ORIGINAL RESEARCH

The Relationship Between Cervical Kyphosis and Idiopathic Scoliosis

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ABSTRACT

Objective: To specifically address cervical spine alterations in scoliotic patients.

Methods: In this study we examined the radiographs of 46 patients diagnosed with idiopathic scoliosis. Measurements included the degree of cervical lordosis and the amount of scoliosis measured by Cobb's angle.

Results: The average age of all patients was 31 years. Statistical analysis revealed that patients with a scoliosis above 30° were statistically significantly more likely to have a cervical kyphosis than control patients, as well as patients with scoliosis less than 30°.

Conclusion: Patients with idiopathic scoliosis greater than 30° displayed a higher trend towards cervical kyphosis than scoliosis populations with a Cobb angle less than 30°. It may be possible that the abnormal biomechanics associated with cervical kyphotic malalignment plays a role in the progression of idiopathic scoliosis.

Key Words: *Chiropractic, scoliosis, cervical kyphosis, Pettibon technique, x-ray*

Introduction

Sagittal spine alignment is gaining attention in the literature in terms of both conventional and complementary and alternative (CAM) treatments for patients with scoliosis. Rigo et al[1] propose that sagittal malalignment of the thoracolumbar spine is associated with the progression of scoliosis rather than being a causative factor.

Whether or not sagittal malalignment is a causative or exacerbating factor, there does seem to be a certain level of consensus that the sagittal spine must be examined in all instances of idiopathic scoliosis.[2-7] Scoliosis patients tend to display alterations in sagittal spine alignment, such as flatback deformity[8], and lumbar hyperlordosis.[9]

However, when referring to sagittal spine alignment, all of the above studies discuss only the thoracic or lumbopelvic spinal regions. The cervical spine is omitted from the equation. An alteration in the normal sagittal cervical spine has been associated with whiplash injuries[10-12], headaches[13-15], neck pain[14,16-19], disc degeneration following cervical fusion[20], and in one case ADD/ADHD.[21]

From a surgical standpoint, the development of a cervical kyphosis postoperatively may cause myelopathy, debilitating postural deformity, and intractable pain.[22] To sum up the nature of cervical kyphosis, Steinmetz et al state:

"*Cervical kyphosis is biomechanically unfavorable for the cervical musculature and other supporting structures. Further, an often excessive, accelerated degeneration of adjacent cervical intervertebral discs may occur, which also contributes to pain. In advanced cases of cervical kyphosis, forward vision, swallowing, and respiration may be adversely affected. Cervical kyphosis, in general, is undesirable. The greater the deformity, the greater the probability of developing an associated neurological deficit or chronic pain. For the aforementioned reasons, we condone an aggressive approach to cervical kyphosis correction in patients with prior cervical surgery who experience symptoms of pain, compressive myelopathy, and/or radiculopathy.*"[23]

Their statements are echoed by Ferch et al[24], who found that correction of cervical kyphosis may promote faster recovery in spinal cord injury patients. The cervical spine's structural configuration in scoliosis cases has been largely unreported in the peer reviewed literature.

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In this study, we evaluated the radiographs of 46 patients who presented to two chiropractic offices for scoliosis treatment. We hypothesize that patients with scoliosis commonly display cervical kyphotic malalignment.

Methods

The radiographs of 46 patients were consecutively selected from two chiropractic clinics. All selected patients had HIPAA approved consent forms on file at the respective clinics, obtained by each clinic's HIPAA compliance officer. Patients were selected based on the following criteria: evidence of a scoliosis greater than 10° Cobb angle, scoliosis cannot be of a neuromuscular type, and scoliosis cannot be secondary to prior surgical intervention or neck pain as a primary symptom.

The amount of cervical lordosis was measured from C2-C7 on the lateral cervical radiograph of each patient, as well as the degree of scoliosis measured by the Cobb method on anteroposterior radiographs.

We utilized the posterior tangent method[25] so that each segment could be evaluated. Based upon this measurement, the cervical lordosis of each patient was categorized into one of two general alignments: lordotic or kyphotic. If two or more vertebral segments maintained a kyphotic alignment, while some maintained a lordotic alignment, the overall alignment was considered kyphotic.

Results

The average age of all patients was 31 years old, with a range of 10-72 years. Qualitative alignment, as well as presence of scoliosis, gender, and age was collected for statistical comparison. Paired t-tests were performed to identify any association between variables. See Table 1.

The incidence of cervical kyphosis was compared to the presence of scoliosis below 30° and above 30°. There was a statistically significant association between the presence of cervical kyphosis and scoliosis above 30°, as well as one between the female gender and scoliosis above 30° ($P<.05$).

A total of 17 patients had a Cobb angle above 30°, while 29 had a Cobb angle below 30°. Of the 17 patients above 30°, 15 of the 17 patients displayed a cervical kyphosis (88%), while 16 of the 29 (55%) had a cervical kyphosis.

Discussion

Previous authors have identified associations between scoliosis and altered sagittal profile. Although this is usually illustrated in the thoracic and lumbar regions, we could find no published studies to date to suggest that altered sagittal cervical spine alignment may be associated with scoliosis.

Given that the head and cervical spine play a very important role in balance and posture control[26], alterations in their structure or biomechanical function may impede normal somatosensory afferent input into the cerebellum. This may be one of the reasons that scoliosis patients tend to display deficits in balance and coordination.[27]

The authors of this study utilized sectional radiography instead of full-spine imaging to minimize the effects of positional distortion on radiograph.[28] We used the Pettibon system of patient placement to minimize measurement error.[29] Because there were only two categories for patients based on cervical spine configuration, those patients with Cobb angles close to 30° could have been put into the other category by different observers. Therefore, those patients who display Cobb angles close to 30° might have been more closely and critically evaluated.

It is unknown how the relationship between cervical kyphosis and scoliosis above 30° would have been affected had it been compared to the incidence of cervical kyphosis in an asymptomatic control group, since no controls were studied here. Secondly, cervical kyphosis was not broken down into segmental and global kyphosis. How these specific types of kyphosis would relate to scoliosis above 30° will be further investigated in future studies. Finally, risk of progression was not accounted for in our present patient population. This step, to be performed in future studies, may better identify the biomechanical impact of cervical kyphosis on patients with moderate to severe scoliosis.

Conclusions

Patients with idiopathic scoliosis greater than 30° displayed a higher trend towards cervical kyphosis than scoliosis populations with a Cobb angle less than 30°. It may be possible that the abnormal biomechanics associated with cervical kyphotic malalignment plays a role in the progression of idiopathic scoliosis. It is unknown from the study design whether cervical kyphosis plays a causative role in the progression of scoliosis, or if the kyphosis is a result of curvature progression. The next logical step in determining the significance, if any, of cervical kyphosis is to evaluate patients at high risk of progression in terms of both scoliosis severity and sagittal plane alignment.

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Cervical Kyphosis						
#	**Age**	**Gender**	**Kyphotic**	**Lordotic**	**>30**	
1	25	F	X		Y	
2	54	F		X	N	
3	59	F	X		Y	
4	16	F	X		N	
5	18	F		X	N	
6	68	F	X		N	
7	18	F	X		N	
8	72	F	X		N	
9	68	F		X	N	
10	59	F	X		N	
11	18	F			N	
12	51	F	X		Y	
13	34	F	X		N	
14	44	M	X		N	
15	25	M	X		N	
16	55	F	X		N	
17	20	F	X		Y	
18	17	F		X	N	
19	17	F	X		N	
20	58	F		X	N	
21	51	F	X		Y	
22	12	M		X	N	
23	18	F		X	N	
24	14	F		X	N	
25	14	F	X		N	
26	15	F	X		N	
27	38	F		X	Y	
28	53	F	X		Y	
29	37	F		X	N	
30	11	F	X		Y	
31	46	F		X	N	
32	11	F	X		Y	
33	10	F	X		N	
34	15	F	X		Y	
35	52	F	X		Y	
36	21	F		X	Y	
37			X		N	
38			X		N	
39			X		Y	
40			X		N	
41			X		N	
42			X		Y	
43				X	N	
44			X		Y	
45			X		Y	
46			X		Y	

Table 1- The incidence of cervical kyphosis compared to the presence of scoliosis below 30° and above 30°.