

Factors Affecting the Efficacy of Halo-Gravity Traction in Early Onset Scoliosis

**Brian Yang BA, Jill Larson MD,
Michael Glotzbecker MD**

Introduction

Halo Gravity Traction (HGT)

- Adjunctive treatment for Early-Onset Scoliosis (EOS)
- Limited data exists describing which factors influence one's response to HGT



Source: D'Astous JL, Sanders JO. Casting and traction treatment methods for scoliosis. Orthop Clin North Am. 2007 Oct;38(4):477-84, v. Review



Boston Children's Hospital
Orthopedic Center



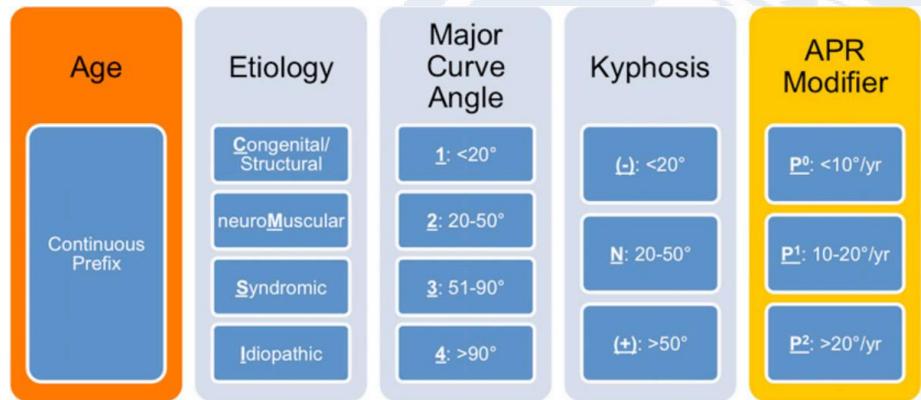
HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Introduction

Classification of Early Onset Scoliosis (C-EOS)

Classifies EOS patients based on:

- Etiology
- Major Curve Angle
- Kyphosis
- Annual Progression Ratio



Source: Williams BA, Matsumoto H, McCalla DJ, Akbarnia BA, Blakemore LC, Betz RR, Flynn JM, Johnston CE, McCarthy RE, Roye DP Jr, Skaggs DL, Smith JT, Snyder BD, Sponseller PD, Sturm PF, Thompson GH, Yazici M, Vitale MG. Development and initial validation of the Classification of Early-Onset Scoliosis (C-EOS). J Bone Joint Surg Am. 2014 Aug;96(16):1359-67. doi: 10.2106/JBJS.M.00253.



Boston Children's Hospital
Orthopedic Center



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Methods

Retrospective cohort analysis

- Patients with scoliosis
- Received HGT between 2010 and 2016

Patients grouped by C-EOS classifications

- Etiology, major curve angle, kyphosis, annual progression ratio (APR)

Groups within C-EOS classifications tested for association with:

- Major curve correction (MCC) due to HGT alone (degrees)
- Percent major curve correction due to HGT alone (% correction)
- Multivariable model of degrees of major curve correction created that considered etiology and major curve angle



Boston Children's Hospital
Orthopedic Center



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Results – Demographics

28 Patients

Median age at scoliosis dx
requiring treatment – 4.75
years (range 1.28-10.91)

Median age at halo application
- 13.9 years (range 3.7-22.5
years)

Indications for halo traction:

- 12 severe curves
- 6 rigid curves
- 4 severe and rigid curves
- 2 kyphoscoliotic curves
- 4 cases w/o explicit reasoning
in medical charts



Boston Children's Hospital
Orthopedic Center



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Results – MCC Association with C-EOS Groups

Median major curve correction
(MCC) – 34° (range 5° to 88°)

Table 1: Demographic and curve correction characteristics of patients receiving pre-halo gravity traction

Characteristics	Number of patients		MCC Median (P25, P75)	Association with MCC (P-value)
		(%)		
Gender	Male	19 (67.9%)	33.0° (15.0°, 43.0°)	0.49
	Female	9 (32.1%)	34.0° (11.0°, 47.0°)	
Etiology	Congenital	6 (21.4%)	12.5° (11.0°, 21.0°)	0.140*
	Neuromuscular	21 (75.0%)	40.0° (20.5°, 44.0°)	
Major Curve Angle	Syndromic	1 (3.6%)	36°	0.014
	Idiopathic	0 (0.0%)	n/a	
Kyphosis	1	0 (0.0%)	n/a	
	2	2 (7.1%)	16.5° (12.0°, 21.0°)	
	3	11 (39.3%)	20.0° (6.0°, 34.0°)	
	4	15 (53.6%)	42.5° (36.0°, 49.0°)	
	+	15 (53.6%)	38.5° (13.0°, 47.0°)	
Progression	-	1 (3.6%)	10°	0.607**
	Neutral	12 (42.8%)	32.0° (20.5°, 42.5°)	
Modifier (n=24)	P0	10 (41.7%)	21.0° (13.0°, 43.0°)	0.300
	P1	4 (16.7%)	25.0° (8.5°, 41.0°)	
	P2	10 (41.7%)	42.5° (24.0°, 49.0°)	

MCC = Major Curve Correction; *Comparison of Congenital vs Neuromuscular only; **Comparison of + vs Neutral only

Results - MCC Association with C-EOS Groups

Major curve correction was not associated with etiology, kyphosis, or APR classification individually.

The median major curve correction due to HGT was 16.5° , 20.0° , and 42.5° for major curve angle groups “2” (20° - 50°), “3” (51° - 90°), and “4” ($>90^\circ$) respectively ($p=0.014$).

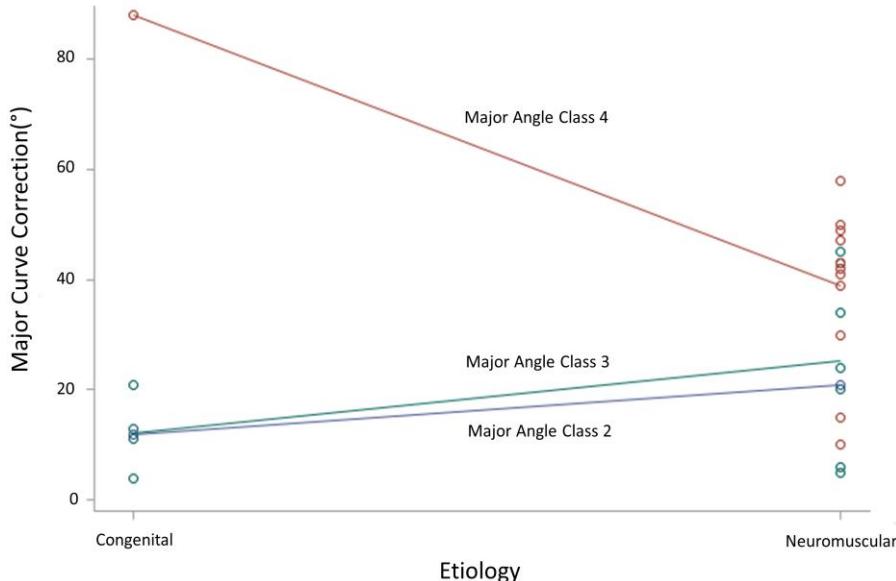


Boston Children's Hospital
Orthopedic Center



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Results – Interaction Effect



There is a significant difference in degrees of major curve correction due to HGT between major curve angle groups “3” and “4” in congenital scoliosis patients (75.8° , $p<0.001$) but not neuromuscular scoliosis patients (13.6° , $p=0.054$).

Significant interaction effect remained when considering percent major curve correction between groups “3” and “4” in congenital patients ($p=0.018$) but not neuromuscular patients ($p=0.615$).



Conclusions

Increasing major curve angle classification is significantly associated with increased curve correction due to HGT.

This effect is particularly pronounced in congenital scoliosis patients between major curve angle groups “3” and “4”.

These findings provide insight into which patients may best benefit from HGT.



Boston Children's Hospital
Orthopedic Center



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

