CURRENT LANDSCAPE OF ADULT IDIOPATHIC SCOLIOSIS
A SYSTEMATIC REVIEW AND META-ANALYSIS

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HOW DO WE DECIDE WHO WE OPERATE ON?

- Radiographic Progression?
- Symptoms?
- For how long do you wait?
BACKGROUND

Natural history of Annual Curve Progression

- **Weinstein et al. – 1983**
  - 102 patients = 133 curves
  - 68% of AIS experience progression of the curve after skeletal maturity
    - Curves >30° & 50-75° progressing the most
  - 30 to 40 year follow up - annual progression rates:
    - Thoracic – [0.3 to 1°]
    - Lumbar - 0.4°
    - Combined
      - Thoracic – 0.3°
      - Lumbar – 0.6°
  - 50 years – these individuals were productive & functional at high levels.
    - Causing little physical impairment than back pain & cosmetic concerns

*Idiopathic Scoliosis*

*Natural History*

**Health and Function of Patients With Untreated Idiopathic Scoliosis**

A 50-Year Natural History Study
Indications for surgical intervention

- Coexistence or isolated occurrence of **back pain**
- Deformity,
  - curvatures $>50^\circ$,
  - progression
- Cosmesis

Without treatment

- Painful spinal osteoarthritis,
- Progressive deformity,
- Worsening spinal stenosis with radiculopathy,
- Rotatory subluxation leading to nerve root impingement and stretching,
- Muscle fatigue from coronal and sagittal plane imbalance,
- Psychological effects of living with a visible deformity.
METHODS

- **MEDLINE/PubMed**
- “adult idiopathic scoliosis” and “adult idiopathic scoliosis AND ADIS.”

**Inclusion**
- Peer-reviewed English articles
- 2000 - 2019

**Exclusion criteria:**
- Reviews, individual case reports, or letters to the editor;
- Studies where adolescent data could not be separated from adult.
- Studies where type of scoliosis was not discerned
RESULTS

- **24 studies** – Qualitative review
  - **86.2%** Quality points - NIH Quality Assessment tool.
- **17 studies** - Analyzed in meta-analysis
  - n = 948 patients
  - Final follow up = 4.3± 1.9 years

Data Analysis

- SPSS ® Version 25
- Weighted means at the 95% confidence interval (CI) were calculated for dichotomous and continuous variables.
- Heterogeneity analysis - Chi-shared based Q statistical test quantified using the $I^2$ Metric.
  - $I^2>50\%$ or $P<0.10 \rightarrow$ random-effect model.
## CHARACTERIZATION

<table>
<thead>
<tr>
<th>Weighted Mean Difference (95%CI)</th>
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<tr>
<td><strong>Demographics</strong></td>
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| Age (years) | 40.9 ± 10.7  
| BMI | 24.2 ± 2.2  
| Major Curve | 58.4 ± 9.7  
| Major curve flexibility | 39.7 ± 15.0  
| **Perioperative Metrics** |  
| Number of Involved vertebra | 10.2 ± 1.5  
| Blood Loss (mL) | 1108.2 ± 402.7  
| Operative Time (Minutes) | 280.5 ± 119.2  

[Frequency Distribution by Age](chart)
MANAGEMENT

- Goal:
  - minimize progression of the curve,
  - maintain results over time
  - optimize balance
  - Improve health related quality of life
    - pain relief,
    - Improve cosmesis,
    - self-image,
RADIOGRAPHIC

- Minimize progression - preop to post op and again from preop to final follow-up.
  - (SMD = 4.44º; 95% - CI [2.43–6.45]; I² = 97.3%; p = 0.0012).
  - preoperatively and at final follow-up.
    - (SMD = 3.92º; 95% - CI [2.42 –5.43]; I² = 96.3% p = 0.0005).

- Heterogeneity due to average curve correction (%)

- Maintain results – No significant change from Postop to Final follow-up

Average correction (%) accounted for 71.41% (p = 0.042)

Average correction (%) accounted for 79.85% of heterogeneity (p = 0.023)
### SAGITTAL ALIGNMENT

- Optimize balance
- Spinopelvic alignment within normal limits
- High SVA

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<thead>
<tr>
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<th>Pre-Op</th>
<th>Final Follow-Up</th>
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<tr>
<td><strong>PT (°)</strong></td>
<td>17.46 ± 13.15</td>
<td>13.52 ± 11.47</td>
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<td><strong>LL(°)</strong></td>
<td>31.82 ± 33.88</td>
<td>33.28 ± 35.13</td>
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<td><strong>TK (°)</strong></td>
<td>29.55 ± 6.11</td>
<td>28.87 ± 3.00</td>
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<tr>
<td><strong>SVA (mm)</strong></td>
<td>9.40 ± 22.0</td>
<td>7.61 ± 20.3</td>
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THORACIC KYPHOSIS
HRQOL

Goals: pain free relief, Improve cosmesis, self-image, quality of life

- SRS-22r
  - Improved most: Satisfaction, Mental health, & Self image
  - Improved Least: Pain & Function

- ODI – none long term
  - Moderate → Minimal → Moderate functional disability

### SRS-22r

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<thead>
<tr>
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<th>Pre-Op</th>
<th>Post-Op</th>
<th>SRS-22 Final Follow-Up</th>
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<tbody>
<tr>
<td></td>
<td>3.53 ± .35</td>
<td>3.71 ± .31</td>
<td>4.17 ± .36</td>
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### ODI

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<td>34.50 ± 9.66</td>
<td>18.25 ± 3.76</td>
<td>23.54 ± 3.28</td>
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Bar charts showing SRS at Final Follow-up:
- Function: Pre-Op 3.98, Post-Op 4.06, Final Follow-Up 4.21
- Pain: Pre-Op 4.21, Post-Op 4.24, Final Follow-Up 4.24
Coronal corrections at postop is maintained over time.

Postoperative progression of thoracic kyphosis may be due to the development/developing of PJK.

Radiographic correlation with HRQoL is inconclusive.

However, following validated HRQOL metrics, in addition to radiographic changes, preoperatively, may be useful to quantify worsening of disease.

Shared decision making
Even though these deformities seem to be balanced, the age of surgical correction is 10 years younger than that of degenerative scoliosis. – So does it cause deleterious changes?

Is local correction an effective in correction

Option to decrease the length of constructs
THANK YOU – QUESTIONS?

- For your Attention
- To my mentors
- University at Buffalo Neurosurgery