

## Study of the Correlation Between Degree of Kyphosis and Lordosis with Spinees' Flexibility

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**Abstract:** Spinal Column is the main axis of the body and plays an important role in keeping a good posture. Flexibility of spine probably influences the curvature of spine. However the exact data about the relationship between the spinal flexibility and its relationship with the curvature of spinal column in young healthy people are lacking. The purpose of this study was to investigate the correlation between the spinal flexibility with degree of the kyphosis and lordosis in young healthy people who were not affected with disease or had not undergone spinal column surgery. 100 young healthy men were evaluated in this study. The spinal flexibility and degree of kyphosis and lordosis was measured with Spinal Mouse (non-invasive tool). The Pearson correlation test was used to investigate the relationship between these variables. Results showed that the relationship between the variables of interest was not significant ( $p>0.05$ ) for flexibility of thoracic spine with degree of kyphosis ( $r = -0.04$ ) and flexibility of lumbar spine with lordosis ( $r = 0.06$ ). According to The results there was not significant correlation between the spinal flexibility and the degree of kyphosis and lordosis.

**Key words:** Spine flexibility • Kyphosis • Lordosis • Spinal mouse

### INTRODUCTION

The function and structure of the body has a potential for keeping good posture. However, bad habits and worst plan and activities stress on this mechanism that can disorder the function and structure of the body. Posture usually defined as the relative arrangement of body parts in related to each other and good posture is that state of muscular and skeletal balance which protects the supporting structure of the body against injury or progressive deformity [1]. One of the most important parts of body is spinal columns. Besides its efficiency in protecting spinal cords, it is very important in movement and keeping stability of the body frame. On the other hand, the archs of spinal columns prevent direct pressure and damage to it [2]. Flexibility refers to normal movement of joints. The common thought is that this feature is a general one but rather the function of each joint is special, so that this feature differs from one joint to another [3]. Spinal column acts as a body axis and provides two main mechanical needs: stability and flexibility. Spinal column's stability provide by muscles that placed in that spot and control their movement and also too strong ligaments that

link the structure as a stable collection. Spine Flexibility in the quality of its structure's shape; it means that several components which place an order collection along each other by ligaments cause that the small movement of spinal column depend on its movable components parts [4]. The joints between the individual vertebrae allow only a slight range of motion, but when the total for a region of the spine is added together, the range of motion is significant [5]. The flexibility of spinal columns is in away that their movements accomplished in three axes. However the spine flexibility can be effected by the shape of joints [6] and the factors such as the back extensor strength and the tension of anterior structure of spinal column like anterior longitudinal ligament and annulus fibrous [3]. Age and gender also can affect spine flexibility [7]. Flint [8] showed that there is no relation between spine extension and lordosis. At the other hand Ohlen *et al.* [9] suggested that the limitation in spinal function for curves with Cobb angles below 50 degrees may be neglected. In contrast Mellin [10] considered relation between lordosis and kyphosis, height and weight with flexibility of spine and showed that the height has a partial effect in spinal column movement but body

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weight has a partial negative correlations with spine movement also he suggested spine flexibility had significant relationships with Lordosis and kyphosis. At other hand Elnaggar *et al.* [11] study the effect of flexion and extension training on Thoracolumbar mobility and stated that the flexion and extension training increase the Thoracolumbar mobility. In other research Tsai and Wredmark [12] compared spine range of motion in health people and former elite gymnast showed that although gymnast have less kyphosis but there is no difference in spine range of motion Between groups and also in lumbar region range of motion. Therefore they did not find any correlation between posture and range of motion in either of the groups. Molz *et al.* [13] considered lordosis and kyphosis effect on spine mobility and showed that lordosis and kyphosis didn't affect mobility and free vertebrae are covered small changes effect in curve angles by increasing mobility on the spinal columns movement.

Youdas *et al.* [14] showed that the lumbar extension range of motion in lying position have association with lordosis. In both group, men and women, the magnitude of lordosis are equal to movement extension amount in health people. Consequently Hinman [15] by comparing old and young people, understood that the kyphosis is high in old people and their thoracic are strict and less less flexible but young ones with less kyphosis have more elastic thoracic region. although few researchers have studied about relation between spinal column flexibility and kyphosis and lordosis, However findings showed contradictory results. The aim of the present study was to examine the association between spine flexibility with degree of kyphosis and lordosis.

## MATERIALS AND METHODS

One hundred healthy male subjects, aged 20–25 yr were recruited from the students at Tehran University.

These students were non-athletic and had no experience of order exercise or sport champions and also, had no pathologic symptoms in spine region or surgery in this part. Subject characteristics are shown in Table 1.

**Measurement Techniques:** The tested person testimonial forms (satisfaction forms) and announce their interested to attend in cooperating in this research.

In all processes, the tested persons were decreased. Before the spine flexibility measurements, it asked them to do exercise for 5 minutes. Spine flexibility measured by spinal mouse (non-invasive tool) at the Maximal extension (legs straight, arms crossed over the front of the body,

Table 1: Descriptive Statistics for volunteers regarding the Size of thoracic kyphosis, Lumbar Lordosis, Thoracic and lumbar flexibility (n= 100)

Variable	Mean	SD
Age (y)	23.27	1.41
Height (cm)	177.42	6.64
Weight (kg)	71.17	10.63
Body mass index (kg/m <sup>2</sup> )	22.01	2.40
Thoracic curve (°)	48.42	8.50
Lumbar curve (°)	- 41.75	6.25
Thoracic flexibility (°)	5.31	9.86
Lumbar flexibility (°)	7.37	9.79

Table 2: The correlation of thoracic and lumbar flexibility with degree of kyphosis and lordosis n=100

Variables	Correlation	Significance
Thoracic flexibility (°)	-0.04	0.965
Kyphosis (°)		
Lumbar flexibility (°)	0.06	0.505
Lordosis (°)		

\*Correlation is significant at the 0.05 level

head in a neutral position, trunk extended as far as comfortably possible). The device is guided along the midline of the spine starting at the spinous process of C7 and finishing at the top of the anal crease (approximately S3); these landmarks are firstly determined by palpation and marked on the skin surface with a cosmetic pencil.

The relevant parameters recorded by the Spinal Mouse in extension position were: all the individual motion segment angles (from T1-2 through to L5-S1), thoracic curvature (T1-2 to T11-12) and lumbar curvature (T12-L1 to the sacrum). The measurement of kyphosis and lordosis degree was also done by using spinal mouse instrument. The measurement is done in Standing upright (in a relaxed position, focusing on a marker at eye level, feet shoulder width apart, knees straight, arms hanging by the side). The stage and kyphosis and lordosis measurement Techniques is similar to flexibility measurement and only difference is that for kyphosis measurement from level 1, T<sub>2</sub> to T<sub>11-12</sub> and lordosis from T<sub>11-12</sub> to S<sub>1-2</sub>. [16, 17] (Table 2).

**Data Analysis:** All the statistical analyses were performed using SPSS statistical package (SPSS 14 for Windows). The Pearson correlation was used to assess the correlation between thoracic and lumbar flexibility with degree of kyphosis and lordosis. Statistical significance was set at 0.05 levels.

## RESULTS

The mean values for estimated variables in the study subjects are listed in Table 1. The correlations between variables are listed in Table 2. However, no significant correlations were observed between the spinal thoracic and lumbar flexibility with degree of thoracic kyphosis and lumbar lordosis.

## DISCUSSION

The study showed that there is no correlation between spine flexibility and kyphosis and lordosis in this studied samples ( $p > 0.05$ ) as it mentioned no significant correlation were found between spine flexibility with thoracic kyphosis degree, ( $P > 0.05$ ,  $r = -0.04$ ) this finding represented that changes of each variable is independent from the change of other variable. In this field, the authors sometimes achieve opposed findings. For example Mellin [10] showed that there is relation between kyphosis and spine flexibility but he did not exactly pointed out that this relation is between kyphosis and whole spinal flexibility or thoracic region. However subsequent researchers didn't approve this relation. According to Ohlen *et al.* [9], spine flexibility isn't affected until deviation degree of curves less than 50 degree. By comparing both healthy people and gymnasts that have less kyphosis, Tsai and Wredmark [12] showed that there is no difference between two groups spine flexibility. He also examined effect of kyphosis on spine ROM and stated that kyphosis degree isn't effected spinal ROM. Finally according to Eun-Hee *et al.* [18] kyphosis angle didn't affect spine flexibility. The noted research is in accordance with our present study results. The review of history research represented that there is no relations between kyphosis degree and movement of that part of body. Therefore, the other factors can effect on movement in this part of body.

From the biomechanical viewpoint and according to Winter and Kumar [19] findings it can be said that the increase of compensate mobility in adjacent vertebrae faded the changes affection of back curve on flexibility of that part. From the anatomical viewpoint, mobility of spinal column vertebra are affected by height difference among middle vertebra disc [20] and shape and direction of joint from one vertebra to another [21] and flexibility of thoracic spine in extension also have negative correlation with the stiffness of that region especially between T<sub>6,7</sub> vertebrae [22] also the thorax decreases the overall flexibility of the thoracic spine [23]. On the other hand,

Eun-Hee *et al.* [18] showed that strength affection on thoracic flexibility.

Regarding to stated point, it can be said that several factors effected thoracic spine flexibility. Therefore didn't unexpected that the spinal column flexibility from kyphosis degree is unaffected and the existence of these effective factors can effect the relation between kyphosis degree and spine flexibility. So, it minor kyphosis affection and consequently, it can be said that since the most extension and flexion movement lied between T<sub>11,12</sub> vertebrae, so we can result that there is no significant correlation between kyphosis degree and thoracic spine flexibility.

In studying relation between lumbar flexibility of spinal column and lordosis degree, the results stated that there is no significant between noted variables ( $P > 0.05$ ,  $r = 0.06$ ). therefore, the changes of each variables is independent from the changes of other variables. Ohlen *et al.* [9] and *et al* showed that spine flexibility isn't affected until 50 degree deviation of curves. Vinter also stated that there is no relation between lordosis degree and lumbar flexibility. According to Youdas *et al.* [14] finding it is revealed that the magnitude of lumbar lordosis has weak correlation with extension ROM. Eun-Hee *et al.* [18] also showed that there is negative correlation between lordosis degree and lumbar ROM.

By attention to 3 recent researches, we can understand that Eun-Hee *et al.* [18] showed negative relationship between lordosis degree and lumbar flexibility. But Youdas *et al.* [14] get positive relationship about them. Furthermore, this subject showed a contradiction among other finding and explained that there is no relationship between lordosis degree and flexibility. For this reason the study result vary from one study to another. And this showed that there is other factors which are affected relation between these two variables.

For example, pain in lumbar region can be a factor which is effected flexibility of spinal column. If we consider the attending sample of Eun-Hee *et al.* [18] research, we can understand that his sample have unhealthy vertebrae in spinal column. Maybe by due attention to these point, we can explain the different reason of above results with present results which is done on healthy and young people. It can also be argued from anatomical view in this text. Spine structure like ligament, joint, anulus of middle vertebra disc and muscles lied in this part have basic role in lumbar flexibility. For example, damage to anulus part can effect on waist flexibility in spinal columns and increase ROM [24]. It can also show that anterior part of lumbar and vertebra joints

surface decrease extension movement [25]. Sharma [26] explained about the joints surface which is responsible for preventing from much extension.

Tanaka [24] believed that quality change or damage to vertebra and its related tissue affected the flexibility of spinal columns. It is probable that the quality and health properties of spine structure is different from one person to another. Therefore, obtaining different results from different group won't be unexpected and maybe these factors cause that here is no significant correlation between mentioned variables in this study.

### CONCLUSION

Our investigation examined the accession between thoracic and lumbar flexibility with degree of kyphosis and lordosis, findings show that there is no significant correlation between thoracic and lumbar flexibility with degree of kyphosis and lordosis. Based on these findings, we recommend that to modifying deformities of spinal column such as kyphosis and lordosis, emphasize on flexibility exercise can't be effective. It is better that we emphasize on strength exercise.

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