Juvenile Idiopathic Scoliosis:
Brace Treatment to Skeletal Maturity

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Disclosures

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  - Ellipse technologies
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Background

Juvenile Idiopathic Scoliosis (JIS): onset between 4-10 years

Surgical correction rate high (49-87%)[1-7]

Intraspinal pathology rate high (12-32%)[8-10]

Mixed methodology and results with bracing[1,2,7]

Methods

Retrospective review 375 patients (4-10 yrs) braced for scoliosis from 2002-12.

- Excluded intraspinal pathology requiring neurosurgical intervention, neuromuscular, syndromic, history of open CT surgery, advanced bone age at time of bracing, infantile scoliosis, braced >10yrs or <4 years old

202 juvenile idiopathic scoliosis patients braced

- 24 excluded: lack of follow up
- 76 in brace with average followup 4.8yrs
- **102 patients at skeletal maturity OR underwent spine fusion**

Sex, BMI, age, family history, MRI results, comorbidities, modified Lenke JIS Curve type, Cobb angles, Risser stage, menarche, bone age, brace type, length of brace wear, number/type of brace change, Cobb angles at brace change, compliance by report, surgical procedure.

Mean, standard deviation, percentage Cobb progression, multivariable logicstical regression, odds ration with 95% confidence intervals

Demographics

Average age 7.9 years

9% male

28% Comorbidities: LLD, spondylolysis, cardiac, neurologic, GI

Main thoracic + lumbar modifier B most common curve pattern

Average Maximum Cobb 29.8° (± 8.7°)

Followed median 5.5 years (4-7 yrs)

Table 1. Patient and bracing characteristics (N=102)

Characteristic	Freq.	(%)
Age (*years; mean ± SD*)	7.9	± 1.45
Sex (*% male*)	9	(9%)
Height (*cm; N=100*)	131.7	± 10.52
Weight (*kg; N=97*)*	30.1	± 9.95
BMI (*N=97*)*	17.1	± 3.80
Comorbidity	29	(28%)
Abnormal MRI (*N=99*)*	21	(21%)
Characteristics at presentation		
Lenke classification (*N=99*)*		
1	55	(56%)
2	8	(8%)
3	18	(18%)
4	0	(0%)
5	4	(4%)
6	14	(14%)
Lumbar modifier		
A	26	(26%)
B	51	(50%)
C	22	(22%)
Family history of scoliosis	49	(48%)
Family history of surgery	14	(31%)
Main Thoracic Cobb angle (*N=99*)*	27.3	± 9.47
Lumbar Cobb angle	21.1	± 8.46
Maximum Cobb angle	28.9	± 8.46
RVAD (*N=89*)*	9.2	± 8.75
Bracing characteristics		
Age (*years; mean ± SD*)	8.1	± 1.36
Number of braces	2	(1 to 2)
Noncompliant	47	(46%)
Total bracing time (*years; mean ± SD*)	3.7	± 11.63
Cobb angle (*N=94*)*	13.1	± 8.69
Cobb angle correction (*%; N=94*)	55.6	± 25.66

*The number in parentheses (*N=*) indicates the number of patients with available data for the given characteristic.

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Standard JIS Boston Protocol

Curve >20° = *MRI*

•*97% MRI*

If MRI normal = brace

- 21% abnormalities non-operative
- 23 (18%) with OPERATIVE intraspinal pathology

Xray in brace in 2 months

- Boston Brace (92%)
- Adjust brace if poor construction/correction
- Average in brace correction: 55.6%

Q4 month clinical follow up

Brace change at discretion of surgeon

- 83% full time (>18 hours)

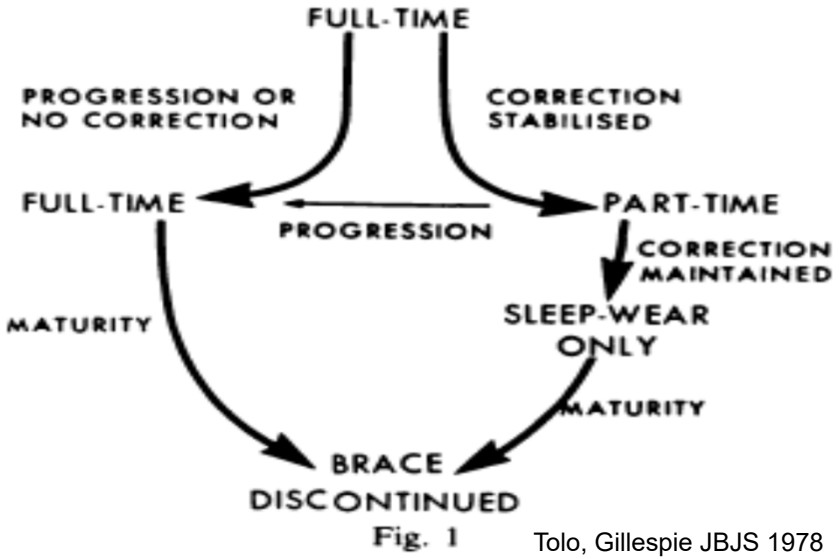

Fig. 1

Tolo, Gillespie JBJS 1978

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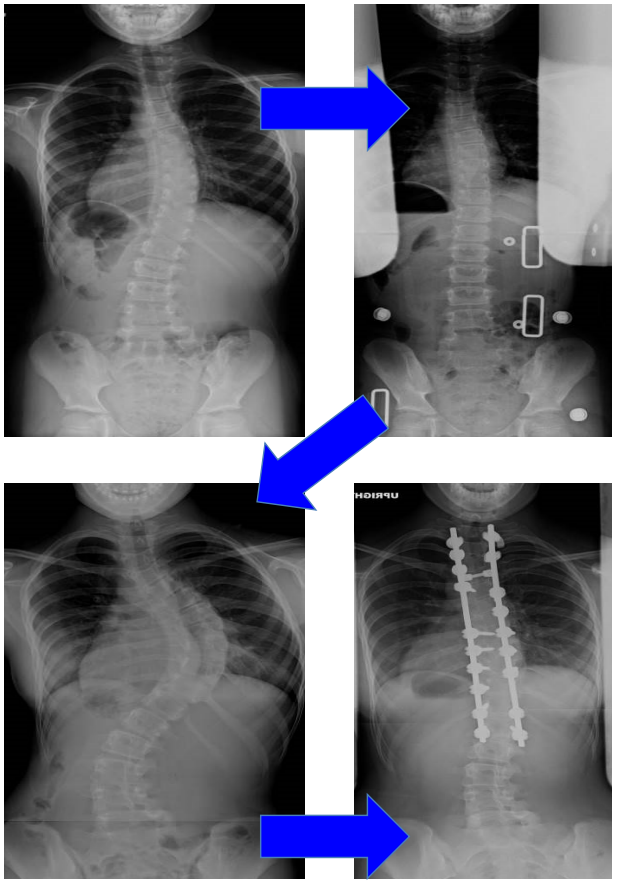
Results

Surgical Correction: 46%

Average age: 12.8 ± 1.9 yrs

Risk factors (p<0.05):

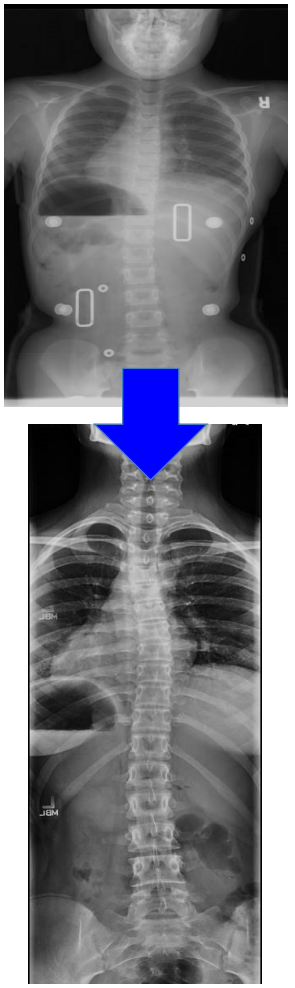
- Comorbidity (OR 8.9, 95% CI 2.1-38.1)
- Larger maximum Cobb at presentation (OR 1.1, 95% CI 1.02-1.19)
  - Every 1° at presentation increases risk of surgery 10%
- Noncompliance (OR=11.3 96% CI 3.2-39.7)
  - 76% operative, 25% nonoperative



Results

Protective factors against surgery (p<0.05):

- –Lumbar modifier B (OR=0.17 95% CI 0.04-0.72)
- –Older age at bracing (OR 0.6, 95% CI 0.37-0.97)
  - Each additional year decreased odds of surgical correction by 40%
- –More brace changes
  - For each brace change, surgical intervention decreased 74% (OR=0.26, 95% CI)
- –In brace correction



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Results

Brace change decision making:

- 61 patients
  - 81 duration of brace wear ($p<0.001$)
    - –Full time ➔ part time: Cobb decrease 9.9° ±15°
    - –Part time ➔ full time: Cobb increased 9.9° ±15.6
  - 17 type of brace
    - –No change in curve (-1.2°)

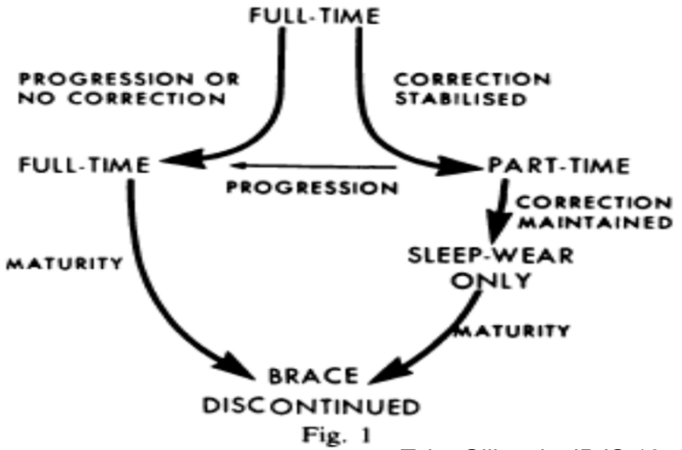

Fig. 1

Tolo, Gillespie JBJS 1978

Results

- No Progression (<5˚)
  - 31 (34%)
- Progressed >5˚, no surgery
  - 19 (21%), average progression 20˚
- Progressed to >45˚, fused with Risser ≤1
  - 29 (32%), average progression 33˚
  - No Growing rods
- Progressed >45˚, surgery delayed Risser ≥3
  - 13 (14%), average progression 32˚

Results

Those still in brace (N=76)

- Average age at presentation 7.5 years
- Average length of current brace wear 4.8 years
- Different group – longer bracing, younger age

Conclusions

Largest series of JIS >20° with standard Boston bracing protocol followed to skeletal maturity

Intraspinal pathology requiring surgical intervention high (18%)

The rate of JIS progressing to need spinal fusion may be lower than previously reported with good brace fit and compliance

Risk factors for progression include other medical issues, larger Cobb angle at presentation, and noncompliance.

Conclusions

Protective factors include lumbar modifier B, older age at presentation, and number of brace changes

Brace fatigue in this population may be real and contribute to noncompliance and poor brace efficacy.[6]

Our data is skewed toward surgical intervention due to surgery as an endpoint with 76/178 still in a brace.

Future Directions

Prospective trial with more accurate compliance data and randomization with full time to part time for stable curves in younger juveniles

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