

# FACTORS INFLUENCING THE RESIDUAL RIB HUMP AFTER POSTERIOR SPINAL FUSION FOR ADOLESCENT IDIOPATHIC SCOLIOSIS



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The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this study.



# Background

Rib hump reduction after scoliosis surgery is cosmetically important. However, a residual rib hump often persists despite a large improvement in the Cobb angle of the main thoracic curve.

What are the factors influencing the residual rib hump?

Does the residual rib hump really affect postoperative patient satisfaction?



# Materials and Methods

40 adolescent idiopathic scoliosis patients (2 male, 38 female; mean age 14.9 years) who underwent posterior spinal fusion from August 2005 to March 2011 were studied (mean follow-up: 21.2 months; range: 6–48 months).

All surgeries were performed by the same surgeon (J.T.) at a single institution using

- 1) Skip pedicle screw fixation <sup>※1</sup>
- 2) Direct vertebral body derotation (DVBD) <sup>※2</sup> as an additional operation

The additional thoracoplasty was **not** performed

※1 Takahashi, et al, spine, 2010

※2 Lee, et al, spine 2004



# Methods 1

## measurement

- Pre and postoperative Cobb angle of main thoracic curve
- Apical rotation using CT
- Apical translation
- Thoracic kyphotic angle(Th5-12)
- Correction rate of apical rotation using CT
- The percent improvement of apical trunk rotation (ATR)
- The number of cases with Ponte osteotomy ※<sup>1</sup>
- Implant density ※<sup>2</sup>

※<sup>1</sup> Ponte A. Surgical Techniques for the Spine 2003

※<sup>2</sup> Quan, et al. Spine 2010



# Methods 2

## Measurement

- **Apical trunk rotation (ATR)**, measured using a scoliometer before and after surgery, was used to determine the extent of the hump.
- Subjects with postoperative ATR of  $\leq 10$  and  $>10$  were classified into group A and B for comparison of each parameter.



Measuring ATR using a scoliometer



# Results 1: Preoperative parameter

	Group A ( postoperativeATR $\leq$ 10° )	Group B ( postoperative ATR > 10° )	p
n	28	12	
age	15.1 $\pm$ 0.4	14.5 $\pm$ 0.7	0.47
ATR (° )	<b>12.4<math>\pm</math>1.1</b>	<b>18.4<math>\pm</math>2.0</b>	<b>0.017</b>
Cobb angle (main thoracic)	52.1 $\pm$ 2.2	60.0 $\pm$ 3.4	0.057
Flexibility(%)	34.2 $\pm$ 3.2	46.6 $\pm$ 4.9	0.18
Apical translation(mm)	31.5 $\pm$ 4.3	50.8 $\pm$ 6.6	0.052
Kyphotic angle(T5-T12) (° )	13.3 $\pm$ 1.6	13.9 $\pm$ 2.7	0.85
Apical rotation(° )	<b>13.8<math>\pm</math>1.4</b>	<b>21.7<math>\pm</math>2.1</b>	<b>0.004</b>



## Result 2: Postoperative parameters

	Group A	group B	p
ATR(° )	7.6±0.3	12.6±0.5	<0.001
Cobb angle (main thoracic)(° )	22.4±1.65	26.4±2.5	0.19
Apical translation(mm)	2.9±3.2	6.2±4.9	0.57
Kyphotic angle (T5-T12)(° )	19.9±1.9	14.5±2.9	0.12
apical rotation(° )	12.0±1.4	17.6±2.2	0.03
correction rate of apical rotation (%)	7.4±6.6	20.5±10.1	0.28
The percent improvement of ATR(%)	36.0±7.1	31.1±13.1	0.7
The number of cases with Ponte osteotomy	9/28 (32%)	2/12 (17%)	0.3
Implant density	1.2±0.0	1.1±0.1	0.29



## Ponte osteotomy

	Ponte osteotomy (+)	Ponte osteotomy (-)	p
n	11	29	
The percent improvement of ATR(%)	34.6±8.8	35.1±8.8	0.97

## SRS-22 sub-scores

	Group A	Group B	p
preoperative self image	2.7±0.1	2.9±1.8	0.46
postoperative self image	4.1±0.1	3.7±0.2	0.13
satisfaction	4.1±0.1	4.0±0.2	0.53



# Discussion 1

Correction of the rib hump

Skip pedicle screw fixation

+

Direct vertebral body derotation (DVBD)

DVBD: The good correction that is equivalent to thoracoplasty is obtained for mild preoperative rib hump ※1



※1 Samdani, et al, SPINE 2012



# Discussion 2

## What are the Factors influencing the residual rib hump?

Curve flexibility? ※1,2

Or not curve flexibility? ※3

## Current study

Preoperative ATR and apical rotation was significantly different between group A and B

Any other parameters including curve flexibility did **not** affect postoperative rib hump (ATR)

※1Barrett, et al, J Bone Joint Surg Br 1993

※2Harvey, et al, Spine 1993

※3Hwang, et al, Spine 2012

※4 Samdani, et al, SPINE 2012

## Does the residual rib hump really affect postoperative patient satisfaction?

No difference in SRS-22 self-image scores ※4

## Current study

The degree of residual rib hump itself did not directly affect patient satisfaction and self image



# Conclusion

- 1) The preoperative factors which influenced the residual rib hump after skip pedicle screw fixation + direct vertebral body derotation were ATR, and apical rotation.
- 2) Removal of apical rotation deformities, rather than Cobb angle correction, is considered important in reducing the postoperative hump.
- 3) Patient satisfaction or self-image did not worsen significantly according to the hump size, but was affected by various other factors.

