

# In-school Pre-screening for Adolescent Idiopathic Scoliosis: Results of Adam's Forward Bending Test and Obliquity in Shoulders of Adolescent Girls in Hong Kong



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# 1.1 Idiopathic Scoliosis Background

- A lateral curvature of spine  $\geq 10^\circ$  in stand position
- Structural scoliosis
- Unknown etiology
- Most common and clinically important type of scoliosis
- 5.8% students have idiopathic scoliosis in HK (Department of Health Annual Report 2011/12)

Hresko, M.T., 2013, Idiopathic scoliosis in adolescent. *The New England Journal of Medicine*, 368(9) pp.834-841.

Yamada, K., Yamamoto, H., Nakagawa, Y., Tezuka, A. & Tamura, T., 1984, Etiology of idiopathic scoliosis. *Clinical Orthopaedics and Related Research*, 184 pp.50-57.

# 1.2 Scoliosis Screening

- Identify scoliosis at an early stage
- Has been practiced worldwide for many years
- Aims to detect back trunk asymmetry in children at risk to develop progressive scoliosis
- Contributing significantly into the research for idiopathic scoliosis etiology

Adobor, R.D., Rimeslatten, S., Steen, H. & Brox, J.I., 2011, School screening and point prevalence of adolescent idiopathic scoliosis in 4000 Norwegian children aged 12 years. *Scoliosis*, 6 pp.23

Grivas, T.B., Hresko, M.T., Labelle, H., Price, N., Kotwicki, T. & Maruyama, T., 2013, The pendulum swings back to scoliosis screening: screening policies for early detection and treatment of idiopathic scoliosis - current concepts and recommendations.

*Scoliosis*, 8 pp.16.

# 1.2.1 Screening Program in HK

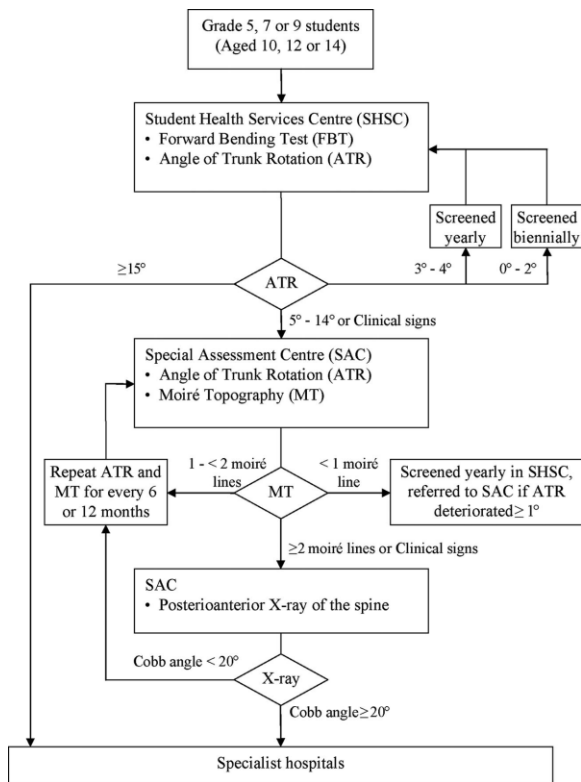


Figure 1.1 Protocol of the school screening program for AIS in Hong Kong (Source: Lippincott Williams & Wilkins, 2010)

- Screening program is a part of the Student Health Service since 1995
- For Grade 5, 7, and 9 students
- Carry out FBT and ATR in Student Health Service Center
- $5^{\circ} \leq \text{ATR} \leq 14^{\circ}$ , further assessment (Moiré Topography and X-ray)
- $\text{ATR} \geq 15^{\circ}$ , refer special hospitals directly

Luk, D.K., Lee, C.F., Cheung, M.C., Cheng, C.Y., Ng, K.W., Lam, T.P., Mak, K.H., Yip, S.F. & Fong, T.Y., 2010, Clinical effectiveness of school screening for adolescent idiopathic scoliosis: A large population-based retrospective cohort study. *Spine*, 35(17) pp.1607-1614. <sup>5</sup>

# 1.3 Objectives

- Purpose of our in-school pre-screening:  
Recruit early scoliosis subjects for wear trial
- Objectives of this presentation:
  1. Present the results of the in-school pre-screening
  2. Investigate the prevalence of shoulder obliquity of girls aged between 10-13 years old.

# 2 Methods

## 2.1 Subjects

- In-school pre-screening in HK during 2012-2015
- Target population: 10-13 year-old girls
- 794 girls from 7 local schools

## 2.2 In-school Pre-screening

### 2.2.1 Adam's Forward Bending Test

- Performed by a professional Prosthetist-Orthotist (P&O)
- Angles of trunk rotation (ATR) in thoracic and lumbar are measured by OSI scoliometer
- $ATR \geq 3^\circ$  are referred to future test



Figure 2.1 OSI scoliometer for ATR measurement



## 2.2.2 Scolioscan

- 3-dimensional ultrasound imaging assessments of the spine
- Spinal curvature can be measured



Figure 2.2 Scolioscan Report

## 2.2.3 Shoulder Balance Measurement

- Photographs were taken in front of the sheet of 5 cm x 5cm grids (CorelDraw)
- Clavicular angle (CA): Angle between the line connecting the highest points of the clavicle in the horizontal plane
- CA are measured directly from the clinical photos
- Shoulder obliquity:  $CA \geq 1^\circ$  or  $CA \leq -1^\circ$



Figure 2.3 Photograph taken from 2m away from subjects with 1m height tripod

Matamalas, A., Bagó, J., D'Agata, E. & Pellisé, F., 2014, Reliability and validity study of measurements on digital photography to evaluate Sshoulder balance in idiopathic scoliosis. *Scoliosis*, 9 pp.23.

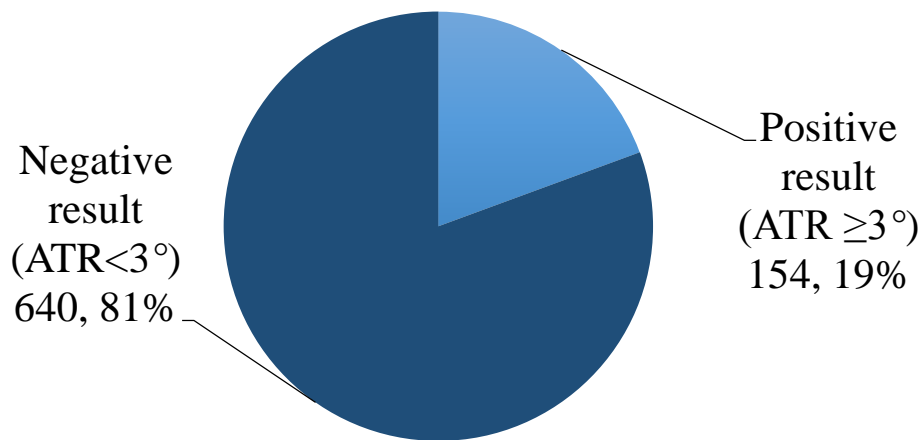
Canales, J.Z., Cordás, T.A., Fiquer, J.T., Cavalcante, A.F. & Moreno, R.A., 2010, Posture and body image in individuals with major depressive disorder: a controlled study. *Revista brasileira de psiquiatria*, 32(4) pp.375-380.

## 2.3 Statistical Method

- Descriptive statistic to show the distribution of data
- The analyzed data are described by percentage, numbers, pie chart, and bar chart

# 3 Results

## 3.1 Adam's Forward Bending and Scolioscan



- 60 girls with ATR ≥ 3° underwent Scolioscan; 43 have positive results with a spinal curve > 10° (positive predictive value, 71.7%)

Figure 4.1 Result of Adam's Forward Bending

## 3.2 Shoulder Obliquity

- 443 students underwent shoulder balance measurement
- 25% (included normal and possible AIS group) girls have shoulder obliquity

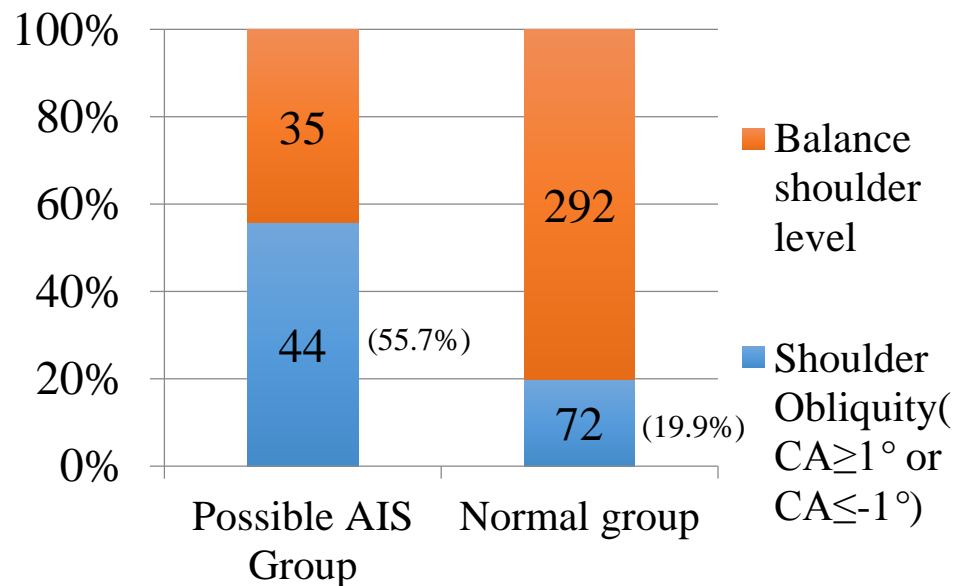


Figure 3.2 Shoulder obliquity distribution in possible AIS and normal group

# 4 Discussion

## 4.1 Adam's Forward Bending Test

- 19% adolescent girls have positive results in Adam's forward bending test,  $ATR \geq 3^\circ$
- Comparing with some literatures (Adobor et al., 2011; Shu et al., 2011), this study get higher percentage (As cutoff point:  $ATR 3^\circ$  in this study;  $ATR 5^\circ$  or  $7^\circ$  in most literatures)  
Reason of  $3^\circ$  cutoff: Recruit early/mild scoliosis subjects
- Attention in adolescent idiopathic scoliosis

Adobor, R.D., Rimeslatten, S., Steen, H. & Brox, J.I., 2011, School screening and point prevalence of adolescent idiopathic scoliosis in 4000 Norwegian children Aged 12 Years. *Scoliosis*, 6 pp.23

Shu, S.W., Modi, H.N., Yang, J.H. & Hong, J.Y., 2011, Idiopathic scoliosis in Korean schoolchildren: a prospective screening study of over 1 million children. *European Spine Journal*, 20(7) pp.1087-1094.

## 4.2 Shoulder Obliquity

- Attention in adolescent posture problems
- 19.8% Normal subject also have shoulder obliquity; result coherences with a study by Sekouris and Smyrnis (2009)
- Occurrence of shoulder obliquity in possible AIS is 3 times than normal group; a justified result:
  - ❖ Shoulder imbalance is a common signs of scoliosis
  - ❖ Shoulder asymmetry in idiopathic scoliosis is usually related to the presence of a proximal thoracic curve

Sekouris, N. & Smyrnis, P., 2008, First rib asymmetry and shoulder imbalance – Assessment of first rib index (FRI) in thoracic X-rays of people without scoliosis. *Scoliosis*, 4 pp.10.

Ono, T., Bastrom, T.P. & Newton, P.O., 2012, Defining 2 components of shoulder imbalance. *Spine*, 37(24) pp.E1511-E1516.

# 5. Conclusions

- **19%** (154 out of 794) of adolescent girls have signs of scoliosis (ATR  $\geq 3^\circ$ )
- **25%** (327 out of 443) (included normal and possible AIS group) girls have shoulder obliquity
- Normal students also have high occurrence (19.8%, 72 out of 292) in shoulder obliquity.
- Occurrence of shoulder obliquity in possible AIS is 3 times than normal group
- The need for greater awareness of adolescent spinal and postural care in community



# 6. Reference

- > Adobor, R.D., Rimeslatten, S., Steen, H. & Brox, J.I., 2011, School screening and point prevalence of adolescent idiopathic scoliosis in 4000 Norwegian Children Aged 12 Years. *Scoliosis*, 6 pp.23
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- > Hresko, M.T., 2013, Idiopathic scoliosis in adolescent. *The New England Journal of Medicine*, 368(9) pp.834-841.
- > Luk, D.K., Lee, C.F., Cheung, M.C., Cheng, C.Y., Ng, K.W., Lam, T.P., Mak, K.H., Yip, S.F. & Fong, T.Y., 2010, Clinical effectiveness of school screening for adolescent idiopathic scoliosis: A large population-based retrospective cohort study. *Spine*, 35(17) pp.1607-1614.
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- > Ono, T., Bastrom, T.P. & Newton, P.O., 2012, Defining 2 components of shoulder imbalance. *Spine*, 37(24) pp.E1511-E1516.
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