

# ANALYZING SPINAL CURVES FOR PROLONG SITTING IN UNIVERSITY GOING STUDENTS

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## ABSTRACT

### **Objective**

*The purpose of this study was to analyze the spinal curves for prolong sitting among physical therapy students at Ziauddin University*

**Study Design:** *Quasi-experimental study design*

**Study Setting and sample size:** *One hundred physical therapy students of all the batches aged between 17-25 years were analyzed for their spinal curves using scoliometer and measuring tape at the Biomechanics Lab situated at the University*

### **Methodology**

*The patients were initially assessed through a self-administered questionnaire following by the measurements taken by 2 qualified and trained physical therapist for 3 alternative days in a week. Any noticeable kyphotic, lordotic and scoliotic changes were documented. Distance from the midline, poking chin and shoulder alignment were also observed.*

### **Results:**

*An increase in cervical curve was recorded in males (18.9%) when compared with females (9%) whereas kyphotic curve remains same in both the genders. The scoliotic curve shows the similar values (54.5% in males, 38.8% females). Cochran's Q statistics revealed no significant relationships found between prolong sitting and spinal curves ( $p > 0.05$ ). The kappa value and confident interval shows substantial agreement to almost perfect agreement and the p-value  $< 0.0$  shows the significant result that was found for three week assessment. Average kappa value was 0.8 that displays almost perfect agreement among the two raters.*

### **Conclusion:**

*An increased scoliotic curve was mostly documented among the physical therapy students although awareness regarding their posture is a part of their first year curriculum. Hence, it emphasizes on the exercises related to prolong sitting that should be an area of concern for the instructors as well as clinical supervisors.*

## INTRODUCTION

Prolong sitting in an inadequate posture on ergonomically inefficient furniture and carrying heavy backpacks in schools causes center of gravity in the body to move backward, to compensate this shift, children bent forward exerting extra muscular force on their vertebrae resulting in spinal deviation<sup>1-9</sup>. Prolong static sitting with awkward posture causes extra stress on the muscles, ligaments and bones of university students during studying, reading, doing lab works or assignments<sup>1</sup>. Low level of awareness among students about the importance of ergonomic principles and its benefits is another major contributor in the development of poor postures. A research study showed a very low level of awareness about ergonomics and benefits of its endeavors among medical and physiotherapy students of Karachi<sup>2</sup>.

Abnormal Stresses on soft tissues and bones primarily leads to discomfort, pain or soreness that in due course of time converts into postural deformities and if not corrected this will lead to degenerative changes in the later ages. Considerable amount of literature has been published on high prevalence of bad posture and its effects amongst young individuals belonging to different gender, race, profession, education, health and socioeconomic statuses<sup>3</sup>. Munaz et al. in his meta-analysis conducted on prevalence of low back pain in children and adolescent revealed that low back pain initiates at childhood<sup>4</sup>; children encounter at least one episode of low back ache by the age of 14 to 17 years, out of which 5 to 19% experience recurrence of pain<sup>5</sup>. Navaid-us-Saba et al. (2012) concluded high prevalence of cervicogenic pain among physical therapy students in a study conducted to assess association of poor sitting posture and cervicogenic pain; pain was found to be more prevalent in female students as compared to males<sup>6</sup>.

Multiple studies conducted by researchers in Iranian university students indicated high prevalence of postural abnormalities<sup>7-9</sup>. The results of study conducted by Atri AE (2013) showed varied physical abnormalities in 92.7% of Ferdowsi University students; the highest abnormality recorded in upper body was an uneven shoulder affecting 77.9% boys and 75.1% girls, head forward and lordosis are among other prevalent abnormalities, scoliosis with 11.2% is considered as being less prevalent among postural abnormalities. Yet in another research thesis on the condition of spinal column among university students in Arak showed 97.25% prevalence rate of spinal abnormality<sup>7</sup>. Post prevalent deviation is reported by RahimiA (2003) that corresponds to flat foot in 73.2% girls and to lordosis in 56.7% boys, the least deviation being 6.2% that is kyphosis in girls<sup>8</sup>.

A detailed examination of postural abnormalities by Patricia (1992) showed high incidence of postural abnormalities of varying degrees in thoracic and cervical spine in her target population, where 66% students were found to be forward headed, 38% kyphotic, 73% right rounded shoulder, and 66% left rounded shoulder<sup>9</sup>.

Postural problems related to spine are generally developed during childhood and adolescent; spinal asymmetry being one of the major cause<sup>10</sup>. Loss of natural curves of human spine affects the overall appearance of individual and compromises functioning of certain vital organ within the ribcage and abdomen. It may also cause loss of normal function of joints, muscle and ligaments leading to pain, muscular fatigue, shortness or elongation of ligaments, blood lactic acid accumulation and in some cases cardiovascular disorder<sup>11</sup>.

Amongst multiple non-invasive methods for the assessment of spinal curves scoliometer has been indicated as a reliable and valid tool for the repetitive assessment of spinal axial rotation by a single observer in a study conducted by Murrell GA<sup>12</sup>.

No significant work has been done to analyze the variations in spinal curves and postural abnormalities in the university students in Pakistan. Keeping in mind the disability and socioeconomic burden these abnormalities can exert on an individual and on a society as a whole in later stages of life it is imperative to

conduct this research to increase awareness among students about the importance of maintenance of good posture during their academic activities and otherwise routines.

## **METHODOLOGY**

### **Study Design**

A Quasi experimental study design was selected

### **Sample Size and Sampling Technique**

100 university going students of both the genders were nominated through simple random sampling from Ziauddin College of Physical Therapy

### **Inclusion/Exclusion Criteria**

Students aged between 17–25 years with Body Mass Index (BMI) less than 30, predominantly having no structural and functional deformity and proving their consent were included in the study whereas student with any congenital deformity, spinal pathology, structural scoliosis and previous spinal fracture or surgery were excluded.

### **Ethical Approval**

The ethical approval was obtained from the ethical review committee of Ziauddin College of Physical Therapy for the conduction of this research

### **Data Collection Tools**

The data was collected through assessment and using a self-administrated questionnaire. The assessments were made using the scoliometer and a measuring tape.

### **Procedure**

The data collection was divided into two parts where two qualified and trained physical therapist collected the data in the allotted time in biomechanics laboratory of the university. Physical therapists assessed the spinal curve by using scoliometer. Each subject was measured at the start and the end of university hours for three alternative days in a week. On every visit, the complete assessment of spinal curves (cervical, thoracic and lumbar) of subjects was measured by the physical therapists and the measurements from the midline to the scapula was taken by a measuring tape. As soon as the participant enters the laboratory a specific number was allotted to retain the anonymity, then height and weight were measured by using stadiometer. The participants were requested to fill the section A of the self-administered questionnaire at the start of university hours whereas section B was filled after the university hours. Section A included the information regarding the carrying of bag, the dominant side of carrying a bag and the duration of it. Further queries were associated with prolong sitting, the average duration, discomfort and pain accompanying it.

A secluded area was provided to the participant to observe poking chin, shoulder alignment and cervical curve. Any noticeable kyphotic, lordotic and scoliotic changes were also observed and documented. Scapula was measured from the midline using a measuring tape followed by the measurements from scoliometer.

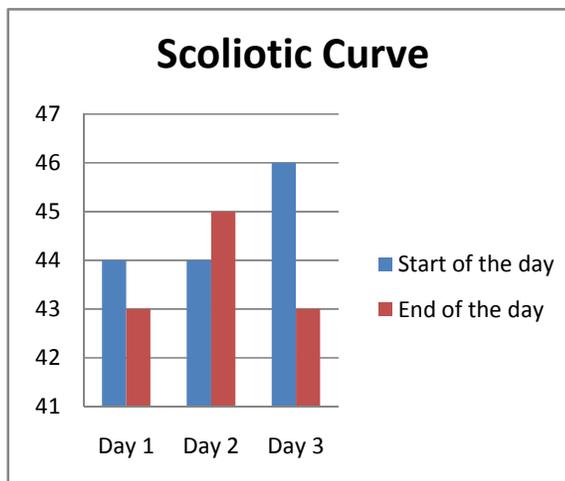
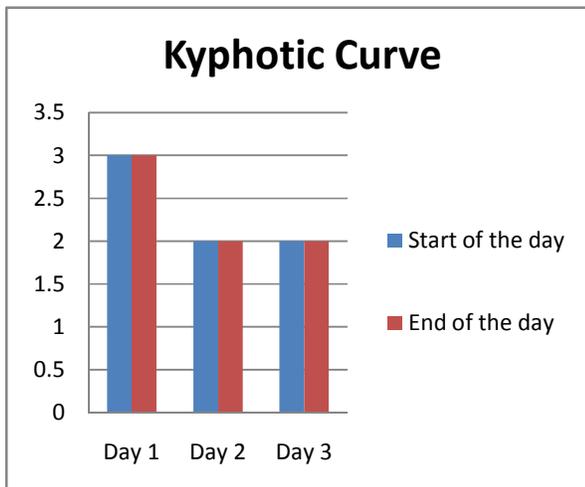
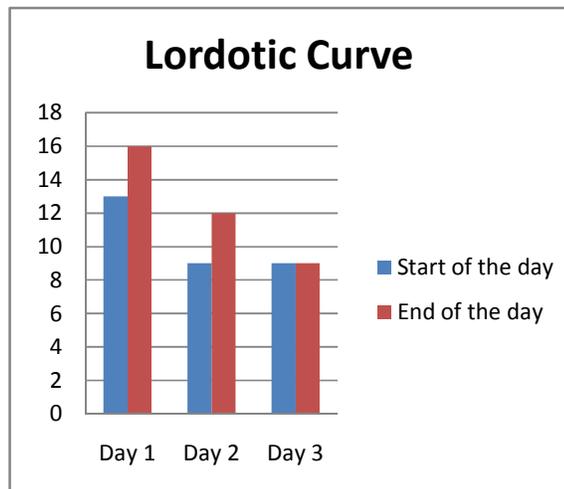
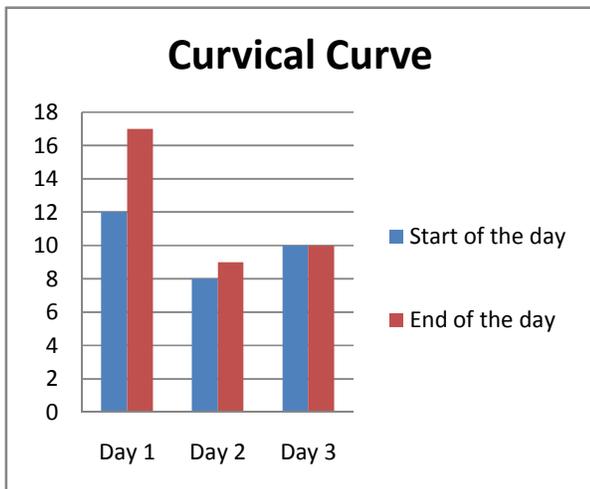
### **Statistical Analysis**

SAS 9.1.3 was used to analyze the data. Non-parametric Cochran Test was applied for the assessment of spinal curves due to prolong sitting. Cross tabulation of gender with the spinal curve was also generated.

Fleiss' Kappa coefficients (for categorical data) were used to assess inter-rater reliability by two therapists. Fleiss's Kappa is used to measure the overall agreement between two raters and is adapted for nominal scales with multiple categories. Interpretation of the Kappa coefficients is as follows: Values 0.81 – 1.00= almost perfect; 0.61 – 0.80= substantial; 0.41 – 0.60= moderate; 0.21 – 0.40= fair; 0.01 – 0.20= slight;  $\leq 0$  = poor agreement<sup>8</sup>. P-value  $\leq 0.05$  was considered significant. Cross tabulation of gender with the scoliotic curve was also generated.

**RESULTS**

The study analyzes spinal curves for prolong sitting in university going students that was conducted at Ziauddin College of Physical Therapy. Sample of 100 students were selected for the study with the mean age of 20 years. Among them, 33% were males, 67% were female students. To see the effect of prolong sitting in university students, data was collected at the start and the end of university hours for three alternative days a week. Cochran's Q statistics was also performed in order to check the effect of prolong sitting for the duration of three weeks. Data revealed that, there is no significant relationships found between prolong sitting and spinal curves ( $p > 0.05$ ). Descriptive statistics of three week assessment of spinal curves is demonstrated in graphs. Graph shows that after three weeks assessment there is no significant change in numbers of subjects due to prolong sitting.



The association between the gender and the spinal curve was carried out on the basis of day 1 assessment. Where data revealed no association between spinal curve and gender, but the percentage of each gender showed very interesting result as shown in Table 1. The cervical curve was recorded as 18.9% of males and 9% females whereas percentage of increased kyphotic curve remained same in both the genders. Furthermore, the scoliotic curve was also measured higher, that is, 54.5% in males than normal while females remained 38.8% scoliotic. Among them 94.4% of males and 69.2% of females was 5° right scoliosis. Therefore, in our study, the ratio of scoliotic curve is higher in males than females.

| <b>Table.1 Assessment of Spinal Curve</b> |                    |                      |                      |
|---|--------------------|----------------------|----------------------|
|   | <b>Male (n=33)</b> | <b>Female (n=67)</b> | <b>Total (n=100)</b> |
| <b>cervical curve</b>                     |                    |                      |                      |
| Normal                                    | 81.8               | 91                   | 88                   |
| Increased Cervical Curve                  | 18.2               | 9                    | 12                   |
| <b>kyphotic curve</b>                     |                    |                      |                      |
| Normal                                    | 97                 | 97                   | 97                   |
| Increased KC                              | 3                  | 3                    | 3                    |
| <b>lordotic curve</b>                     |                    |                      |                      |
| Normal                                    | 84.8               | 88.1                 | 87                   |
| Increased LC                              | 15.2               | 11.9                 | 13                   |
| <b>Scoliotic Curve</b>                    |                    |                      |                      |
| Normal                                    | 45.5               | 61.2                 | 56                   |
| Scoliotic Curve                           | 54.5               | 38.8                 | 44                   |
| <b>Type of Scoliotic Curve</b>            | <b>(n=18)</b>      | <b>(n=26)</b>        | <b>(n=44)</b>        |
| 10° Right                                 | 0                  | 11.5                 | 6.8                  |
| 5° Left                                   | 5.6                | 19.2                 | 13.6                 |
| 5° Right                                  | 94.4               | 69.2                 | 79.5                 |

The accuracy and validity of measurement depend upon the reliability of the examiner. Table 2 depicts the response of subjects by raters and inter-raters reliability. The kappa value and confident interval shows that the substantial agreement to almost perfect agreement and the p-value <0.0 shows the significant result that was found for three week assessment. Average kappa value was 0.8 that displays almost perfect agreement among the two raters.

| <b>Table.2</b>                     |              |                            |                |
|------------------------------------|--------------|----------------------------|----------------|
| <b>Reliability of Spinal Curve</b> |              |                            |                |
|                                    | <b>Kappa</b> | <b>Confidence Interval</b> | <b>p-value</b> |
| DAY 1 Start                        | 1.0          | (1.0, 1.0)                 | 0.0            |
| Day 1 End                          | 0.9363       | (0.8, 1.0)                 | 0.0            |
| DAY 2 Start                        | 0.7516       | (0.53, 0.97)               | 0.0            |
| Day 2 End                          | 0.8125       | (0.62, 1.0)                | 0.0            |
| DAY 3 Start                        | 0.8125       | (0.62, 1.0)                | 0.0            |
| Day 3 End                          | 0.7516       | (0.53, 0.97)               | 0.0            |
| Average Kappa Value                | 0.8          |                            |                |

## DISCUSSION

The purpose of this study was to evaluate and analyze the spinal curves among university going physiotherapy students and to find its association with prolong sitting. Students spend most of their time during and after university hours in long sitting postures, their activities varies from taking lectures, making assignments, performing group activities, working in labs, spending time in Learning Resource Centre (LRC) and surfing the net. Conversely, a difference is observed with different activities, lectures, assignments, facilitators and Activities of Daily Living. Also, it has been presumed that the senior students spend more time in hands-on-skills and observational clinical rotations. Apparently they are considered more aware about their postures when compared with the junior batches.

Interestingly, our study has shown no significant result for prolong sitting whereas in a study conducted in Finland on school going students revealed significant results using adjustable and non-adjustable chair<sup>3</sup>. This study was conducted on only 16 girls and 14 boys that would limit the generalizability. On the other hand, the study conducted at the Firdowsi University had also shown changes in the spinal curve among their students<sup>7</sup>. During their study it was observed that the cause of spinal abnormalities were due to the muscular weakness, bad posture, performing daily activities with dominant hand and carrying heavy bags on the shoulder<sup>2</sup> that are also believed to be contributing factors in the outcomes of our study<sup>3</sup>. Indeed, similar results were obtained during a systemic review conducted by Qamar et al (2013) where the results of the review revealed that adolescent girls and children reporting higher prevalence by using heavy backpacks<sup>20</sup>.

The results of Atri et al. shows that the most affected areas in males were uneven shoulders 77.9%, lordosis 46.5% and scoliosis 2.5% whereas the amount of abnormalities in females are reported as lordosis 33.9%, scoliosis 20% and kyphotic 20%<sup>7</sup> where as in our study we found scoliosis as the most prevalent deviation in spinal curve; indicating about 54.5% of males and 38.8% females were scoliosis. Along with this, our study also revealed that 3.0% of males and females are kyphotic. These results were similar with the conducted by Hanninen O & Koskelo R<sup>3</sup>.

The incidence of idiopathic scoliosis around the world ranges from 1% to 12%, whereas the incidence of the deformity with Cobb angle is found to be  $\geq 10^\circ$  and resulting from screening programs is approximately 2%<sup>21</sup>. Our results are contradicting with the previous studies among 100 university students where only 44% of them were scoliotic. We have analyzed the scoliotic curve by using scoliometer that has already found to be a reliable and valid tool<sup>12</sup>. Previously, a number of researches were conducted on the spinal analysis including both school going student and general population that showed the prevalence of scoliosis ranging from 1% to 13% by using Adman Test<sup>6,7</sup>. To our knowledge, no such study has previously been conducted in our country.

The reliability was calculated to analyze the spinal curve, as in our study, the spinal curve was measured by the scoliometer for analyzing the spinal curve<sup>12</sup> and measurement scale was used to measure the distance from the scapula. It was found that, Kappa value was 0.8 that shows almost perfect agreement (Fleiss calculation) with the p value  $< 0.0$ ; showing the significant agreement between the two observers, trained by the first author. In another study, the ICC model was utilized to evaluate the reliability of spinal track measurement of scoliotic angle measured by Cobb angle. The intra examiner reliability of the spine track system reading was recorded from good to extremely good. The inter examiner reliability of spine track was good as the mean differences between readings were less than  $4^\circ$ . It should be noted that, measurement of the Cobb angle itself is subjected to systematic measurement error.

In the study of Atri et al. (2013), it was concluded that 92.7% of students had one or more physical abnormalities<sup>3</sup>. Gilani MSR (2001) concluded about 82.1%<sup>14</sup> and Golpayegani (1994) had 97.2%<sup>21</sup> with one or more physical abnormalities. Another important fact we had found in our study is that, right side scoliosis was most common, about 38% as compared to left side which was only 6% that could be due to right dominant side and the chairs that had only right sided arm rest forced students to tilt themselves on the right side while doing their class works.

## CONCLUSION

Globally, researchers have been keen to create awareness programs both in schools and universities but Pakistan is lacking in awareness programs regarding posture not only among Physical therapy students but other health care professional also. Prolong sitting and exercises related to it should be an area of concern for both the clinicians as well as for researchers. In near future studies on larger scale should be conducted not only on postural awareness but also on the correction of posture

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