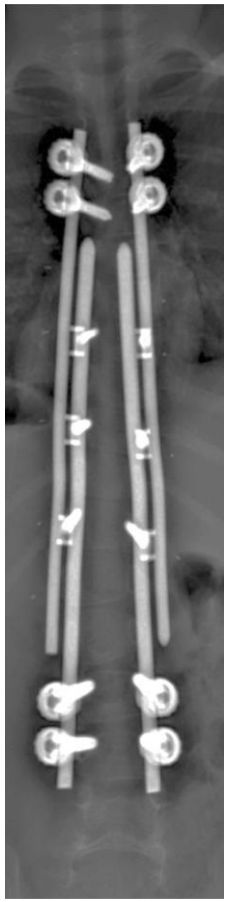
Modern Luque Trolley for the Management of Early-Onset Scoliosis: **The First Ten Patients with a New Gliding Implant with Two-year Follow Up**



Learning Curve

Andrew Tice[1], Ahmed Aoude[2], Ron El-Hawary[3], ***Jean Ouellet[2]***

1. **University of Ottawa, CHEO**
   Ottawa Ontario, Canada

2. **McGill University Health Centre & Shriners Hospital,**
   Montreal, QC, Canada.

3. **Dalhousie University, IWK Health Centre**
   Halifax, NS Canada

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Disclosures

Direct Conflicts

DepuySynthes Spine:	Prior **Consultant** for the **development of New Guided growth implants** **No Royalties**
AO Foundation:	**PI** international multicenter study Modern Luque Trolley system

Indirect Conflicts

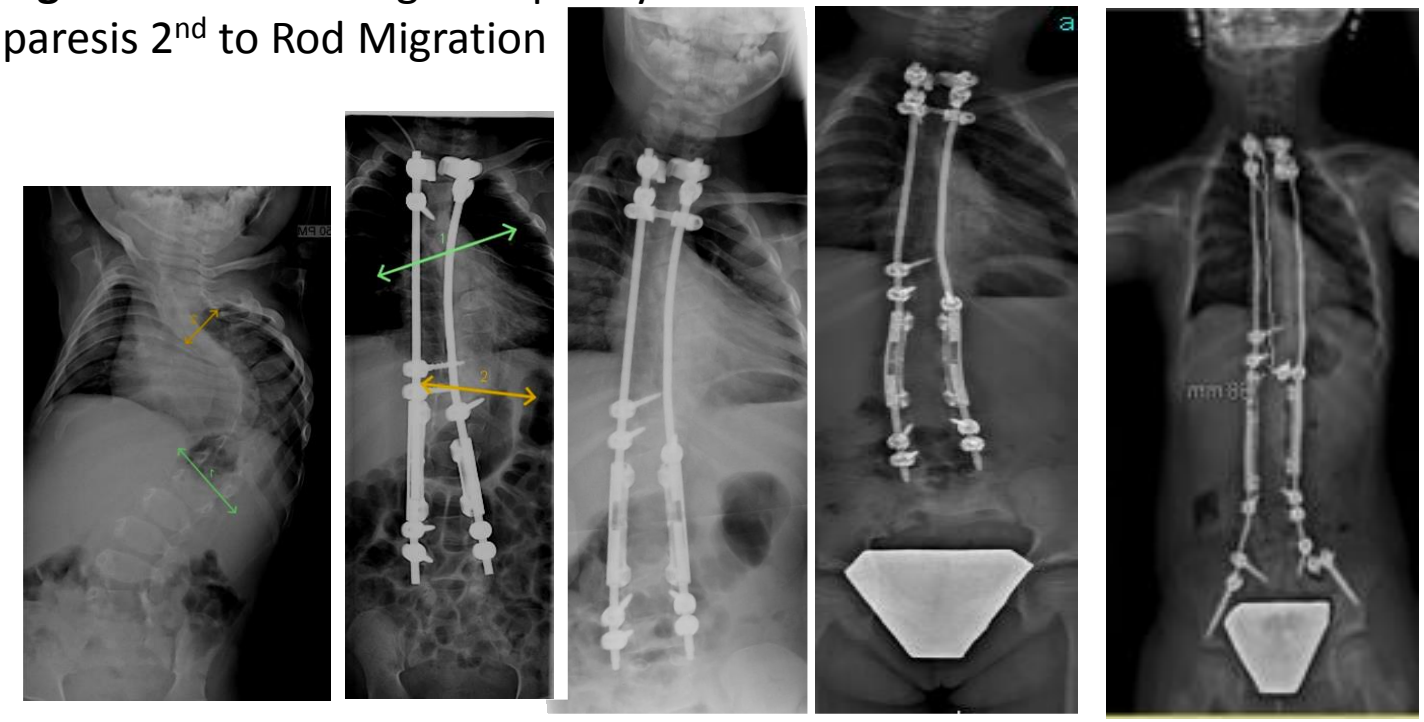
AO Foundation:	Institutional Research and Fellowship Support

IMPLANT IS CE marked but is NOT FDA APPROVED

Background

Current Treatment options for EOS: Dual Growing Rods, Rib based distraction, Magnetic Rods **achieve spinal growth** however they **continue** to have **a high complications rate**, a high rate of planned and unplanned surgeries.

16 surgeries later : Iatrogenic Spondylolisthesis
Paraparesis 2nd to Rod Migration



1.5 yr 2.5yr 5 yr 7yr 9yr old

Background

Original Growth guidance construct was Luque Trolley:

Segmental fixation
- Every level
- Sublaminar wires
- Correction relied on
- Binding Lamina to rod

Non fusion
- Fixation was relying of wire
- Rods would migrate

“Loose” construct
- no solid anchor
- no rotational control
- Significant residual deformity

Many Issues leading to poor outcomes

Spontaneous fusion

Implant failures

Deformity progression

Luqué ER, (1977) Ortho Trans 1:37-38.

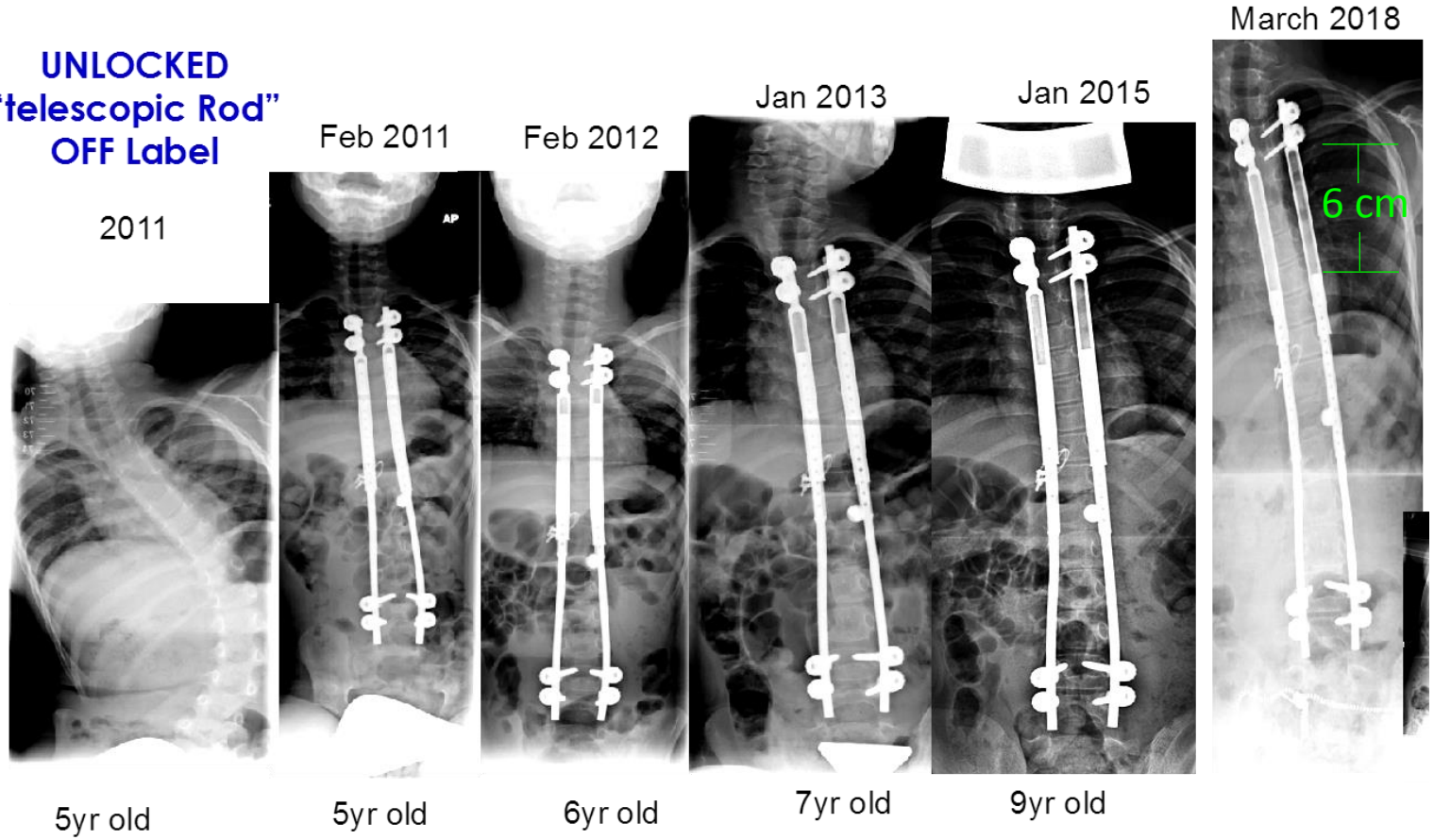
Background

SYMPOSIUM: EARLY ONSET SCOLIOSIS

Surgical Technique

Modern Luqué Trolley, a Self-growing Rod Technique

UNLOCKED
"telescopic Rod"
OFF Label



No distraction purely self guided growth : 6 cm over 7 yrs

Advantages

1. **Avoiding repetitive surgeries**
   Institutionalizing the children
   Repetitive Anesthesia at early age
   Decrease risk of infection
3. **Avoid overloading** the spine
   Leading to iatrogenic
   sagittal deformities
3. **Allow some motion**
   Minimize law of diminishing return

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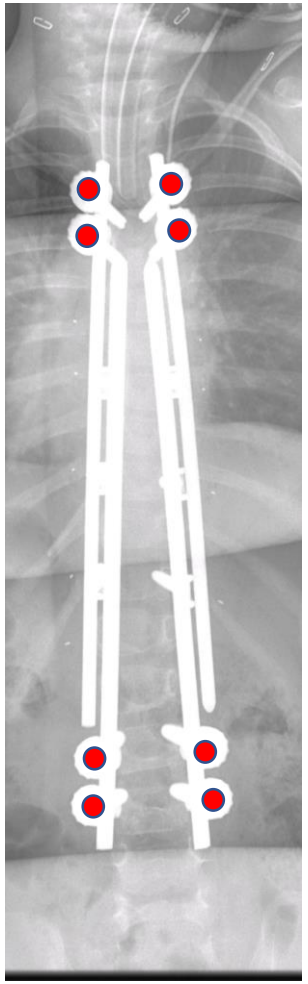
* Clin Orthop Relat Res (2011) 469:1356–1367

Surgical Technique

Modern Luque Trolley



New Gliding spinal implants & new surgical technique to address specific short comings (complications) of original Luque Trolley

1. Independent though Solid
Prox / Distal anchor Fusions
Four Rod Construct

Minimize Implant failures

Gliding Anchors **Apical**

Fix Anchors **Proximal & Distal**

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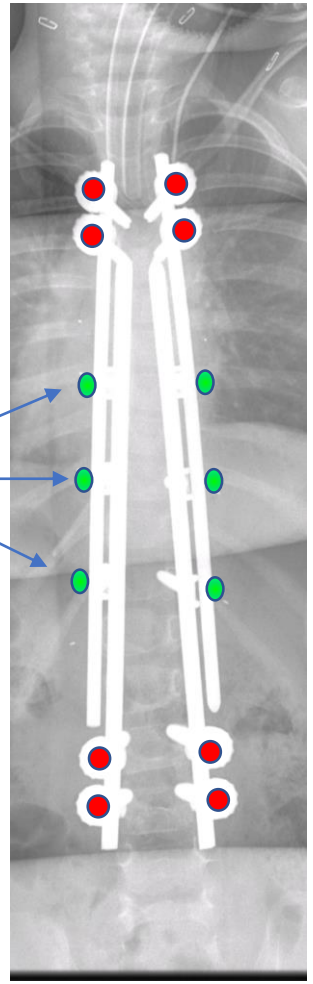
Surgical Technique

Modern Luque Trolley

New Gliding Anchor



New Gliding spinal implants & new surgical technique to address specific short comings (complications) of original Luque Trolley

1. Independent though Solid
Prox / Distal anchor Fusions
Four Rod Construct

Minimize Implant failures

2. Limited Apical fixation
Gliding Anchors
Maximal apical translation

Maximize correction to normalize forces across growth plates

3. Limited surgical dissection

Minimize Autofusion

Gliding Anchors **Apical**

Fix Anchors **Proximal & Distal**

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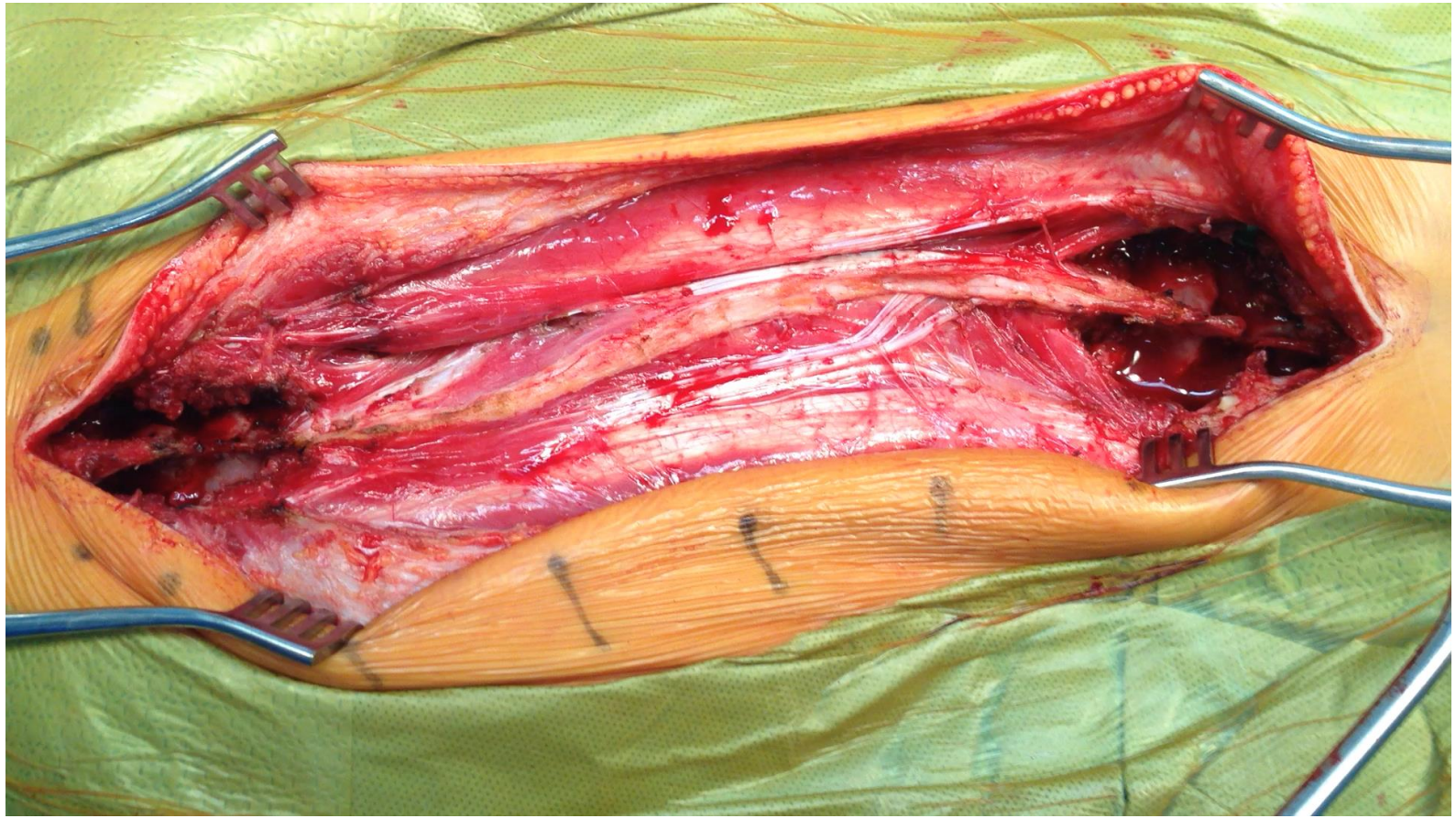
Surgical Technique

Surgical Exposure:

Classic Subperiosteal dissection at the **proximal and distal Fixed anchors.** Formal **Two level Fusion**

Trans-muscular dissection for gliding anchors avoiding bone exposure. Minimizing risk of spontaneous fusion. Wiltse type approach.



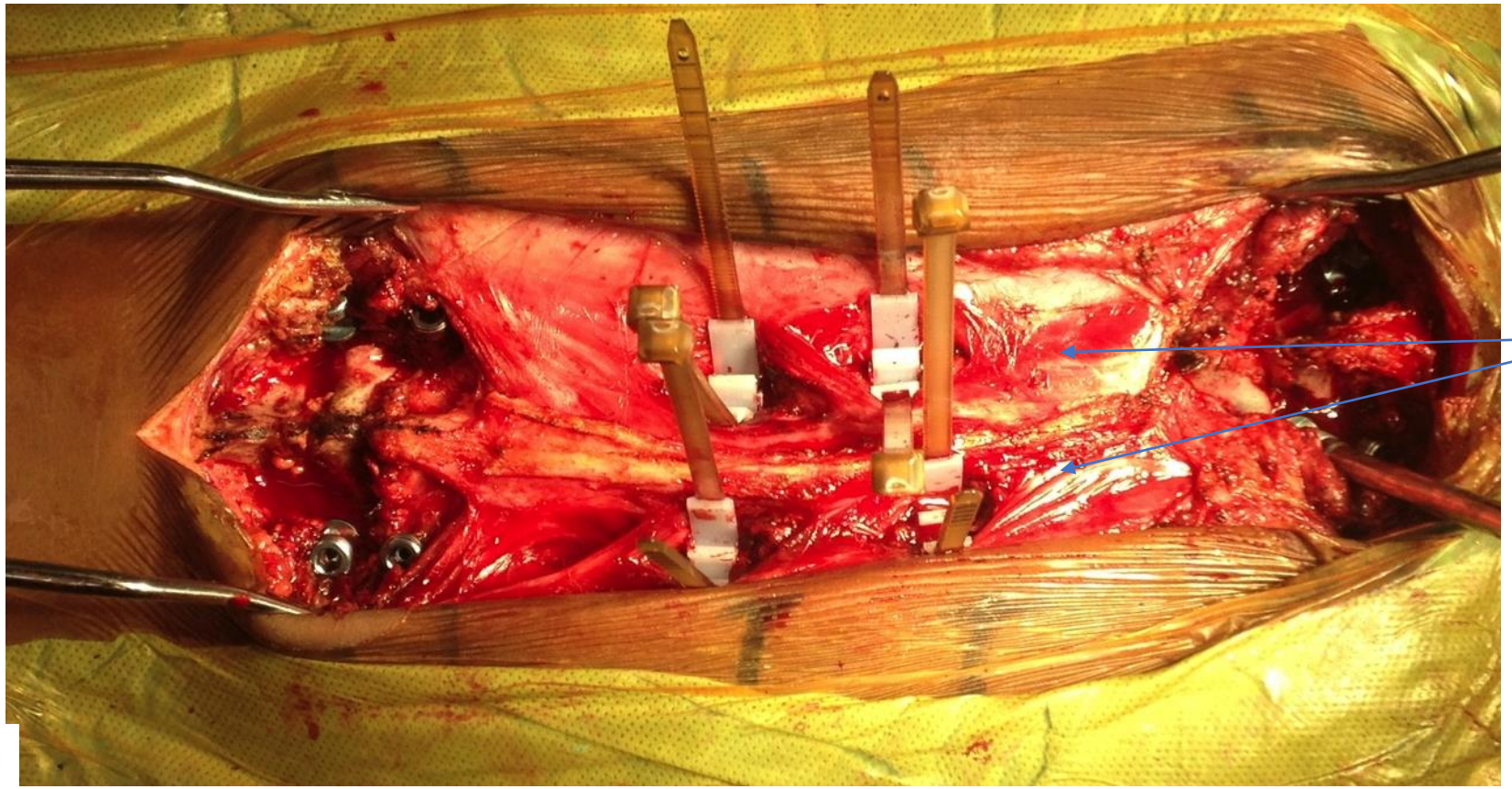
Dissection :
Longissimus & Iliocostalis

Multifidus & Spinalis

Surgical Technique

Apical Gliding screws:

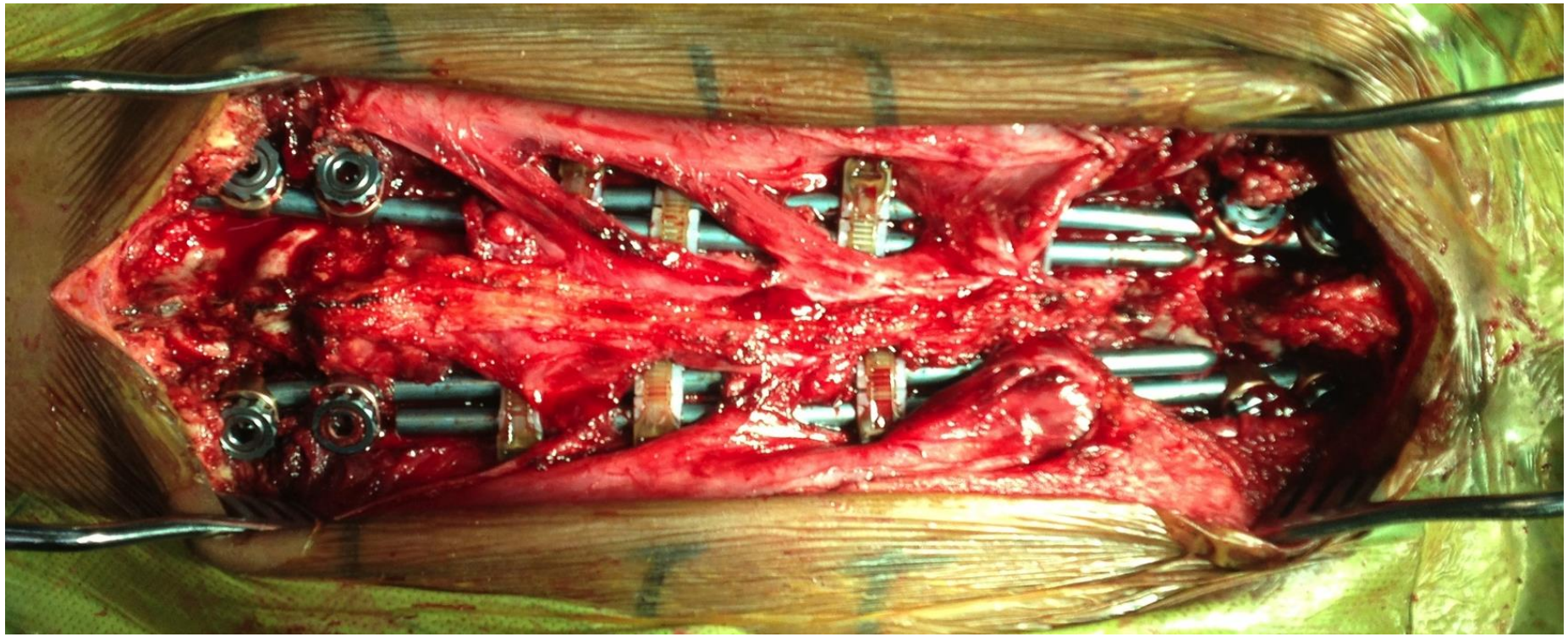
- inserted **transmuscularly** to minimize risk o**f auto fusion**
- are Keep off the spine to minimize auto fusion



Surgical Technique

Reduction Technique

Two pairs of rod each fixed **proximally and distally** that overlap at **across the apex. Cantilever and Rod derotation** maneuvers achieve deformity correction.



Hypothesis

Growth guidance technique using modern spinal implants with a **engineer gliding anchor** would **decrease** overall **complication rate, planned and unplanned surgery** in EOS Patient, while still allowing the spine to grow

Methodology

Retrospectively study on patients that underwent Modern Luque Trolley Construct with a minimum of 2 year follow up. Clinical & Radiological data as collected, complications, growth T1-T12, T1-S1 reoperations

Indication

- **Skeletally immature < 10 yrs or Open TriRadiate Cart**
- **Progressive deformity despite failed casting or bracing**
- **All EOS etiologies**
- **Expected deformity > 50 degrees**

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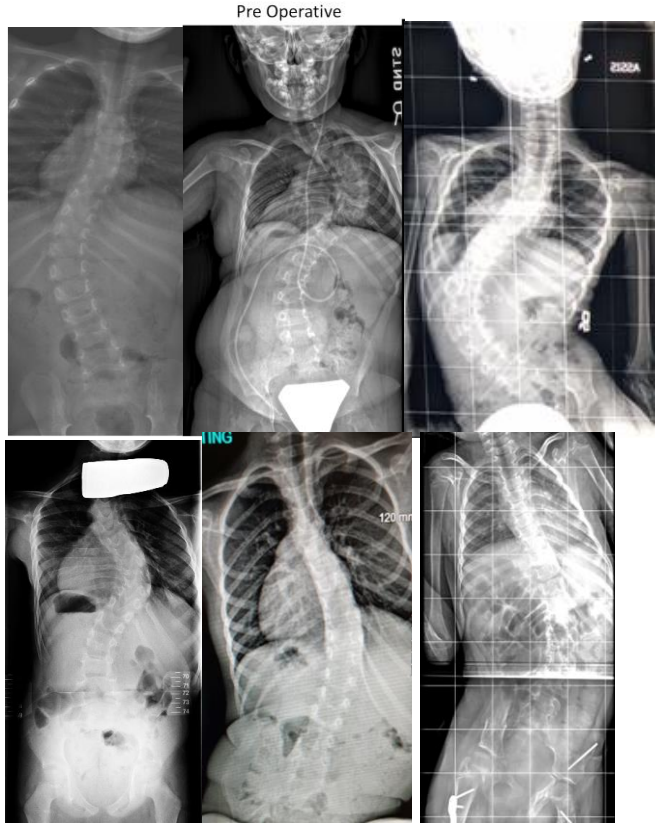
Results Canadian Cohort Special access – three institutions

Demographics	
Sinnce 1st January 2015	**n= 25**
Trolley cases than 2yr F/U	**N= 10**
AGE (range)	**8,4** y,m (5+7 - 14+5)
Gender	5 F 5 M
Etiology	2 Idiopathic 4 Neuromuscular 4 Syndromic
Avereage F/U (range)	**28** months (24 – 35)
Segments Spanned	**10 levels** (8 – 13)

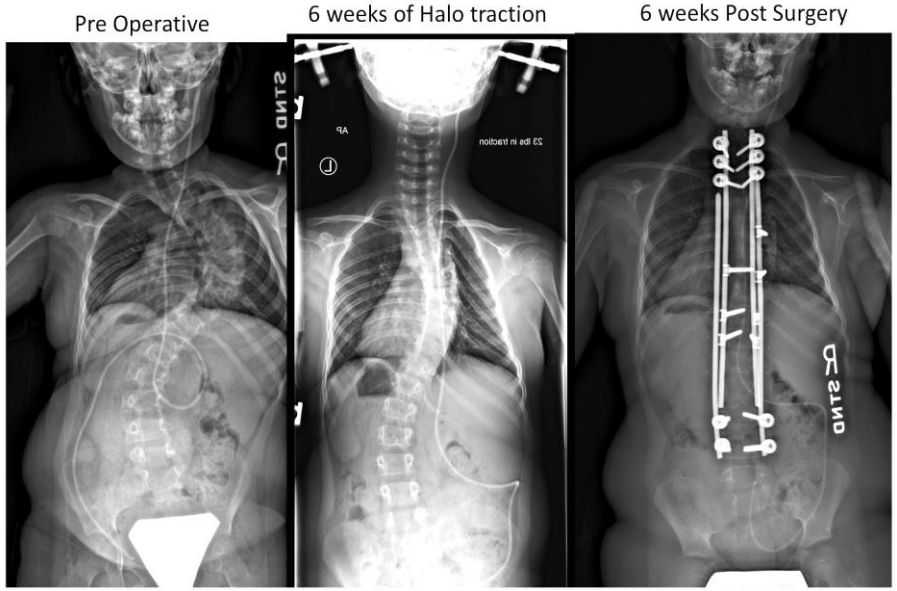


Results

Deformity Correction

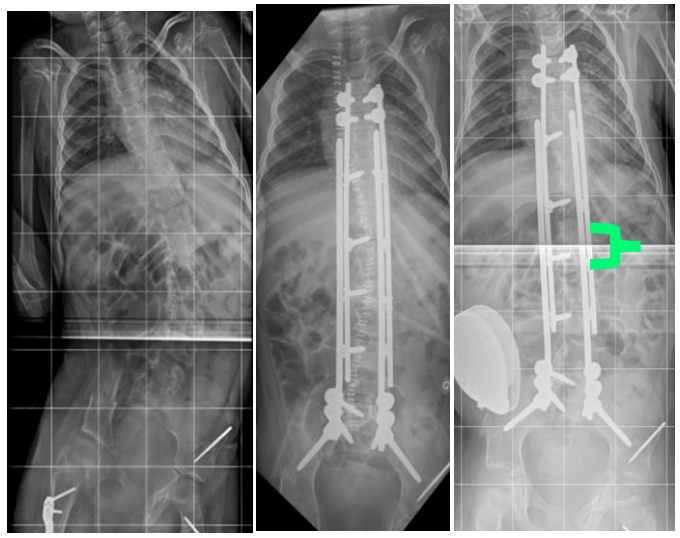
Preop Cobb	68° (47°-93°)	% correction
Post Op Cobb	**26° (3° - 42°)**	**61 % (90% - 22%)**
Last F/U Cobb	31° (4°-52°)	55 % (92% - *14%*)

Loss of correction: **Av. 2.5 degrees/year**



- 8° /yr ie additional correction
+ 10° /yr ie Cobb progression

Immediate **Cobb Correction**
correlate with
implant density / curve flexibility



Pre Op Post Op 2 yr Post Op

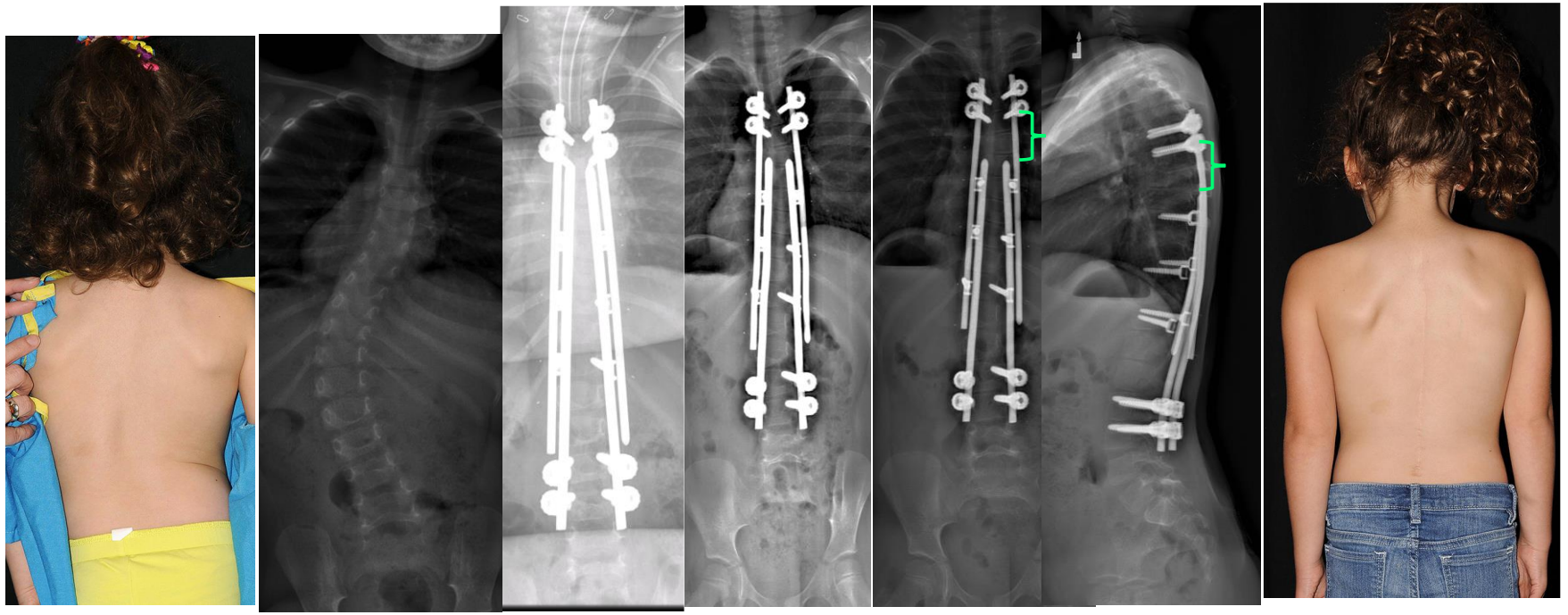
8 yr old Functional spastic Diplegic grew 2 cm over two yr.

Results

Growth

Ave. growth / years / per vertebra	0.62 mm	(0.1 – 1 mm)
Ave. T1-T12 spinal height gain post OP	2.9 cm	(1.2 – 4 cm)
Ave. T1-S1 spinal height gain Post Op	4.4 cm	(1.8 – 5.8 cm)

5 yr. old girl with 50° | 1yr | 3 yr F/U | 8.5 yr old



Overall growth:

65%

of Expected Growth

3yr Post Op no revision nor lengthening surgery. The spine has grown 4 cm across the 10 instrumented vertebra representing 114% of expected growth

Demiglio calculation (3.5 yr X 10 vertebral X 1 mm = 35mm

Courtesy:
Dr Ron Elhawary

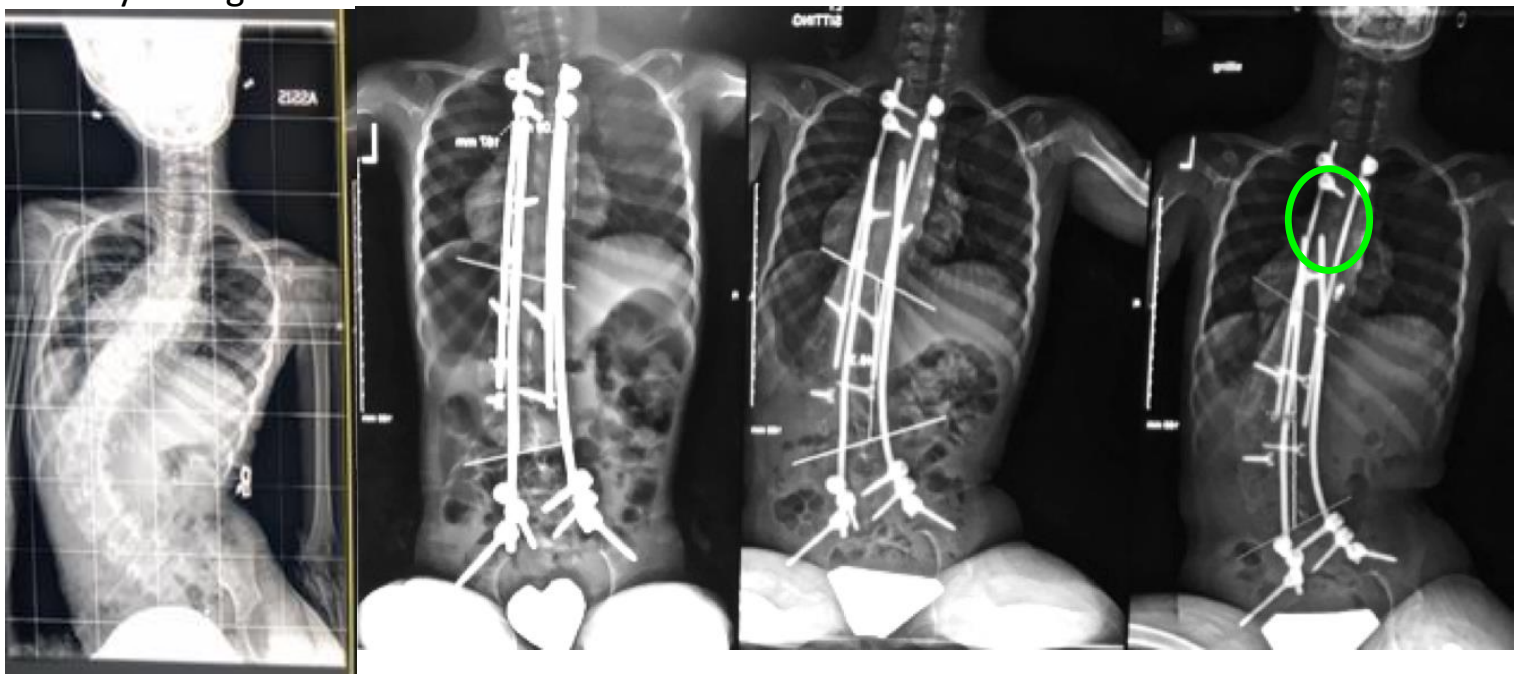
Results

Poor Outcome: < 50% expected growth

3 pt. – Large Residual deformity > 20° – Curve Progression - poor growth

Preop Cobb	68° (47°-93°)	% correction
Post Op Cobb	26° (3° - **42°**)	61 % (90% - **22%**)
Last F/U Cobb	31° (4°-**52°**)	55 % (92% - ***14%***)
Av. Cobb progression / yrs	2.3°	(-8° - **25°**)
Ave. growth / yr / per vert	0.62 mm	(**0.1** – 1 mm)

7 yr. old girl



10.5 yr. old girl

58% of expected growth

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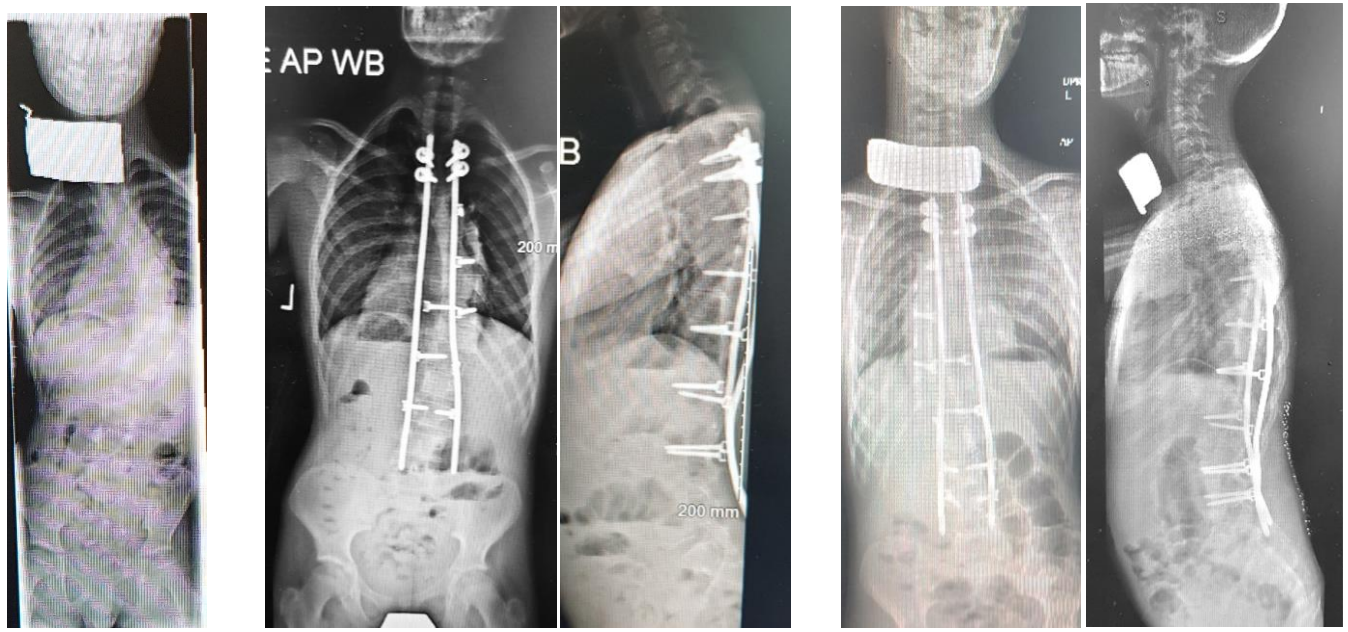
Results

Complications

Complications	N= 3 in two patients
1 prominent hardware	Revision surgery
2 Superficial Wound infection	PO antibiotics



Post Op – as patient bended forward distal rod was prominent. Revision surgery consisted of adding a set of gliding screw one level distal

Discussion:

Limitation: Obvious **short Follow up** with **few patients**

Growth guidance:

WORKS BUT IS **NOT** for all **EOS -**
It Can **control curve progression** while allowing **spinal growth**
Decreases / avoid **repetitive surgeries / Interventions**
Overall growth may be **less - 65% of expected**
Overall has **Less** complications

Patient Selection is Key

– intervene earlier when curve are still flexible ?

Maximal correction provides **better growth** and **less curve regression**

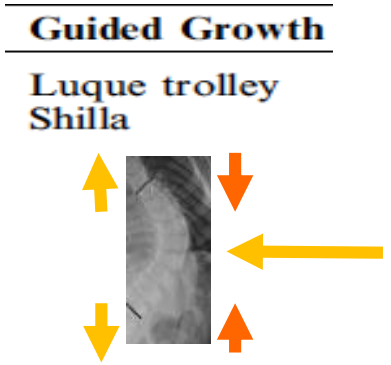
THANK YOU

Growth Guidance:

Conceptually to successfully achieve optimal growth guidance:

- **normalizing the forces across** all the vertebral **growth plate.**
  Maximal Deformity correction
  Apical control is mandatory.

- One wants a **semi-constrained system** allowing for
  motion minimizing auto fusion
- No **excessive forces applied** To minimize **junctional iatrogenic kyphosis** or **implant dislodgement** - inherent spinal growth drives length
- **Harmonious sagittal plane** allowing growth to occur through out the spine



Apical Translation