Respiratory Muscle Strength in Early Onset Scoliosis

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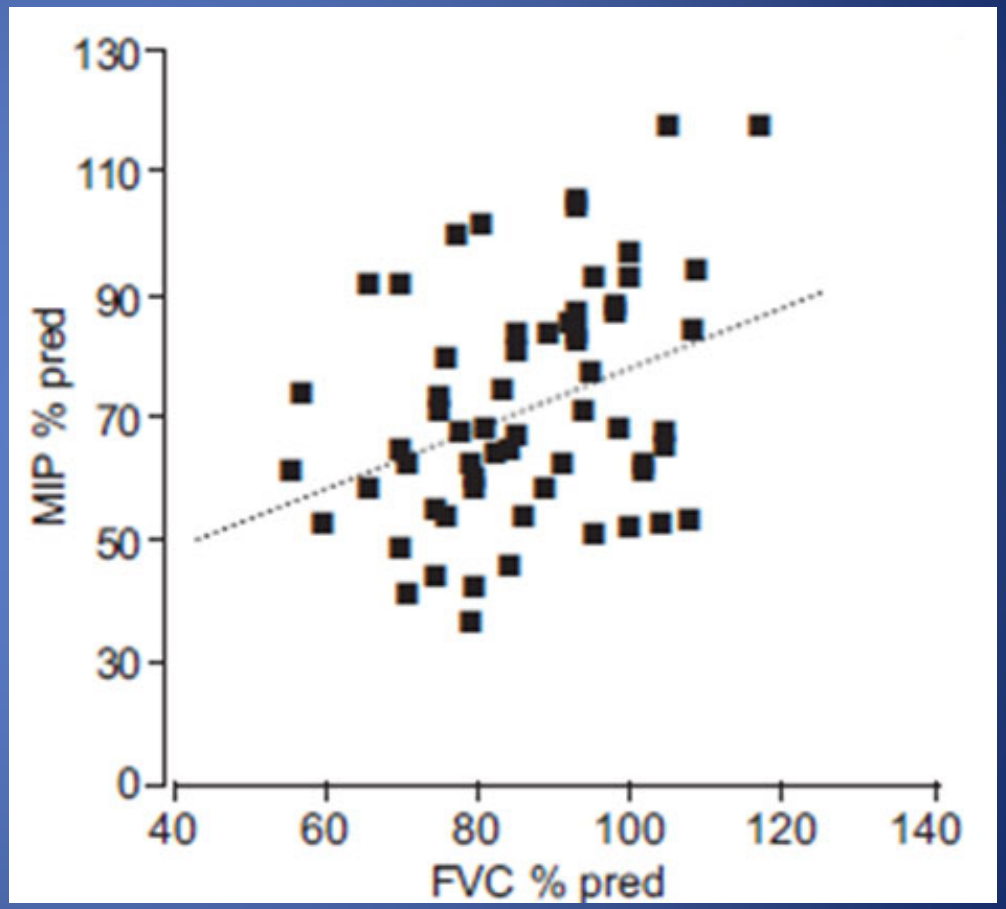
Introduction

- EOS produces restrictive lung/chest wall disease, measured by a reduced vital capacity.
- In Adolescent Idiopathic Scoliosis, loss of vital capacity correlates with reduced inspiratory force generation by respiratory muscles.



Martinez-Llorens AIS Data, 2010.

Hypotheses

- Is Maximum Inspiratory Pressure, the maximum force generated by inspiratory muscles, reduced in EOS and does it relate to reduced vital capacity?
- Is Maximum Expiratory Pressure (MEP), the force generated by the abdominal muscles, reduced in EOS and does it relate to reduced vital capacity?
- Do MIP and MEP relate to nutritional status as reflected in BMI (using arm span for height)?
- Do MIP and MEP correlated with Cobb angles in EOS?

Patient Population and Measures

N=17, 12 +/-3 years old, 13 females

Diagnoses: 7 congenital scoliosis
4 Syndromic scoliosis
4 Infantile scoliosis
2 Post-surgical for tumor resection

Surgical Status: 13 s/p growing construct
2 s/p spine fusion

Measurements: Maximum Inspiratory and Expiratory Pressures (MIP,MEP) as % of age- and gender-specific published norms.

Forced Vital Capacity (FVC) as % normal using arm span for height

Respiratory Function Values

- MIP (cm H2O) = 42+/-16
  - % predicted = 46+/-16%
- MEP (cm H2O)= 49+/-15
  - % predicted = 44+/-16%

  - FVC (% predicted) = 38+/-14%
  - BMI (% normal)= 32+/-34%
  - Cobb angle = 64+/-30 degrees

Figure 1. Scatterplot of FVC % predicted vs. MIP % predicted

MIP and FVC are low and correlate with one another

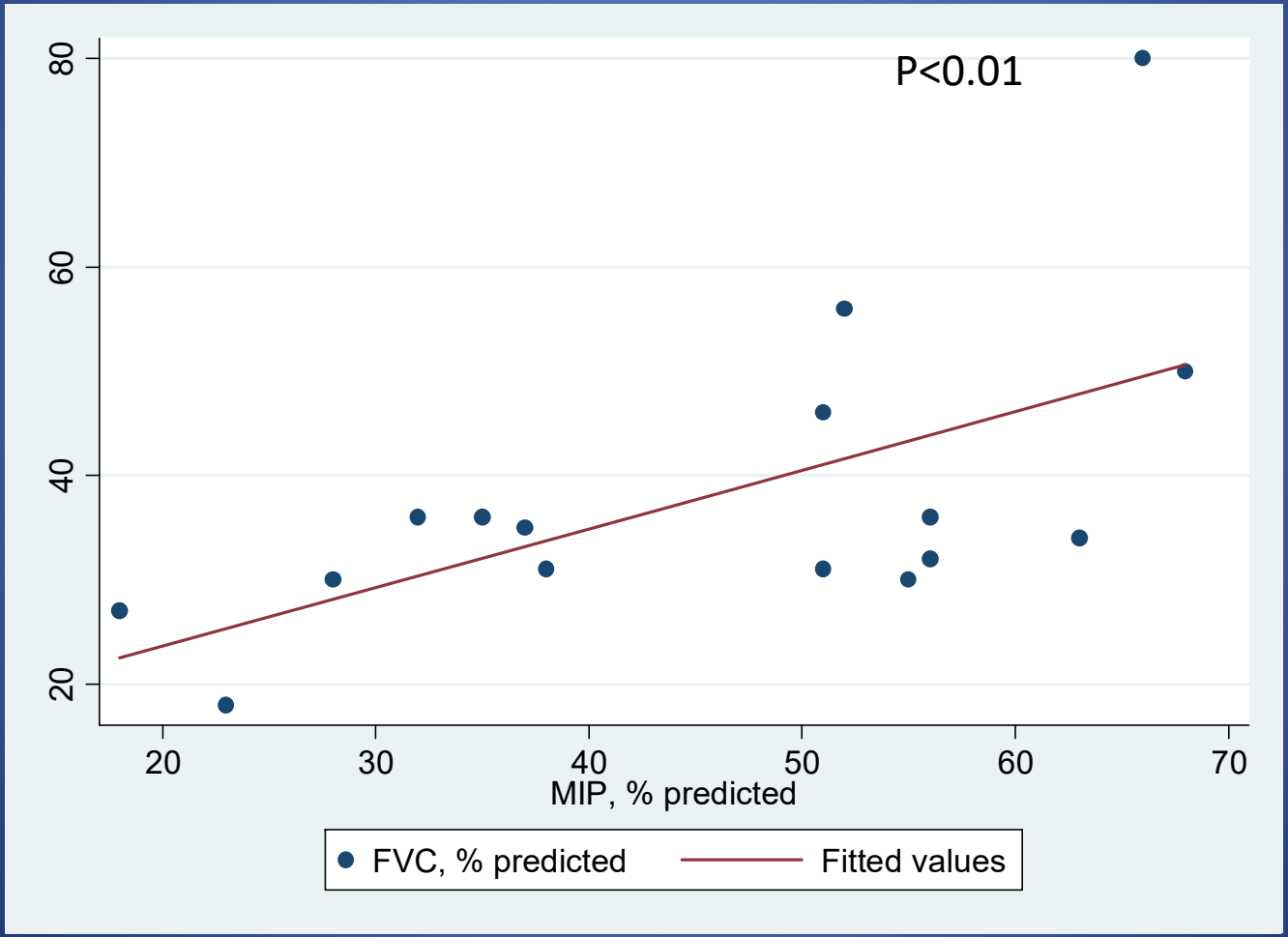


Figure 2. Scatterplot of FVC % predicted vs. MEP % predicted

MEP is also low and correlates with low FVC

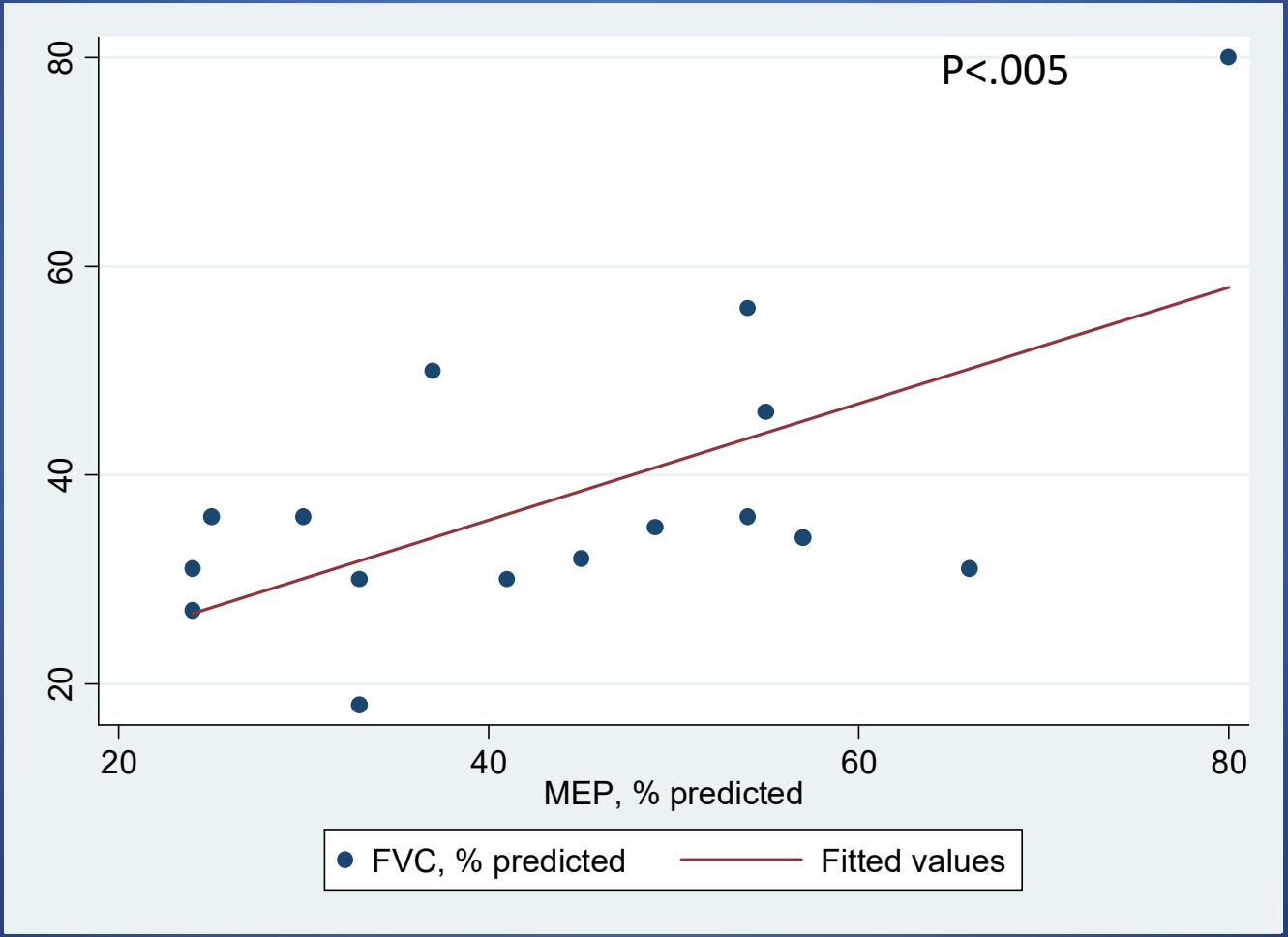


Figure 3. Scatterplot of MIP % predicted vs. BMI percentile

MIP does not correlate with BMI

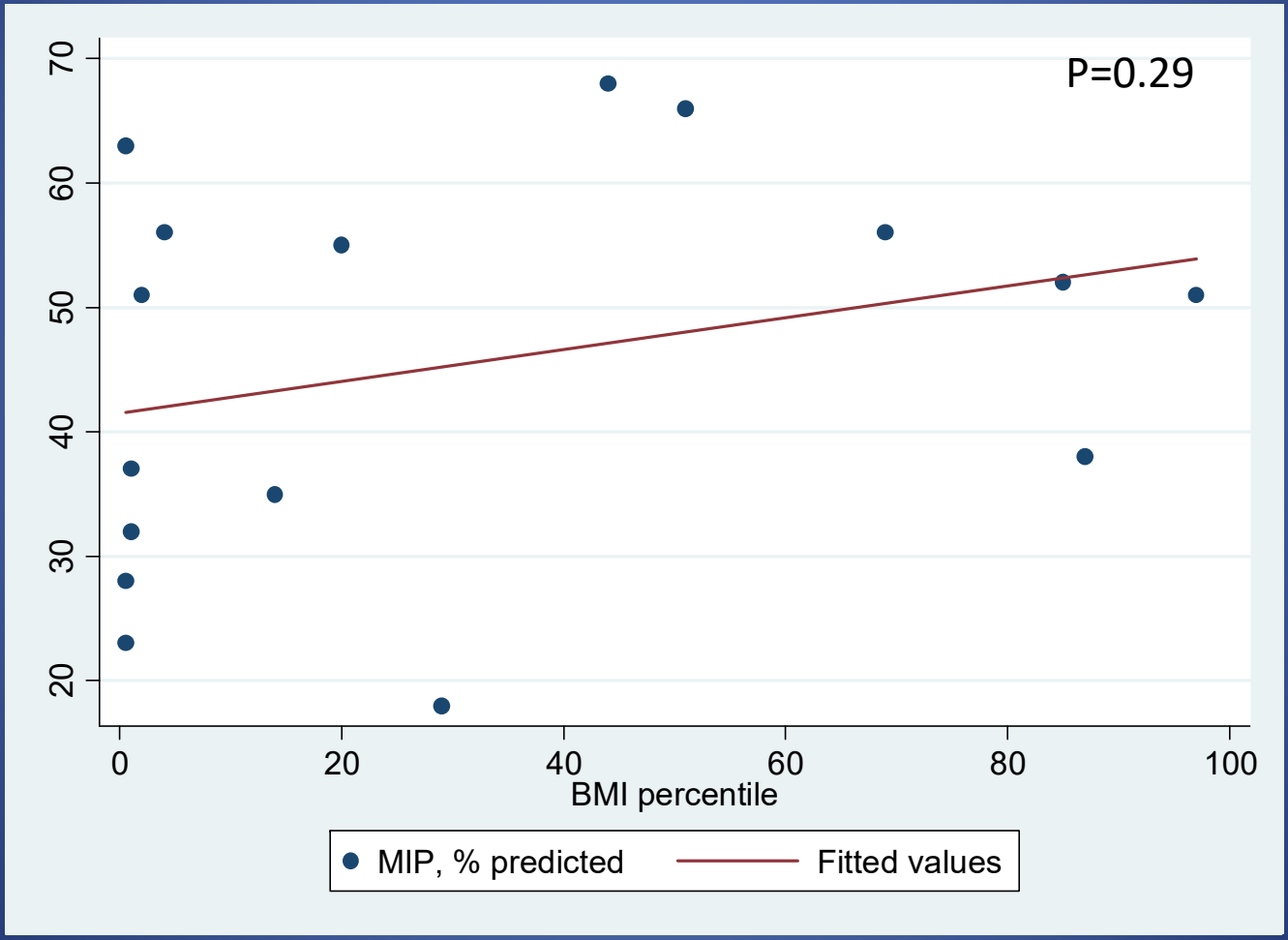
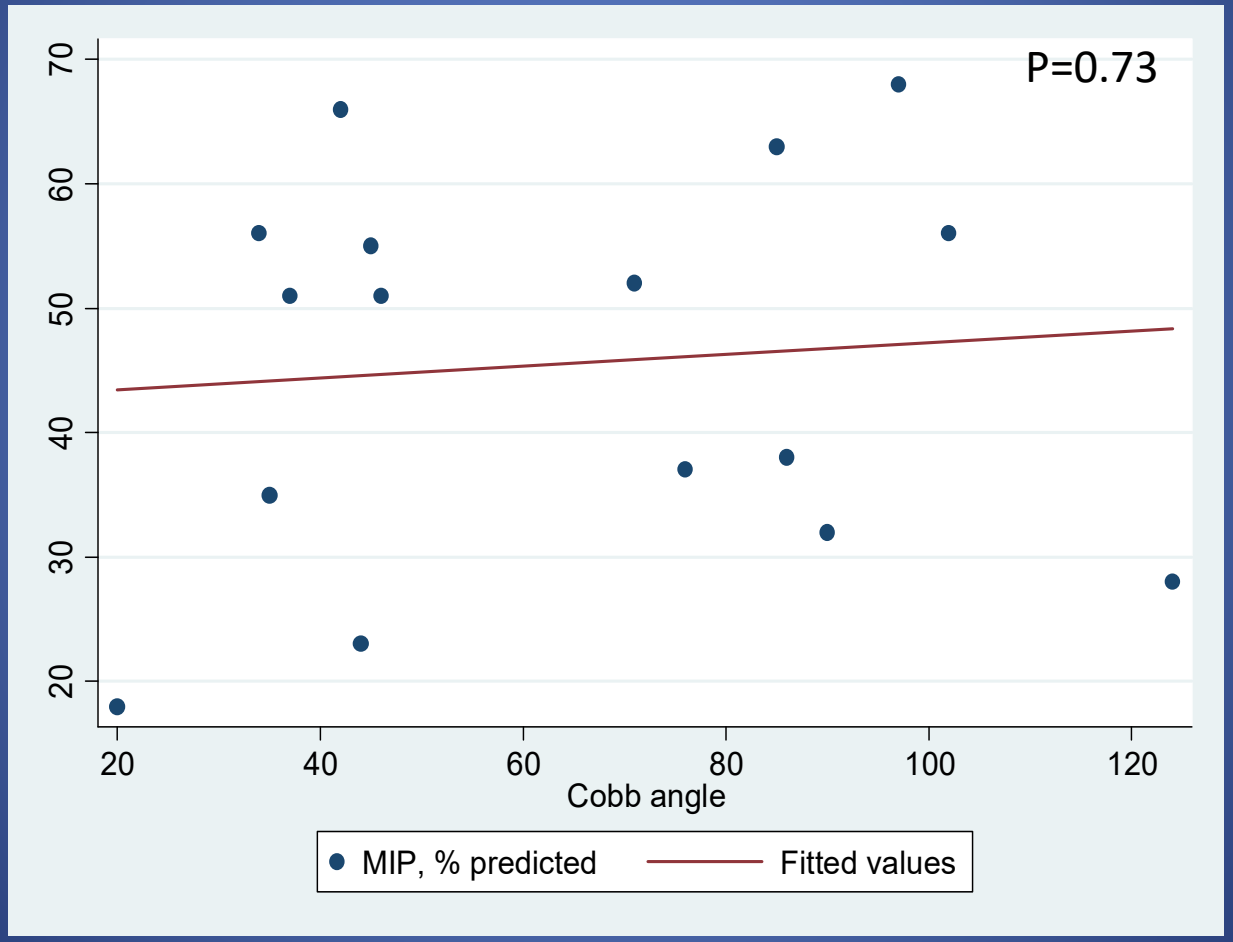


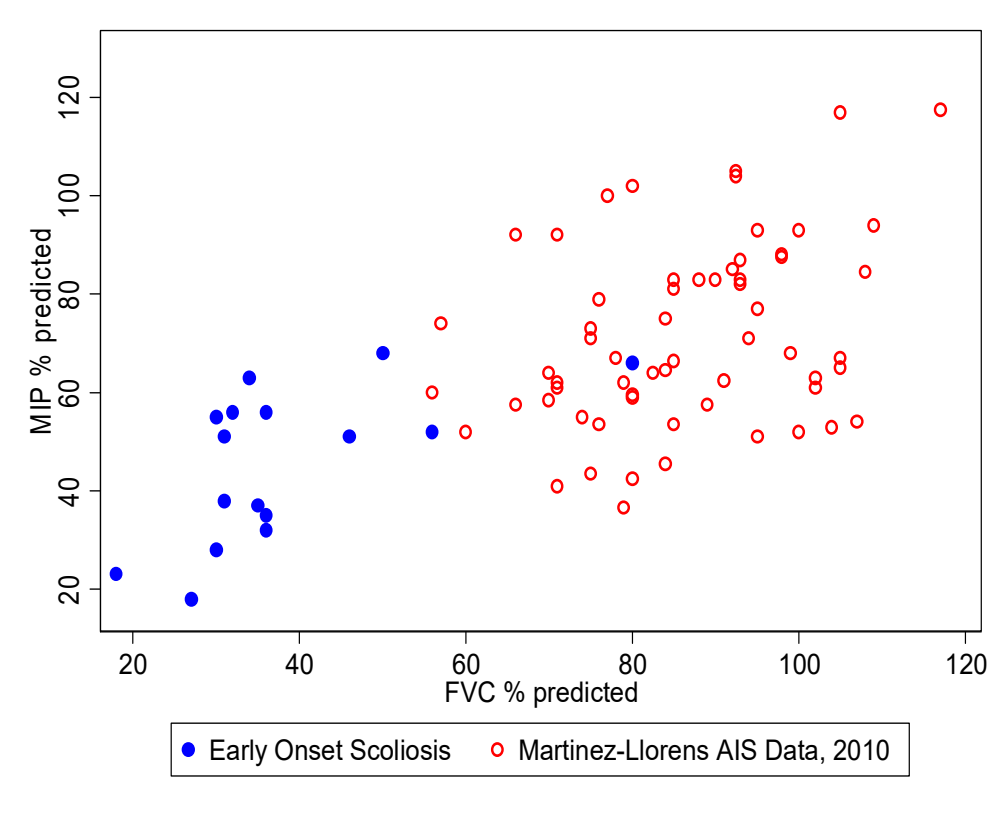
Figure 5. Scatterplot of MIP % predicted vs. Cobb angle

MIP does not correlate with Cobb Angle



Summary of Results

- Both MIP and MEP are significantly reduced in children with EOS and both significantly correlate with reduced vital capacity.
- MIP and MEP do not correlate with BMI.
- MIP and MEP do not correlate with Cobb angle.



Speculation

- Reduced respiratory muscle strength results from abnormal and inefficient muscle configuration due to chest wall and mediastinal deformities in children with EOS. (Tethering effect on the diaphragm)
- Reduced strength may also reflect long-standing changes in the diaphragm, such as regional atrophy.
- Surgical approaches that address spine and chest wall deformities must also address respiratory muscle configuration to maximize function post-operatively.