

# Analysis of Correlation between Leg Length Difference, Trunk Asymmetry Scale, Spirometry and Pelvic Asymmetry

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## 다리길이 차이와 몸통 비대칭 척도, 폐활량, 골반 비대칭과의 상관관계 분석연구

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### Abstract

**Purpose:** The purpose of this study was to analyze the correlation between the discrepancy in functional and anatomical leg length and the discrepancy in length of Acromion to ASIS, pelvic asymmetry, Adam's angle, and vital capacity ability.

**Methods:** To measure trunk asymmetry, functional leg length and anatomical leg length discrepancy between left and right, shoulder asymmetry discrepancy test, Adam's forward bend test and vital capacity measurement, and pelvic asymmetry were measured. The data was analyzed with the version of SPSS 22.0 for Window and the correlation of each measured Value was analyzed for the mean value.

**Results:** The Anatomical leg length discrepancy showed positive correlation between Adams Forward Bend Test and Functional Leg Length Discrepancy, Acromion to ASIS discrepancy ( $p < 0.05$ ) also showed a positive correlation with FEV1/FVC ( $p < 0.05$ ) and There was a positive correlation between discrepancy in Pelvic Asymmetry (front) ( $p < 0.05$ ).

**Conclusions:** Leg Length Discrepancy means that asymmetric scales in other areas were correlated and affected the asymmetry on other areas.

## 1. Introduction

Recently, with the advancement of science and technology, people spend more time in a sitting position. Because of this, there are many cases of living in an unhealthy posture for a long period of time. As a result, the number of people with incorrect posture and body alignment is increasing [1].

In order to correct and prevent these problems, The measures to evaluate the degree of asymmetry are widely used in clinical practice [2,3].

In previous studies, it was found that the asymmetry of the shoulder, pelvis and spine occurs as the difference in functional and anatomical leg length increases, but there have been few studies on quantitative values on the specific extent to which they occur.

Therefore, the purpose of this study was to investigate the relationship between leg length difference and Trunk Asymmetry Scale, Spirometry and Pelvic Asymmetry.

## 2. Subject and methods

### 2.1 Subject

This study was performed with 50 (M / F, 20 / 30) college students attending S University in Chungcheongnam-do. The age was  $21.2 \pm 1.57$  years, height was  $166.5 \pm 8.9$  cm and body weight was  $62.4 \pm 12.6$  kg.

### 2.2 Study procedure

In order to measure the difference between the functional and the anatomical leg length, the leg length of the subject in the supine position on the bed was measured. The measurement location was measured from the left and right ASIS to the medial malleolus on the same side and the distance from the xiphoid process to the medial malleolus [4].

To measure the difference in trunk asymmetry, the length from the subject's shoulder to the pelvic was measured. The measurement position was measured from the acromion on the left and right side to the ASIS on the same side.

In the Adams forward bend test, the subject started with a 90° flexion of the shoulder joint in an upright position, and instructed to do a 90° hip flexion. At this time, the angle was measured in the protruding parts of the back of both sides of the spine [5]. Lung function was measured using spirometry (pony Fx, COSMED, Italy) [Fig. 1]. PALM (palpation meter) equipment was used to measure the inclination of the pelvis of the study subjects.

The measurement in each scale was measured three times each, and mean values were used. All measurements were recorded as mean ± standard deviation.

### 3. Results

The Anatomical leg length difference (ALLD) was positively correlated with ADAM's FBT ( $r=0.303$ ), FLLD ( $r=0.289$ ), and Acromion to ASIS difference ( $r=0.469$ ) ( $p<0.05$ ).

The anatomical leg length difference (ALLD) and FEV1/FVC ( $r=0.275$ ) showed a positive correlation ( $p<0.05$ ) [Table 2].

The anatomical leg length difference (ALLD) and PALM (anterior view) ( $r=0.348$ ) showed a positive correlation. [Table 3].

[Table 1] The value of the measurement scales.

variable	Mean±SD
ADAMs (°)	1.60±1.07
ALLD (cm)	0.63±0.25
FLLD (cm)	0.65±0.28
Acromion to ASIS (cm)	1.30±0.59
FVC (%)	3.75±0.94
FEV1 (%)	2.78±0.90
FEV1/FVC (%)	71.78±11.36
PALM (front) (°)	1.27±0.60
PALM (back) (°)	2.88±1.61
PALM (Asymmetry of the left and right sides) (°)	25.88±5.90

\* $p<0.05$ , ADAMs : Adams Forward Bend Test, FLLD: Functional Leg Length Discrepancy, ALLD: Anatomical Leg Length Discrepancy, FVC: Forced vital capacity, FEV1: Forced expiratory volum in 1 second, PALM : Palpation Meter.

[Table 2] Correlation analysis between the body asymmetry scale and the pulmonary function scale

	FVC	FEV1	FEV1/FVC
ADAMs	-0.017	-0.087	-0.072
ALLD	0.057	0.204	0.275*
FLLD	0.017	0.130	0.197
Acromion to ASIS	-0.074	-0.047	-0.031

\* $p<0.05$ , ADAMs : Adams Forward Bend Test, FLLD: Functional Leg Length Discrepancy, ALLD: Anatomical Leg Length Discrepancy, FVC: Forced vital capacity, FEV1: Forced expiratory volum in 1 second.

[Table 3] Correlation analysis between trunk asymmetry scale and pelvic asymmetry

	PALM (front)	PALM (back)	PALM (Asymmetry of the left and right sides)
ADAMs	0.242	-0.045	0.173
ALLD	0.348*	-0.055	0.249
FLLD	0.209	0.225	0.130
Acromion to ASIS	0.259	0.042	0.189

\* $p<0.05$ , ADAMs : Adams Forward Bend Test, FLLD: Functional Leg Length Discrepancy, ALLD: Anatomical Leg Length Discrepancy, PALM : Palpation Meter.

### 4. Conclusion

In conclusion, the anatomical leg length difference was correlated with body asymmetry scale (ADAM's FBT, functional leg length difference, Acromion to ASIS) and anterior pelvic asymmetry. In addition, it was found that there is a correlation with FEV1/FVC, which is one of the lung functions. The results of this study can be used as basic data for improving body alignment and lung function.



[Fig. 1] Spirometer

### References

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