# Spinal Growth In Normal Children Between 3 And 11 Years Old Using 3D Reconstruction: A Longitudinal Study

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# Disclosures

- Work supported by the Academic Chair in Pediatric Spinal Deformities of CHU Ste-Justine
- Stefan Parent MD, PhD is consultant for EOS-Imaging, DePuy Synthes Spine and Medtronic and Shareholder of Spinologics
- Hubert Labelle is Shareholder for Spinologics
- Other grant support include SSSF, CIHR, NSERC, OREF, DePuy Synthes Spine and Medtronic

# INTRODUCTION

- What do we know about normal growth?
- Not a lot of studies
- Difficult to have precise images
- Radiological markings, imprecise measurements
- Influence of pathology on normal
- 3D Reconstruction data not existent

# INTRODUCTION

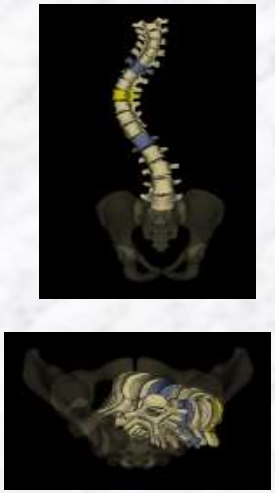
- "Growth is a succession of acceleration and deceleration phases and a perfect knowledge of normal growth parameters is mandatory to understand the pathologic modifications induced on a growing spine by an early onset spinal deformity."- Dimeglio A[1]

[1] Dimeglio A, Canavese F, The growing spine: how spinal deformities influence normal spine and thoracic cage growth. Eur Spine J. 2012 Jan;21(1):64-70. doi: 10.1007/s00586-011-1983-3. Epub 2011 Aug 30.

# Study Objectives

A) Measure normal values for:

- Total height
- Vertebral dimension
- Kyphosis
- Lordosis



3D Visualisation

B) Calculate growth rate per month for the age categories

# METHODS

- EOS Imaging x-rays of all patients seen between 2007 and 2014 at the spinal clinic were reviewed

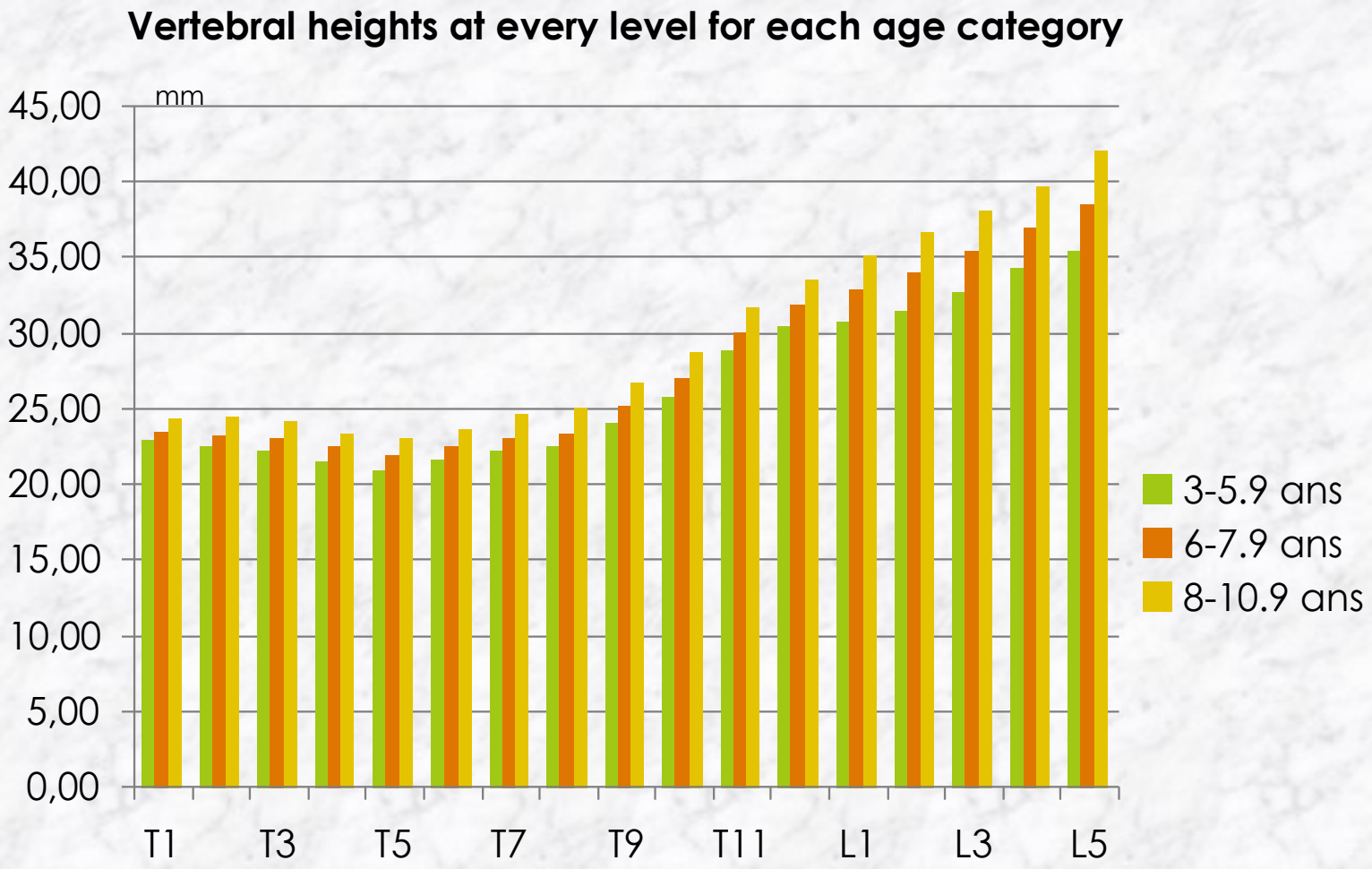

# METHODS

- All asymptomatic patients with a curve of less than 10° and more than one visit were identified,
- Absence of pathology with spinal growth influence
- PA and Lat calibrated radiographies were used for 3D reconstruction of the spine, using Idefx.

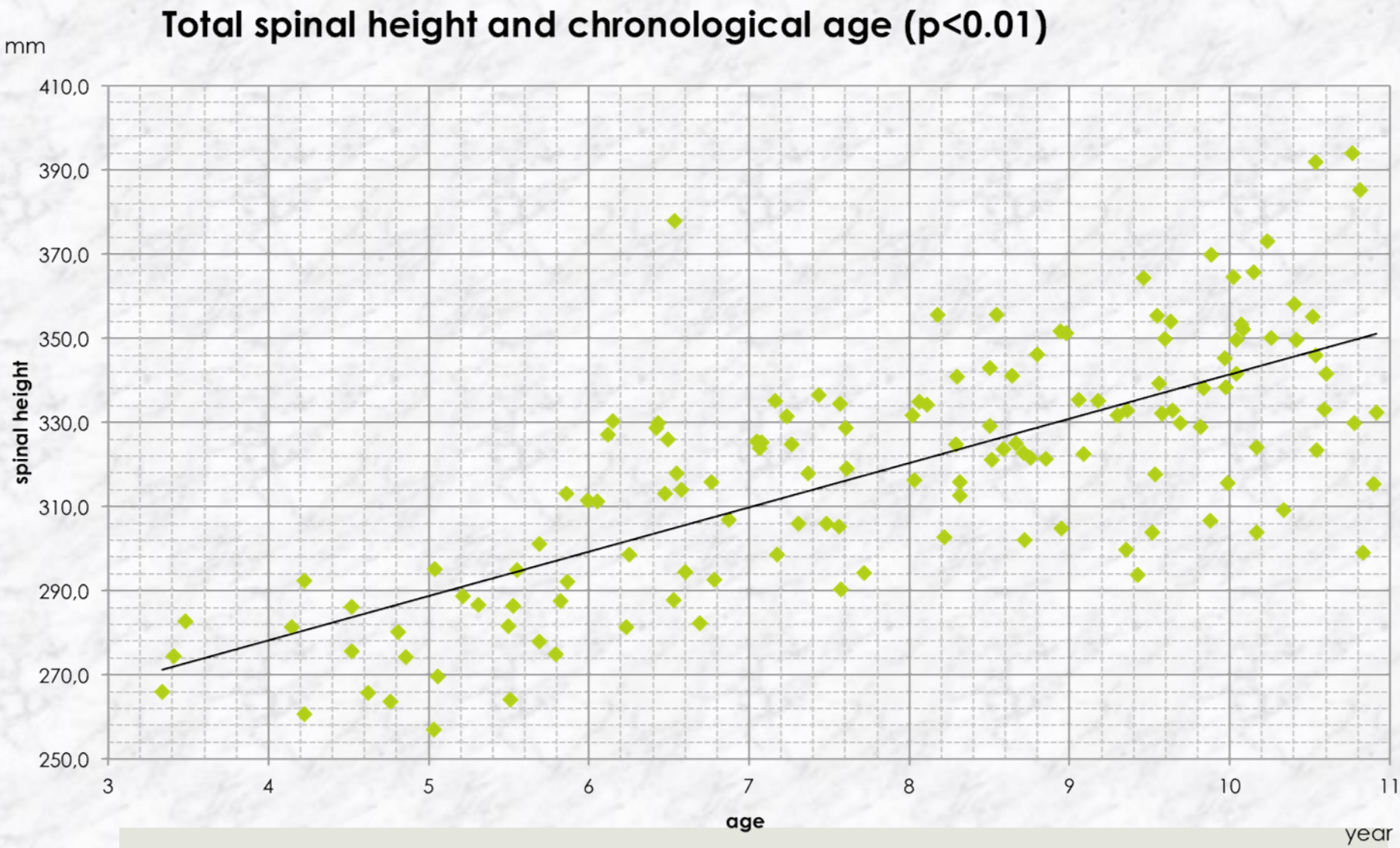
# METHODS

- Values for total height, vertebral dimension, vertebral growth, kyphosis and lordosis were calculated.

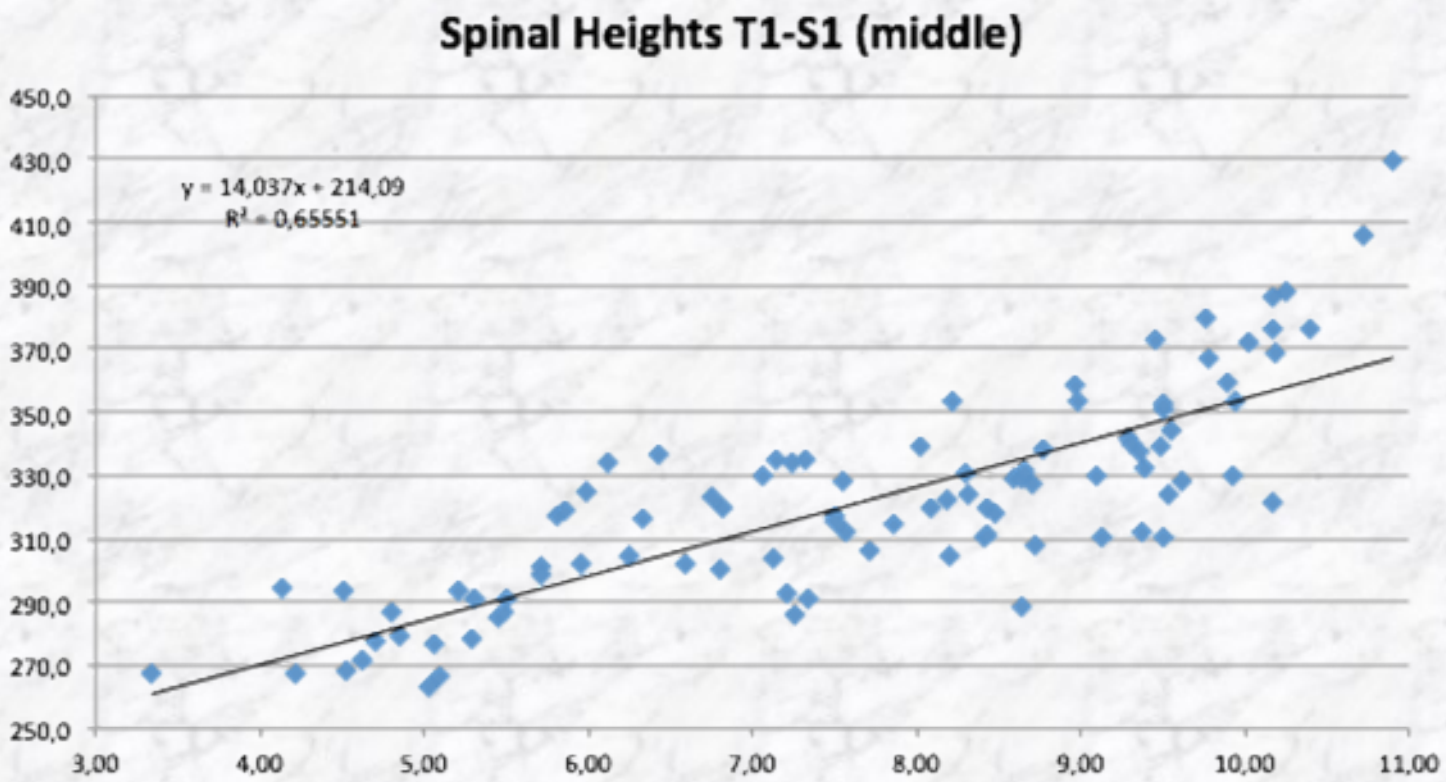
# RESULTS


Vertebral heights at every level for each age category
mm
45,00
40,00
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
T1
T3
T5
T7
T9
T11
L1
L3
L5
3-5.9 ans
6-7.9 ans
8-10.9 ans

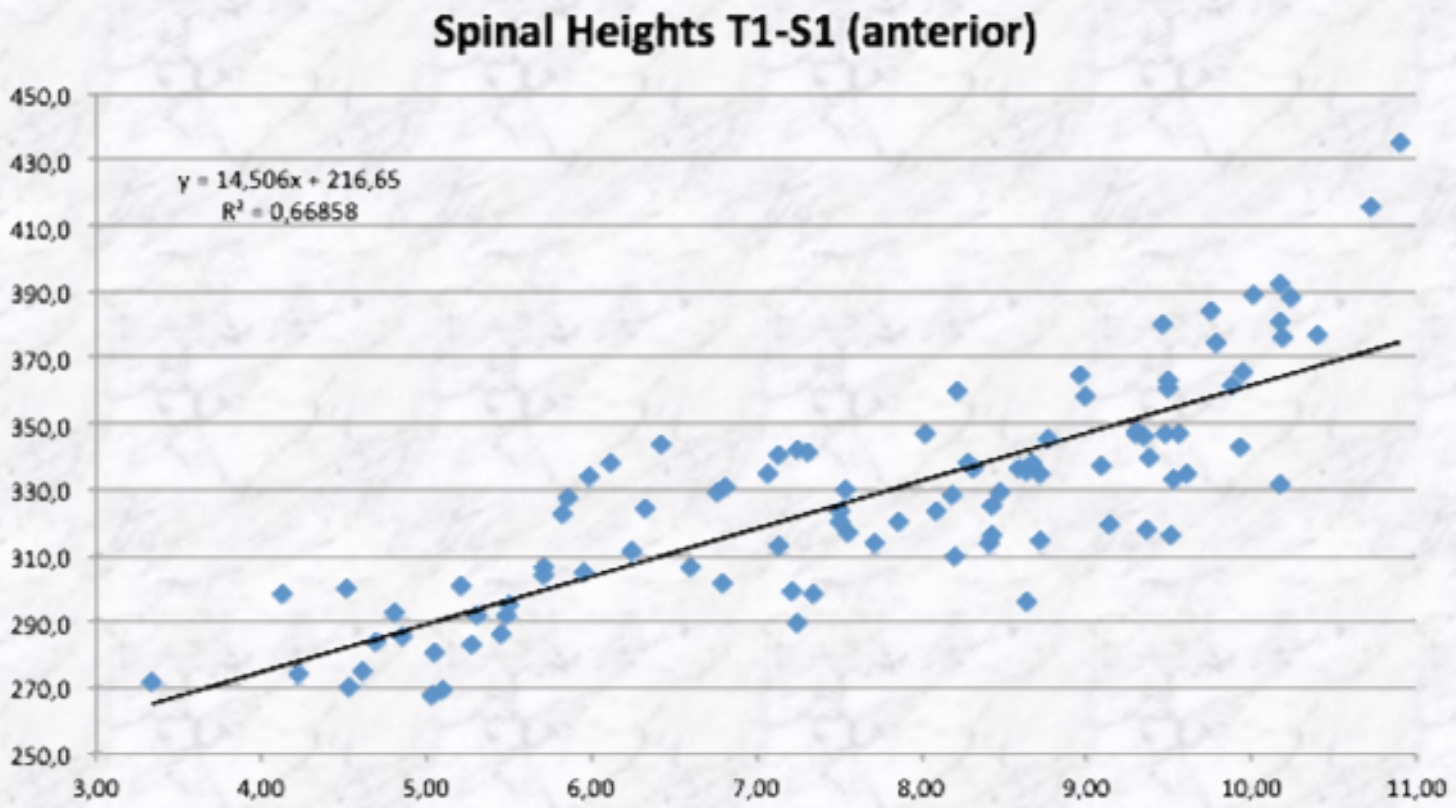
# RESULTS


Total spinal height and chronological age (p<0.01)
mm
410,0
390,0
370,0
350,0
330,0
310,0
290,0
270,0
250,0
spinal height
3
4
5
6
7
8
9
10
11
age
year

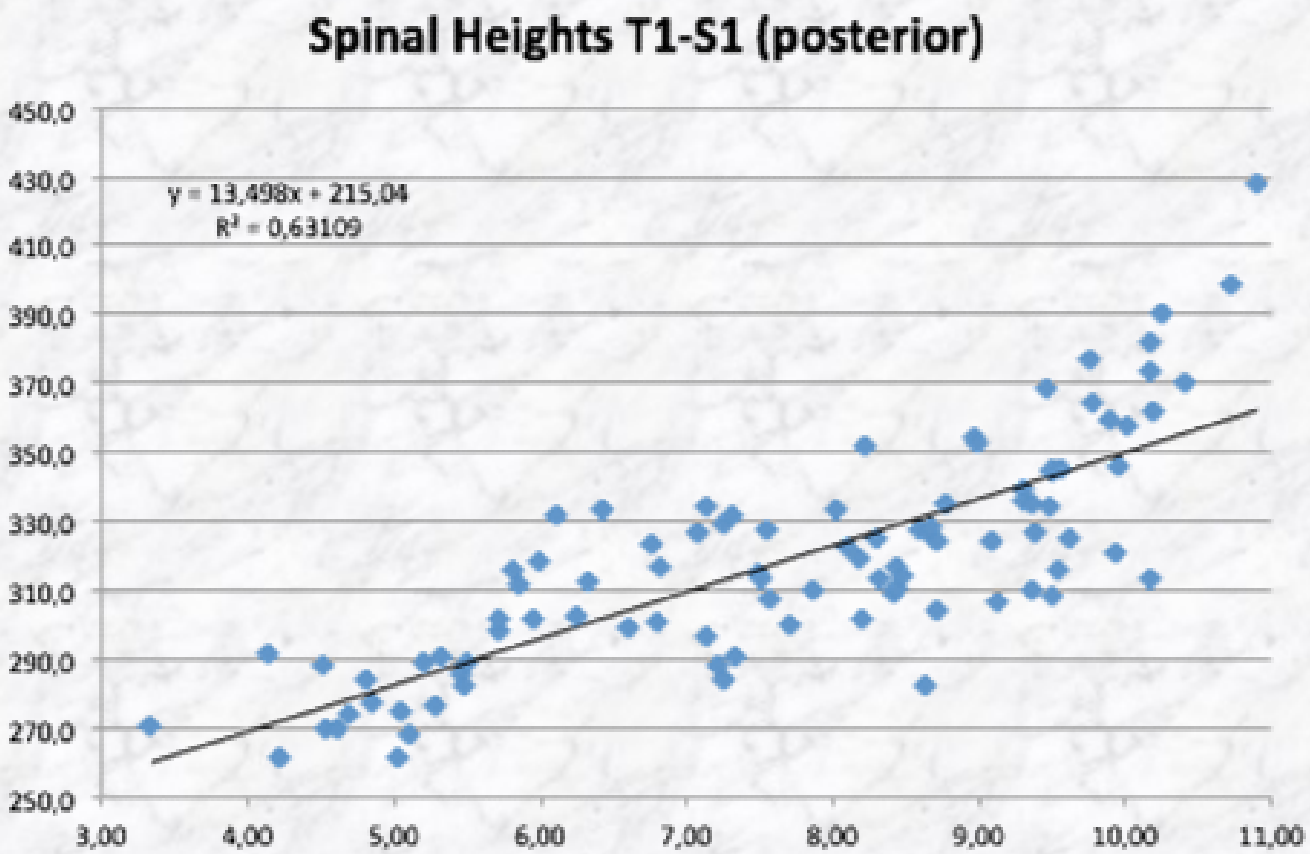
# 3D Height


Spinal Heights T1-S1 (middle)
y = 14,037x + 214,09
R² = 0,65551
450,0
430,0
410,0
390,0
370,0
350,0
330,0
310,0
290,0
270,0
250,0
3,00
4,00
5,00
6,00
7,00
8,00
9,00
10,00
11,00

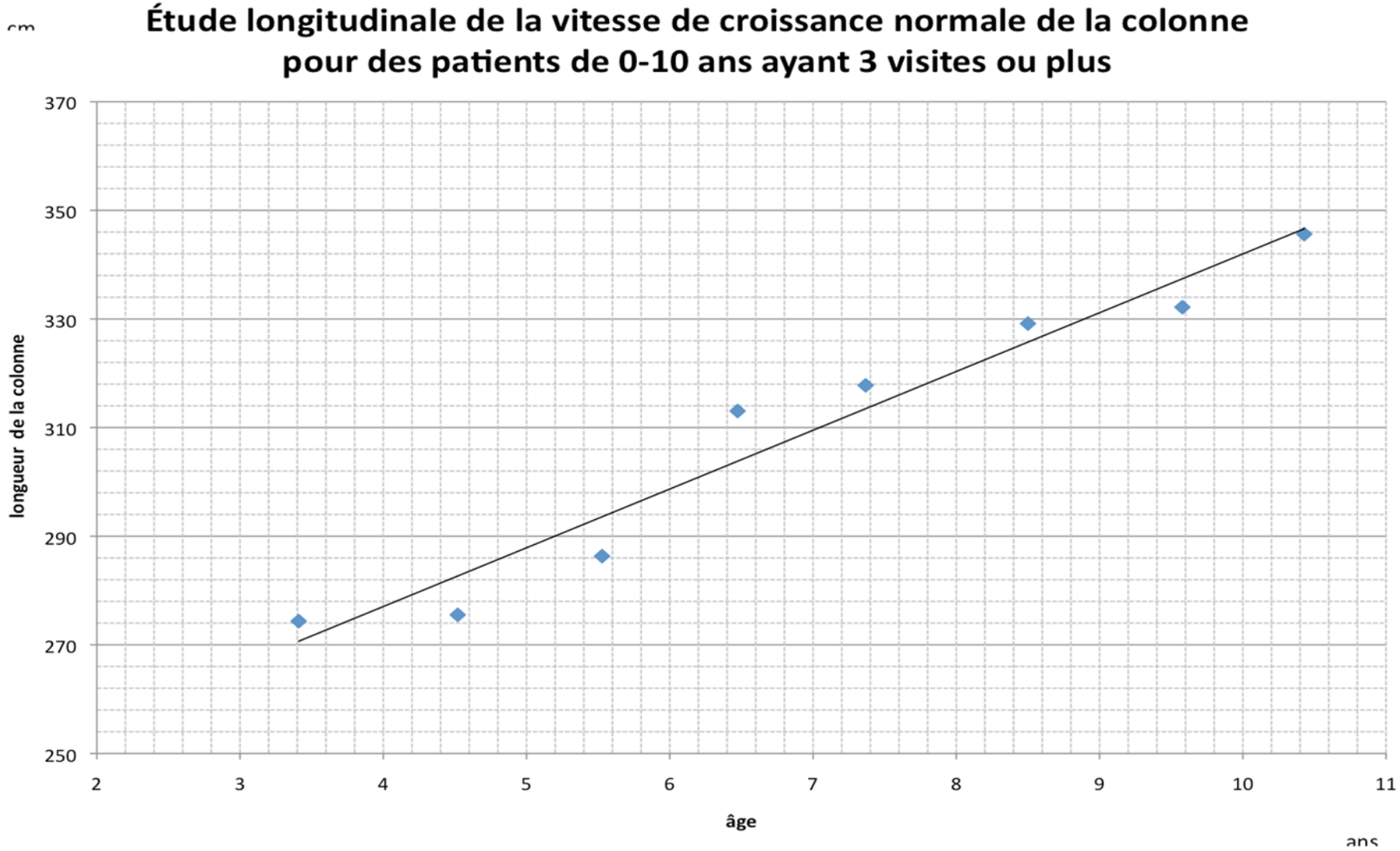
# 3D Height


Spinal Heights T1-S1 (anterior)
y = 14,506x + 216,65
R² = 0,66858
450,0
430,0
410,0
390,0
370,0
350,0
330,0
310,0
290,0
270,0
250,0
3,00
4,00
5,00
6,00
7,00
8,00
9,00
10,00
11,00

# 3D Height


Spinal Heights T1-S1 (posterior)
y = 13,498x + 215,04
R² = 0,63109
450,0
430,0
410,0
390,0
370,0
350,0
330,0
310,0
290,0
270,0
250,0
3,00
4,00
5,00
6,00
7,00
8,00
9,00
10,00
11,00

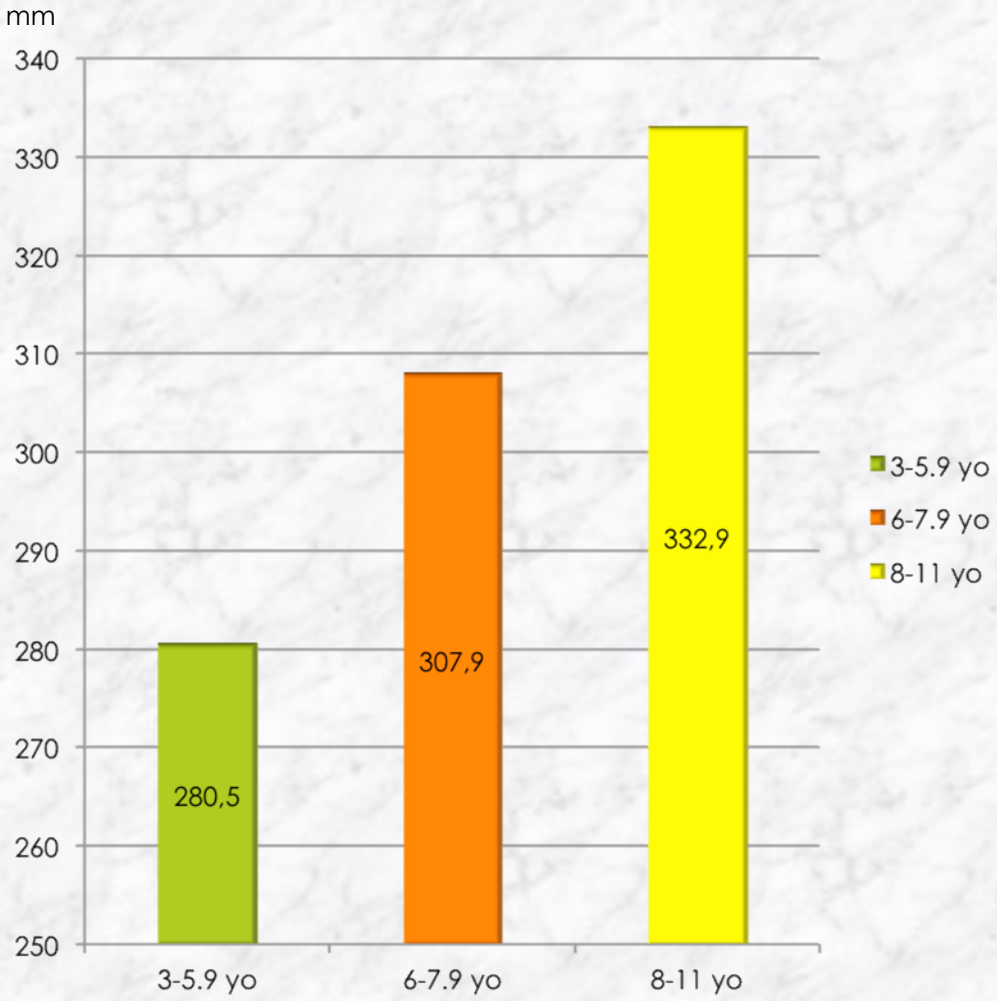
# RESULTS


Étude longitudinale de la vitesse de croissance normale de la colonne pour des patients de 0-10 ans ayant 3 visites ou plus
cm
longueur de la colonne
370
350
330
310
290
270
250
2
3
4
5
6
7
8
9
10
11
âge
ans

# RESULTS

- Total height: ($p < 0.01$)

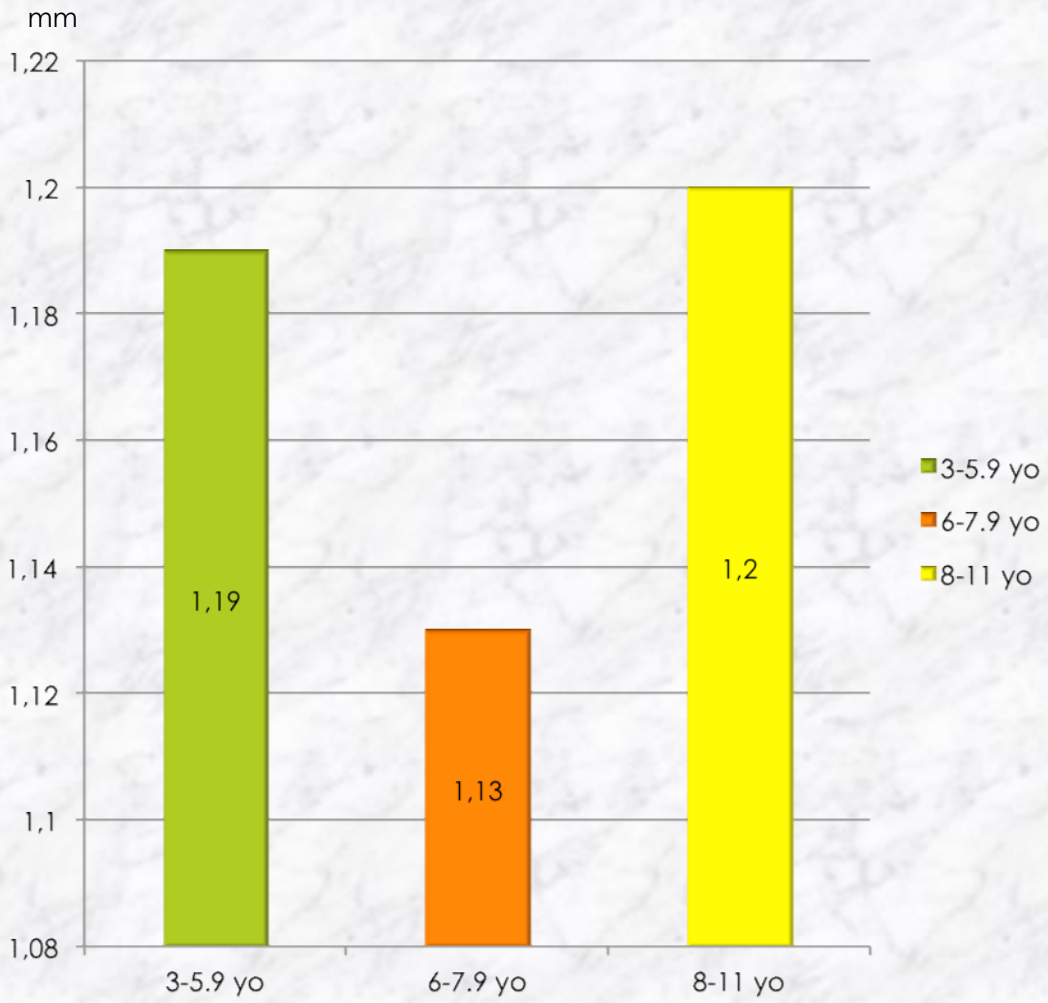
1. 3-5.9 yo: 280.5mm ±14.8mm
2. 6-7.9 yo: 307.9mm ±15.0mm
3. 8-11 yo: 332.9mm ±26.1mm



# RESULTS

- Growth rate/month:

1. 3-5.9 yo: 1.19mm ±0.40mm
2. 6-7.9 yo: 1.13mm ±0.23mm
3. 8-11 yo: 1.20mm ±0.66mm



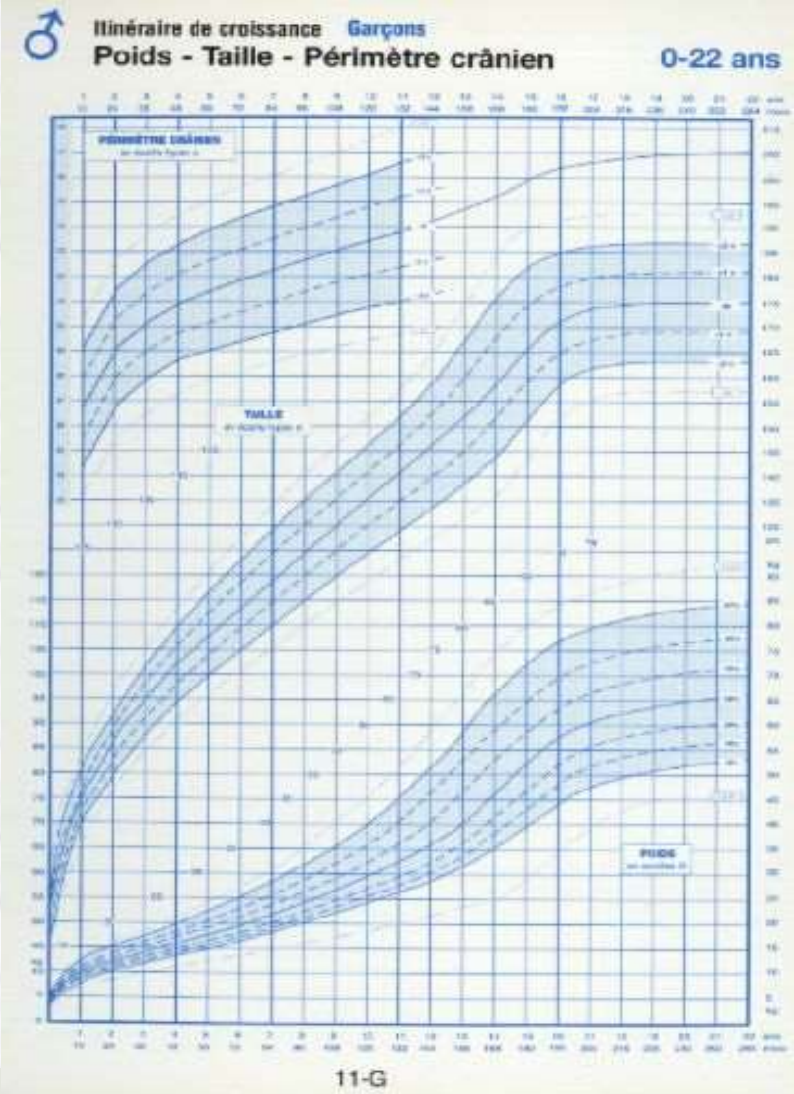
# CONCLUSION

- First attempt to measure spinal growth in follow-up patients under the age of 11 years

- Normal database

# CONCLUSION / Futur Objectives

- Help for the elaboration of a spinal standard growth curve
- predict spinal length at maturity
- spinal height changes in pathologic conditions.
- Evaluate impact of Tx on pathologic conditions



# Thanks to the team

- Marjolaine Roy-Beaudry
- Patrick Tohmé
- Léonie Tremblay
- Marie Beauséjour
- Dr. Hubert Labelle
- CHU Sainte-Justine

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