How Do We Optimize Comprehensive Care in EOS?

Evaluating Height and Growth

Ron El-Hawary, MD, MSc, FRCS(C) Halifax, Nova Scotia, Canada





Disclosures

- Grants / Research Support
 - Depuy-Synthes Spine
 - Medtronic Canada
 - Joint Solutions
 - EOS Imaging
- Consultant
 - Depuy-Synthes Spine
 - Medtronic Canada
 - Apifix Ltd.
 - Wishbone Medical



Overview

- Case Based Presentation
- 3D CT Lung Volumes
- Spine Height Normal, 18 cm rule
- Spine Length Sagittal Spine Length (SSL)
- Spine Length 3D (3D-TSL)
- 3D-TSL References



Case – April 2015

- 5 Y old girl
- Scoliosis
- Prader Willi Syndrome

















The Volume of Lung Parenchyma as a Function of Age: A Review of 1050 Normal CT Scans of the Chest With Three-Dimensional Volumetric Reconstruction of the Pulmonary System

Sohrab Gollogly, MD,* John T. Smith, MD,* Spencer K White,* Sean Firth, PhD,† and Keith White, MD*



Region	Volume (ml)	Mean HU 🛛 🖄
🔲 Rt Lung	336.94	-617.7 ± 221.4
🔲 L Lung	291.69	-597.9 ± 218.2
Total	628.63	







April 2015





April 2015 – TROLLEY Guided Growth







May 2016















April 2015 - October 2017

Weight Height Sitting Height Arm Span

EOSQ = 88/100 (Feb 2017)





April 2018







April '15 – April '18







Normal Spine Growth





Dimeglio, JPO-B 1993

Normal Spine Growth





Dimeglio, JPO-B 1993

Normal Spine Growth





Dimeglio, JPO-B 1993

Spine Growth



"Growth from Insertion" True Growth Phase



Expected Growth:

Age 6-10 yrs

= 5.8 cm total

= 4.3 cm growth (159% Expected)

18 cm Rule

- Outcomes (8 years old)
 - T1-T12 18.6 cm
 - % FVC

Karol et al., JBJS 2008

Can Distraction-Based Surgeries Achieve Minimum 18 cm Thoracic Height for Patients with Early Onset Scoliosis?

> Yehia ElBromboly, Jennifer Hurry, Charles Johnston, Anna McClung, Amer Samdani, Michael Glotzbecker, Tricia St. Hilaire, Tara Flynn, Ron El-Hawary, Children's Spine and Growing Spine Study Groups

Rib-based Distraction Surgery Maintains Total Spine Growth

Ron El-Hawary, MD, MSc, FRCS(C),* Amer Samdani, MD,† Jennie Wade, BS, CCRP,‡ Melissa Smith, NP,‡ John A. Heflin, MD,‡ Joshua W. Klatt, MD,‡ Michael G. Vitale, MD,§ John T. Smith, MD,‡ and Children's Spine Study Group

International Congress on Early Onset Scaliasis CEOS 2018 vember 15 – 16. 2011

JPO 2016

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International Congress on Early Onset Scoliosis

CEOS 2018

vember 15 – 16. 2011

Kyphosis

JPO 2016

Out of Plane Growth?

Sagittal Spine Length Measurement: A Novel Technique to Assess Growth of the Spine

Alan J. Spurway, PEng, MSc^{*}, Chukwudi K. Chukwunyerenwa, MD, MCh, FRCS (C)¹, Waleed E. Kishta, MD, PhD, FRCS (C)², Jennifer K. Hurry, MSc, Ron El-Hawary, MD, MSc, FRCS (C)

Spine Deformity 2016

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ational Congress

Spine Deformity 2016

April '15 – April '18

- Expected Growth SSL:
 - Age 6-10 yrs
 - Unknown
- Delta T1-S1 SSL
- = 6.3 cm total = 4.3 cm growth

Three-dimensional True Spine Length: A Novel Technique for Assessing the Outcomes of Scoliosis Surgery

Alan J. Spurway, P.Eng., MASc,* Jennifer K. Hurry, P.Eng., MASc,* Luke Gauthier, MD, FRCS(C),* Ben Orlik, MD, FRCS(C),*† Chukwudi K. Chukwunyerenwa, MD, MCh, FRCS(C),* Waleed E. Kishta, MD, PhD, FRCS(C),* and Ron El-Hawary, MD, MSc, FRCS(C)*†‡

- 3D-TSL
- Biplanar, 3D Measurement Technique
- Follows the True Path of the Spine

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• 3D-TSL is

- Accurate (0.4% error)
- Reliable (0.952 ICC)
- Repeatable (0.944 ICC)

• 3D-TSL results in greater spine length as compared to traditional coronal plane measures.

- Delta T1-S1 3D-TSL
 - = 5.0 cm total = 4.3 cm growth

Reference Centile Curves for 3D Spine Length in Healthy Children

Marie Beausejour PhD, Félix Thibeault MS, Paul Dallaire PhD, Ron El-Hawary MD, MS, James O. Sanders MD, Burt Yaszay MD, Behrooz A. Akbarnia MD, Marjolaine Roy-Beaudry MSc, Patrick Tohmé, Léonie Tremblay, <u>Stefan Parent MD, PhD</u>

Centile curves of 3D True Spinal Length in children 3 to 11

Conclusions

3D CT Lung Volumes

Spine height and growth has traditionally been measured utilizing coronal plane spine height measurements.

- Dimeglio's data

Conclusions

Spine height should be measured pre-operatively and immediately post-operatively

- Initial "growth"
- Not really growth just straightening a curve(s)

Spine height should be measured at routine intervals

- Distraction / True Growth Phase

Conclusions

Out of plane spine growth

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- Spine Length 3D (3D-TSL)
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