

**Paper #4**

**The Use of Halo Gravity Traction in the Treatment of Severe Early Onset Scoliosis**

*Kwando Poku Yankey, Oheneba Boachie-Adjei, FOCOS Spine Research Group, Henry Osei Tutu, Irene Wulff, Rufai Mahmud, Sravisht Iyer, Henry Ofori Duah*



WITHDRAWN

curve correction at over 2 year f/u indicating its effects may persist the long term effects of HGT.

**Hypothesis:** HGT results in improved initial correction and subsequent maintenance of correction in patients with large stiff curves.

**Introduction:** Treatment of severe scoliosis with HGT prior to MCGR has not been previously reported. Complication rates range from 0-100%. With an ave 44% initial correction of the major curve reported in the literature. Loss of correction and diminishing returns are the norm.

**Methods:** IRB approved retrospective single site cohort study of a prospective database. 42 patients underwent MCGR between 2014-17, 12 with prior growing constructs were excluded, 30 patients were included, 12 patients underwent preop HGT.

**Results:** HGT group major curve averaged 90o (69-114o) vs 77o (56-113o) in the non HGT group p= 0.018. Preop bending films accounted for 72% of the total correction achieved in the non-HGT group vs 27% in the non-HGT group. An additional 45% of the total correction was achieved in traction. Comparable correction occurred intratop. See table 1. At most recent follow-up the HGT group maintained their correction better than the nonHGT group p=0.019 gaining 2 o of correction vs a 6 o loss of in the nonHGT group. Ave follow-up was 878vs 804 days in the HGT vs nonHGT groups.

**Conclusion:** Large, rigid curves can achieve equivalent correction to flexible curves with HGT. 43% of the total correction achieved occurred in traction. 30% of the total correction occurred intraoperatively in the HGT group vs 28% in the non-HGT group. At most recent follow-up HGT patients had maintained their major curve correction better than the non-HGT while the numbers are small they are significant because you would expect them to do worse. Indicating that HGT continues to effect the patient positively long past the initial implantation.

	Preop Cobb	Preop Flexibility	Post traction Cobb	Postop Cobb	Change in Cobb postop vs most recent	Average Follow-up (days)
Traction n=12	90°	78°	59°	46°	-2° (-13-9)	878
		27%	43%			
		70%	30%			
Non traction n=18	77°	46°	NA	34°	6° (-5-17)	804
		72%		28%		
P-value	0.027	0.000	NA	0.421	0.019	

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**Paper #6**

**Sagittal Balance in Hyperkyphotic Patients with Growing Rods and the Effect of Preoperative Halo Gravity Traction**

*Cynthia Nguyen, Henry Ofori Duah, Mabel Owiredu, Osei-Tutu Henry, Kwadwo Yankey, Harry Akoto, Irene Wulff, Oheneba Boachie-Adjei*



**Summary:** Hyperkyphosis is a known risk factor for proximal junctional kyphosis (PJK) in growing rods patients. We found that very hyperkyphotic patients who received preop halo gravity traction (HGT) did not have a significantly higher rate of PJK, indicating that pre-op HGT can mitigate some of the risk of hyperkyphosis.

**Hypothesis:** Risk factors for PJK in hyperkyphotic growing rods patients are similar to non-hyperkyphotics. Halo gravity traction has protective effect.

**Introduction:** Hyperkyphosis is a major risk factor for proximal junctional kyphosis (PJK) in patients treated for early onset scoliosis (EOS) with

**Paper #5**

**The role of Halo Gravity Traction Prior to MCGR, When Does Correction Occur?**

*Michelle Welborn, Daniel Bouton, Joseph Ivan Krajbich*



**Summary:** Large stiff curves achieve comparable correction to flexible curves using preop HGT. The HGT patients had better maintenance of

growing rods. We explored sagittal parameters in a population of hyperkyphotic patients and the effect of preoperative halo gravity traction (HGT).

**Methods:** Retrospective review of patients with: EOS and growing rods, pre-operative kyphosis > 40° and 2 year follow-up. Patient demographics, HGT if applicable and surgical details were recorded. We analyzed sagittal parameters on radiographs taken before traction, preop, postop, and at follow-up visits.

**Results:** 49 patients met criteria. Average age was 7.5 (range 2- 14) years. 17 (35%) of patients developed PJK. Patients with PJK had a significantly higher preoperative kyphosis (84 ± 14° vs. 71 ± 15°, p = 0.008) and higher postoperative pelvic incidence (49 ± 14° vs. 40 ± 10°, p = 0.02). There was no significant difference in age, levels fused, apex level, post-operative kyphosis or kyphosis correction index. Patients with > 60° of preoperative kyphosis were 9 times more likely to get PJK (p = 0.05). 19 (39%) patients underwent pre-op HGT for average duration 9.3 (range 4-20) weeks. HGT patients started out with significantly more kyphosis (106 ± 12° vs. 72 ± 17°, p = 0.000), but their kyphosis decreased down to an average of 81 ± 15° after HGT treatment and they did not have a significantly higher rate of PJK (27% vs 47%, p = 0.12).

**Conclusion:** Risk factors for PJK in EOS patients include increased preoperative kyphosis and postoperative pelvic incidence. Very hyperkyphotic patients who underwent pre-op HGT did not have a higher rate of PJK, indicating that HGT can be a useful adjunct in those patients to decrease their risk of PJK.  
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**Paper #7**

**Preop Halo Gravity Traction (HGT) Associated with Decreased Implant Complications in MCGR**

Michelle Welborn, Daniel Bouton, Joseph Ivan Krajbich



**Summary:** Complications associated with MCGR range from 0-100% and unplanned revisions 9-57% with an ave complication rate of 44%. Pts undergoing preop HGT with severe rigid EOS had an 8% implant complication rate at >2yr follow-up.

**Hypothesis:** Our Hypothesis is that by decreasing the stress on implants through preop HGT and postop through a frequent small magnitude lengthening protocol that it would result in less stress on the implants, potentially resulting in fewer implant related complications.

**Introduction:** Implant related complications in MCGR are high. Rod fracture and failure has been attributed in part to increased curve rigidity. We have employed pre-operative HGT in our institution for > 20yrs. Preop HGT impacts both the thorax and the spine improving postop outcomes theoretically because the curve is less rigid. By decreasing the rigidity of the curve it may result in less force on the implants potentially decreasing implant related complications.

**Methods:** Single site prospectively collected database including 30 patient undergoing primary MCGR from 2014-2017. 12 pts with EOS and curves

> 80o and/or flexibility less than 10% underwent preop HGT. All pts underwent a frequent small magnitude lengthening protocol of 2-3 mm every 6-8 weeks.

**Results:** There was a 20% overall complication rate, a 17% implant related complication rate and a 13% unplanned revision rate. 1 patient in the HGT group experienced anchor failure requiring unplanned revision. 3 patients in the nonHGT group required unplanned revision.

**Conclusion:** Implant related complications in patients undergoing MCGR average 44% of patients. We employ a frequent small magnitude lengthening protocol, our patients had a 20% complication rate. Furthermore, patients that underwent preop HGT had larger more rigid curves and would be expected to have a higher complication rate. But in fact had a lower complication rate of 8%. Implant related stresses are multifactorial. Preop HGT and a frequent small magnitude lengthening protocol are ways to decrease those stresses and implant related complications.

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**Paper #8**

**Optimization of Casting in Infantile Scoliosis**

Peter Stasikelis, Graham Fedorak, Ashley Carpenter, Alexandra Nielson, Jacques D'Astous



**Summary:** This is a comparison of casting for infantile scoliosis from two institutions. Center A obtained radiographs before and after each cast and used shoulder straps in an effort to maximize the response to casting. Center B did not use shoulder straps and acquired radiographs only every six months. Otherwise, the casting techniques were nearly identical. This work demonstrates that neither regular radiographs nor over shoulder straps improve the outcomes of casting.

**Hypothesis:** Frequent radiographic imaging and shoulder straps do not improve the results of casting for infantile scoliosis.

**Introduction:** Many works support the use of casting in infantile scoliosis, but what factors optimize the outcomes of casting are not clear. This work evaluates the role of radiographic imaging frequency and over the shoulder straps in the outcomes of casting.

**Methods:** Two surgeons followed nearly identical protocols for applying casts for infantile scoliosis. At center A, the surgeon hoped to improve outcomes by obtaining radiographs before and after each cast and by reinforcing the casts with shoulder straps. At center B, the surgeon did not use shoulder straps and limited radiographs to once every six months. Children were included if they were less than or equal to 3 years old and had a curve of 50° or more at the time of the first cast, and had a minimum of 3 years of follow-up. Center was used as a variable in a multivariable regression that also included: age at first cast, initial curve magnitude, and presence of a syrinx or genetic syndrome with the outcome of curve resolution.

**Results:** There were 40 children at center A, nine of whom experienced resolution of their curves. There were 36 children at center B, and eleven demonstrated curve resolution. At center A, two of 10 children with a syrinx or genetic syndrome demonstrated curve resolution while seven of 30 without these comorbidities did. At center B three of 10 children with a

Outcomes HGT vs NonHGT group

	Rod failure	Rod Fracture	Implant failure/ Pullout	PJK	Unplanned Revision
HGT (12)	0	0	1 (9%)	0	1 (9%)
No HGT (18)	2 (11%)	0	1* (5%)	1* (5%)	3 (16%)
Lit ave	10.6%	11.7%	11.8%	3.8%	33%
	Still lengthening	Achieved maximum length	Revised	Converted to fusion	Follow-up Duration
HGT (12)	5	7	3	4	878
No HGT (18)	11	5	4	1	804

(1 pt with PJK due to implant pullout was included in implant pullout group)