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Relationship between Pulmonary Function and the Degree of Spinal Deformity among Adolescent Idiopathic Scoliosis (AIS) Patients.

Joehaimey Johari **[1], Sobri Nor[1], Andrew Lam[2], Ahmad Sabri Omar[1], Ahmad Tajudin Abdullah[2], Azriani Ab Rahman[3], Mohd Ariff Sharifudin[4], Mohd Imran Yusof [5].**

[1]Department of Orthopaedics, Hospital Raja Perempuan Zainab II (HRPZII), Malaysia.

[2]Department of Orthopaedics, Hospital Sultanah Nurzahirah, Malaysia.

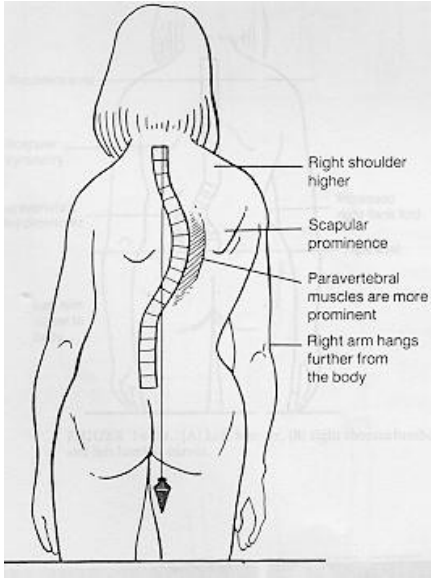
[3]Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia (USM).

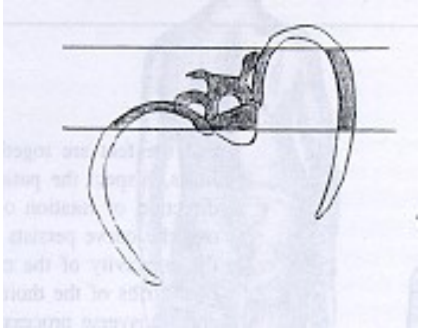
[4]Department of Orthopaedics, Traumatology and Rehabilitation, International Islamic University Malaysia (IIUM).

[5]Department of Orthopaedics, School of Medical Sciences, Universiti Sains Malaysia (USM).

Scoliosis- Definition

- Is a complex, 3-dimensional spinal deformity:
  - **Coronal**
  - **Sagittal (***Hypokyphosis)*
  - **Axial** *(rotation)*





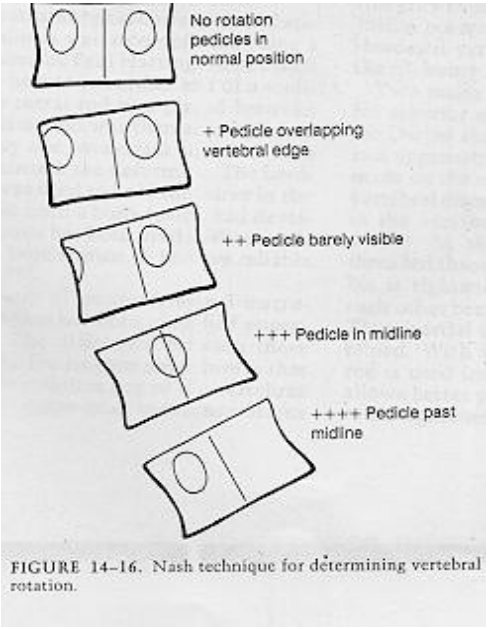
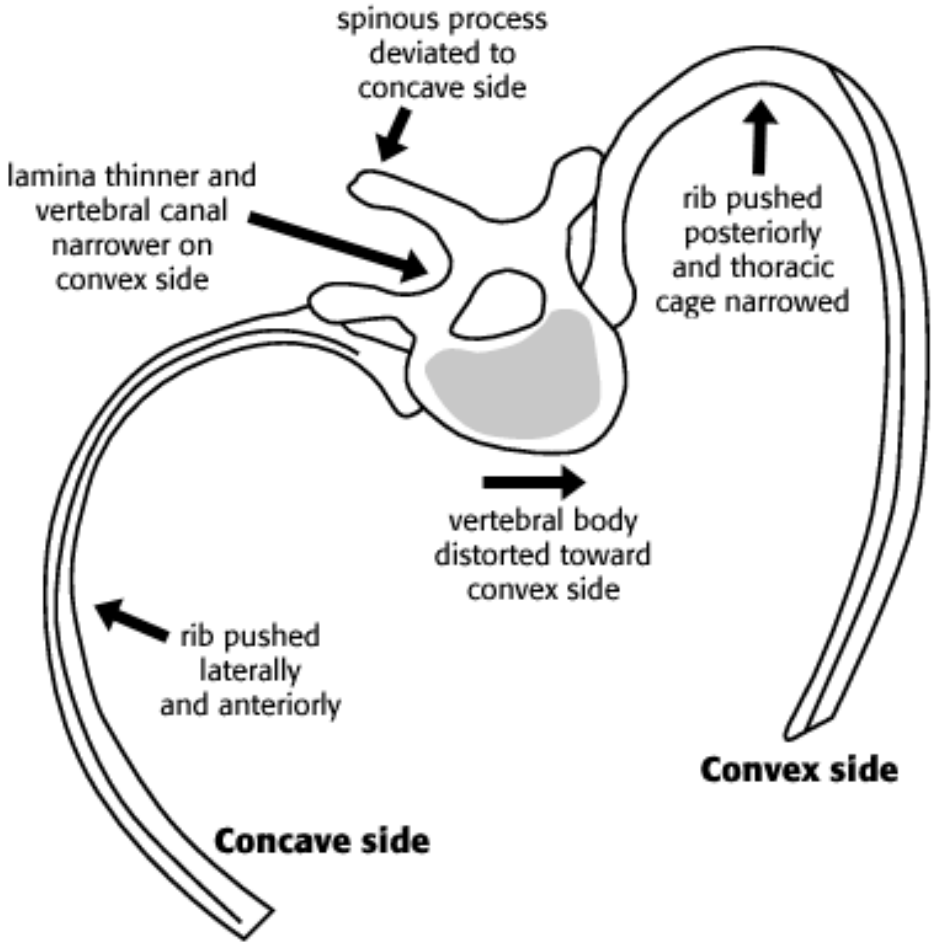
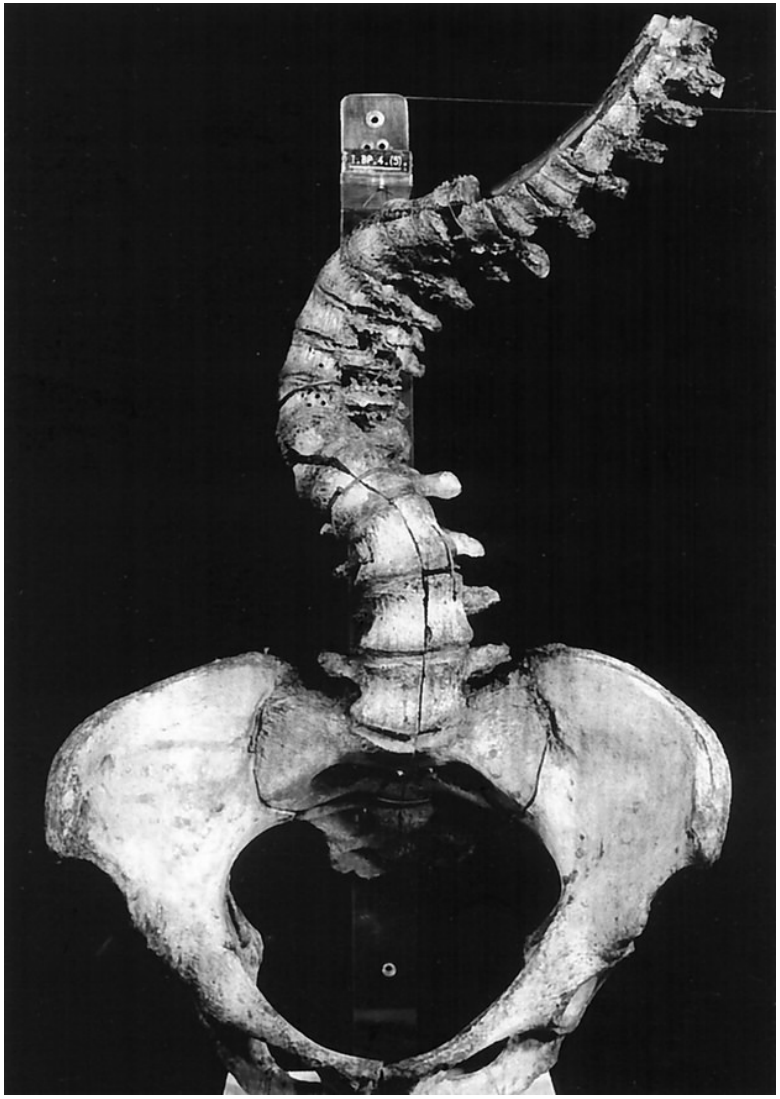


FIGURE 14–16. Nash technique for determining vertebral rotation.


spinous process
deviated to
concave side
lamina thinner and
vertebral canal
narrower on
convex side
rib pushed
posteriorly
and thoracic
cage narrowed
vertebral body
distorted toward
convex side
rib pushed
laterally
and anteriorly
Convex side
Concave side

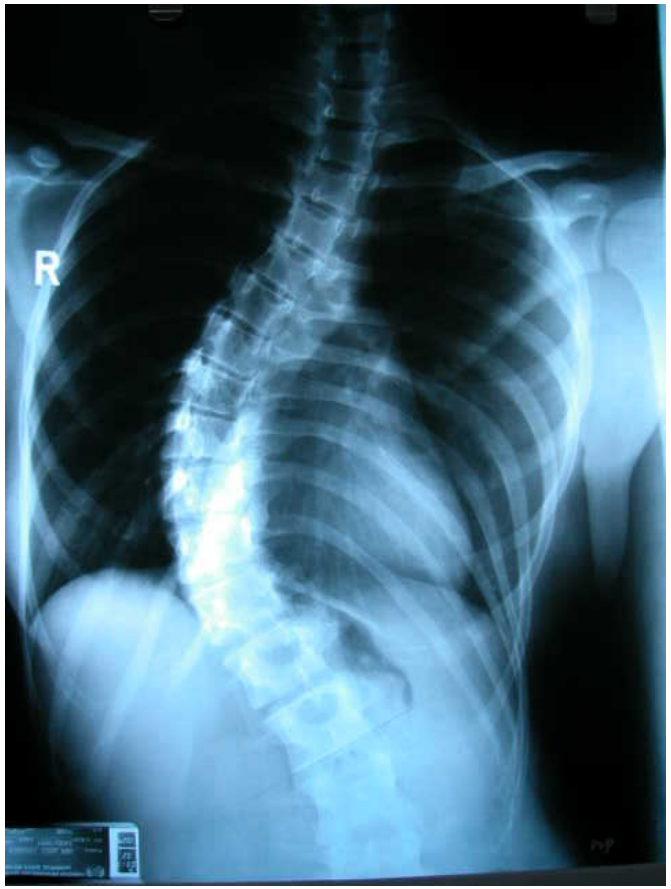


Idiopathic Scoliosis

- International Scoliosis Society (3 types)
  - Infantile (birth - 3 years)
  - Juvenile (4 - 10 years)
  - Adolescent (10 - 17 years)

- *Scoliosis Research Society (SRS):*
  - Early Onset - before 5yrs of age.
  - Late onset - after 5yrs of age.

- What is crucial about age of onset is whether a substantial thoracic deformity is present before the age of 5 years, in which case there is real risk of cardiopulmonary compromise.



Adolescent idiopathic scoliosis (AIS) often causes deformity of the thorax. With deformed spine and rib cage, the lung parenchyma is compressed which may lead to decrease in volume and lung compliance.

Methodology

- A retrospective record review was conducted among patients with adolescent idiopathic scoliosis (AIS) aged 13 to 24 years, admitted to our institution (HRPZII) for surgical intervention from 2000 to 2013.

- A total of 38 patients were studied

Methodology

- The curvature of spinal deformity was measured by Cobb method on anterior-posterior radiographs.

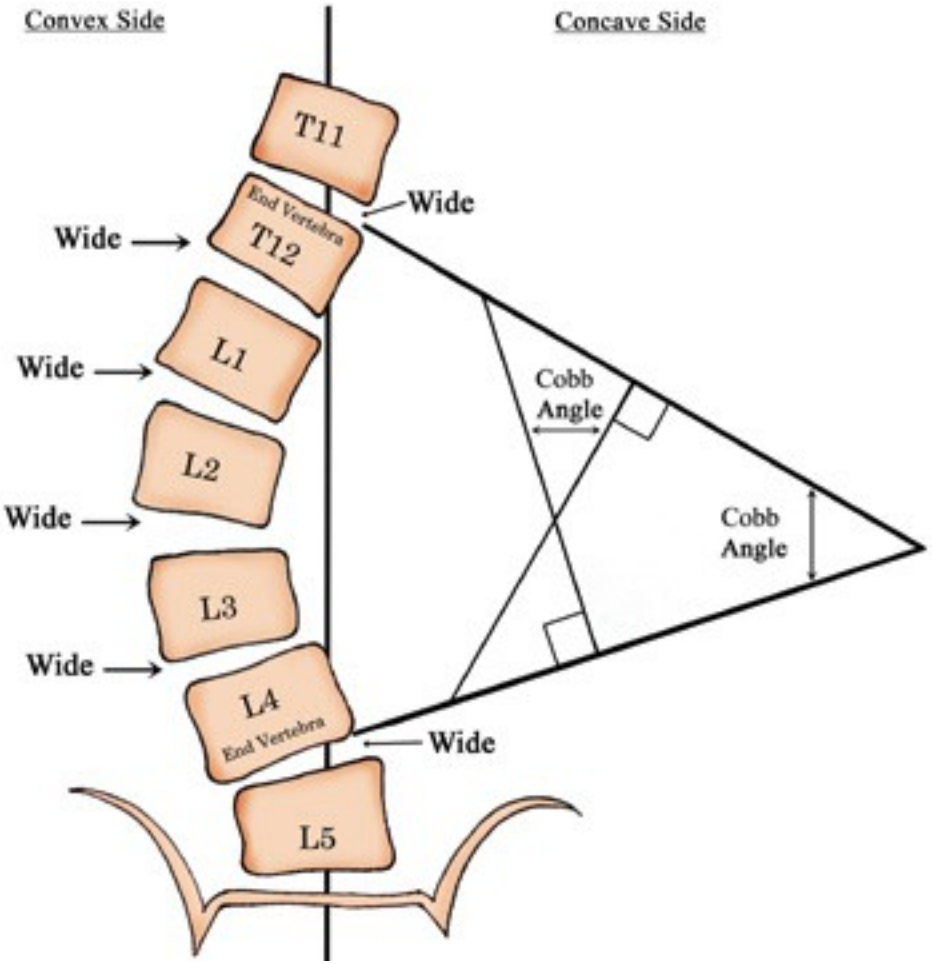
- The forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV 1) were used to evaluate their pre operative pulmonary function.

Cobb Angle Measurement

- Curve magnitude measured in degrees of curvature
- Standard full-length AP radiograph needed.

- ***Cobb angle*** - Line drawn along upper end plate of upper end vertebra and lower end plate of lower end vertebra. Perpendiculars drawn from these lines. Angle of intersection measured

- **John Cobb** was a father figure of scoliosis surgery in America.



Results

Table 1: Demographic characteristics of the patients with adolescent idiopathic scoliosis

Variables	Mean (SD) [*n (%)]
Age	16.7 (6.04)
Sex	
male	3 (7.9)*
female	35 (92.1)*
Cobb angle	58.1 (19.63)
Pre operative FEV1	80.5(21.68)
Pre operative FVC	75.3 (20.05)

Table 2: Relationship between Cobb angle with FVC and FEV1

**Simple Linear Regression*

	b (95% Confidence Interval B)	p value*	R^2
FEV1	-.326 (-.683, 0.030)	0.072	0.087
FVC	-.319 (-.647, 0.009)	0.057	0.097

No significant Relationship between Cobb angle with FVC and FEV1

Relationship between Cobb angle and preoperative FEV1 and FVC

- An inverse relationship between spinal deformity and pulmonary function has been reported by a few studies. *Vitale, Matsumoto et al. 2008* found that the degree of thoracic curves was negatively correlated with FEV1.
- There was also a trend toward significant negative correlations between thoracic curves and FVC. Patients with larger thoracic curves had lower pulmonary function measured by FEV1 and FVC.
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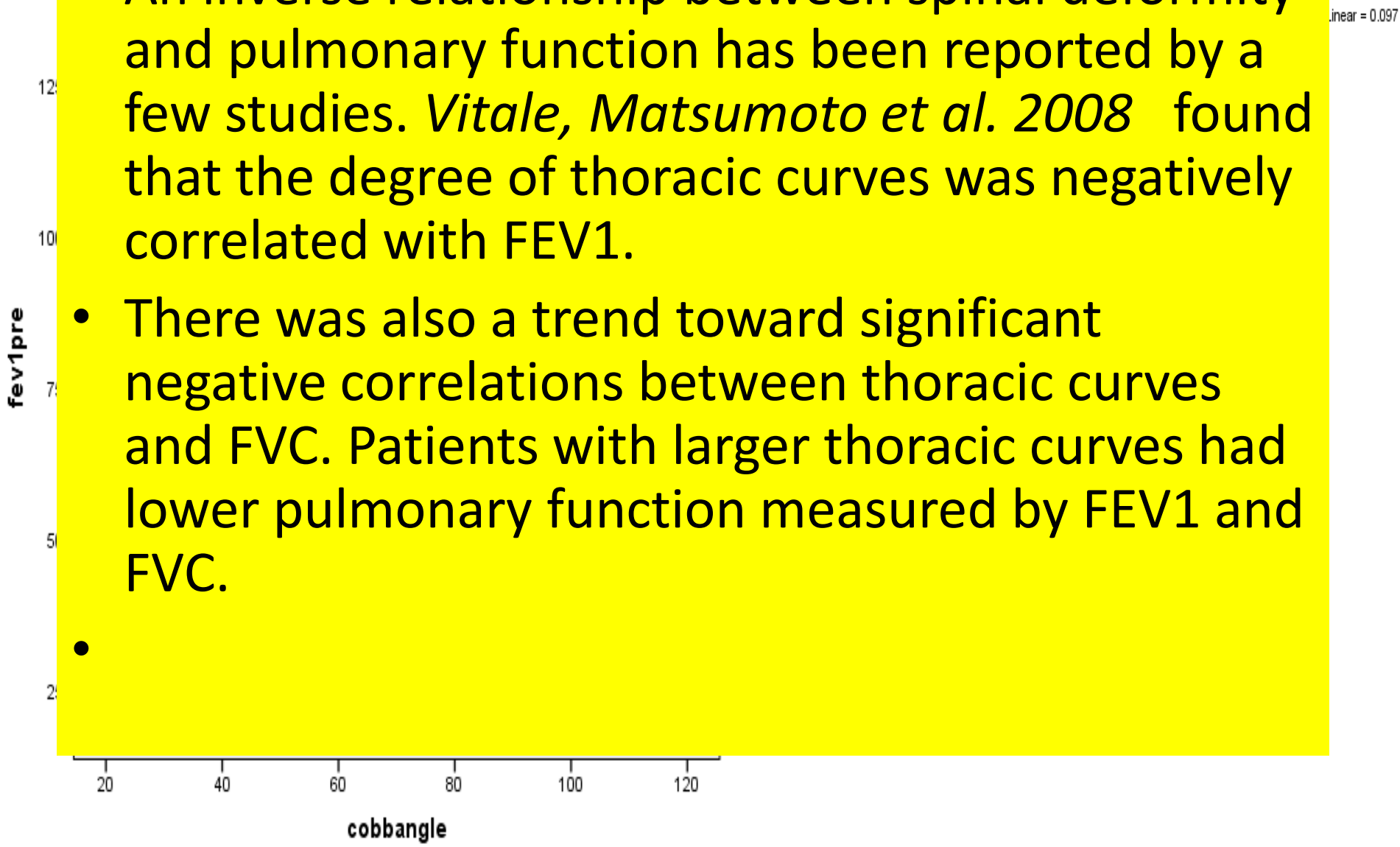


Table 4: Median FVC and FEV1 according to different level of apical vertebrae
** Kruskal- Wallis test

	L1, L2 & L3	T6, T7 & T8	T9-T12	p value**
F				
F				

- more proximally located spinal curve resulted in more impairment in the pulmonary function.

Table 5: Median FVC and FEV1 according to different level of upper end vertebrae

** Mann-Whitney test

	T6, T7 & T8 n=17 median (IQR)*	T9-T12 n=21 median (IQR)*	p value**
FVC	75 (18)	76 (41)	0.953
FEV1	82 (21)	79 (41)	0.436

No significant difference in the Median FVC and FEV1 according to different level of upper end vertebrae

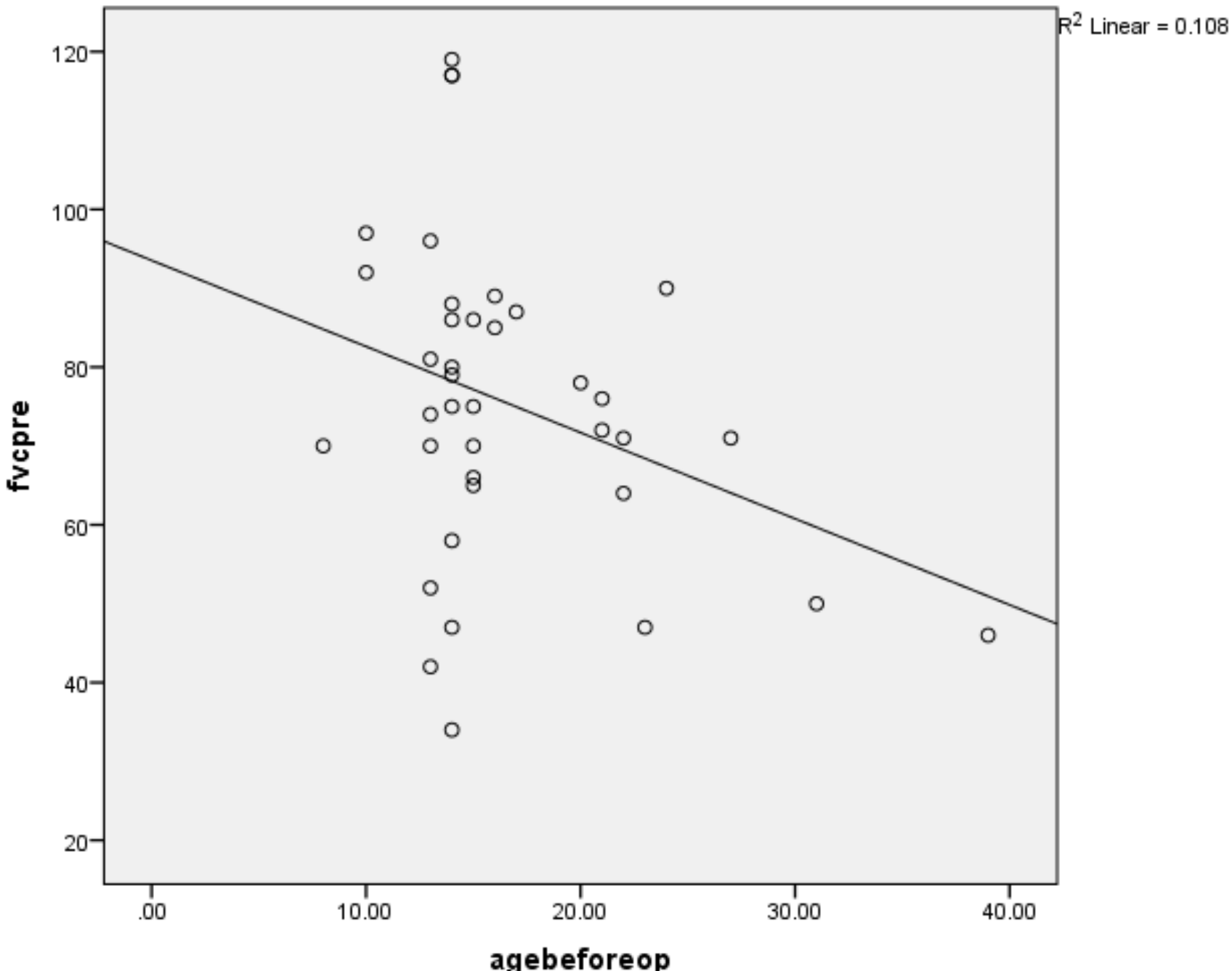
Table 6: Median FVC and FEV1 according to different level of lower end vertebrae

** Mann- Whitney test

	L 1,2,3 n=16 median (IQR)*	T 6-12 n=22 median (IQR)*	p value**
FVC	83.5(19)	70.5 (31)	**0.014**
FEV1	86(20)	78 (32)	0.055

The median FVC was significantly higher among those with affected L1,2,3 than those with affected T6-12

Figure 4: Relationship between age and pre operative FVC



- The older the patients, the poorer the pulmonary function was.
- This is supported by other study which described that the decline in spirometric values over 20 years of age was of the same magnitude as the predicted decline due to aging. Thus respiratory failure develops in adults with large angle scoliosis and a low vital capacity when normal aging reduces the ventilatory capacity further (Pehrsson, Bake et al. 1991)

Conclusion & Recommendation

- Impairment of lung function was seen in more severe spinal deformity, more proximally located curve and in older patients.
- Pulmonary impairment from spinal deformity remains to be one of the indications for surgical intervention.
- Pulmonary function testing is useful in the pre operative evaluation of patients with adolescent idiopathic scoliosis.

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