to the results reported for patients in first three months following whiplash injury using the same device[23].

The measurement method had excellent agreement with intra-class correlation coefficient of 0.95 and an inter-examiner measurement error of 8.8º.

Cervical curvature has been considered to be normally lordotic, similar to thoracic kyphosis. The cervical lordosis can be considered a primary curve, because it is formed at approximately 10 weeks of fetal development. Cervical lordosis is due to posterior wedging of the cervical discs and is necessary for the development of the joints of Luschka and for the proper spinal coupling. Thus, measurement of the sagittal spinal curve is of interest. Several methods have been developed for measurement of overall lordosis and inter-segmental angles[24,25,26]. The average range of overall lordosis using different methods varies from 21-34 degrees in normal subjects. In literature, the Cobb angle analysis has been the method of choice for measurement of overall lordosis and kyphosis of the sagittal curves on lateral radiographs. Good to high intra-class coefficients are reported for Cobb angle analysis for inter- and intra-examiner reliability[18,19].

The measurements of cervical lordosis using two-line Cobb method in this study are in accordance with previous reports[19].

Noris et al[13] stated that non-lordotic curvature of cervical spine in whiplash injury patients suggested muscle spasm caused by pain after injury and that it was associated with poor patients prognosis. Hohl et al[14] reported that angular kyphosis suggested disco- ligamentous injury. On the other hand, non- lordosis and angular kyphosis have been reported to be often observed in the normal population[16,28]. Helliwell *et al*[27] studied the cervical curvature of patients with acute neck pain, those with chronic neck pain and a normal population and they noted that there was no significant difference in the prevalence of straight cervical spine between the patients with acute neck pain and chronic neck pain. The normal population showed a straight cervical spine more frequently than did those with neck pain. They attributed this result to the variations in radiographic positioning of cervical spine. In a large number of patients with whiplash injury and control subjects, Matsumoto[28] found no difference in the prevalence of non-lordotic curvature/or angular kyphosis and concluded that these patterns of cervical curve constitute normal variants rather than pathological findings.

In this study no significant difference was found in the prevalence of the lordotic, straight and kyphotic curve in patients with chronic cervical strains as compared to the control group, suggesting that non-lordotic cervical curvatures might constitute normal variants rather than pathological findings. The small number of subjects in the two groups haven't allowed stratification by age and gender, which might be related to the cervical curvature.

Our results show that the existence of ROM limitations in cervical strain patients is not associated with other than normal distribution of lordotic, straight and kyphotic spine on radiographic images established by the Cobb method. Further studies are needed to improve understanding of the basic biomechanics and pathophysiology of soft tissue disorders to enhance the physician's ability to diagnose accurately and to determine the efficacy of various common treatments.

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