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Pilot hybrid of tele and onsite Prehabilitation Outpatient Physiotherapy Program to Enhance Recovery After Surgery in Adolescent Idiopathic Scoliosis patients receiving Posterior Spinal Fusion: Physiotherapy prospective

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Content

- Introduction
- Physiotherapy Role in prehabilitation
- ERAS program
- Result
- Conclusion
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What is Adolescent Idiopathic Scoliosis (AIS)?

Most common type of scoliosis

3D structural deformity of the spine

Cobb angle 10°

80% diagnosed during adolescence

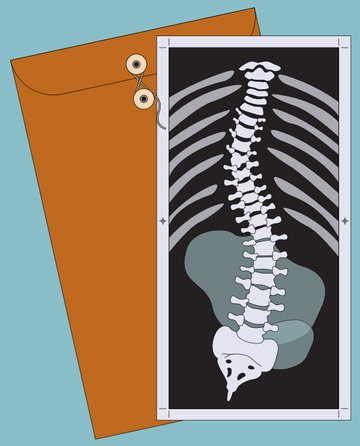
(Cheng et. al., 2015)

How common is AIS?

Prevalence of adolescent idiopathic scoliosis by the age of 19 years

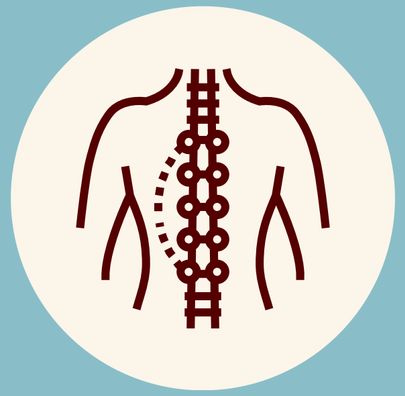
Curve status	Prevalence (exact 95% CI), %			
	Total	Boys	Girls	Girls:boys
Curves ≥10°	3.5 (3.5–3.6)	2.2 (2.1–2.2)	4.8 (4.7–5.0)	2.2
Curves ≥20°	1.8 (1.7–1.8)	0.7 (0.7–0.8)	2.8 (2.7–2.8)	3.6
Curves ≥40°	0.2 (0.2–0.3)	0.07 (0.06–0.09)	0.4 (0.4–0.4)	5.5
Treatment	0.4 (0.4–0.4)	0.1 (0.1–0.1)	0.7 (0.6–0.7)	5.3

(Fong et. al., 2015)



PWH: (yearly)

- ~1000 new scoliosis cases
- ~5000 subsequent scoliosis cases
- ~ 1/10 require surgery

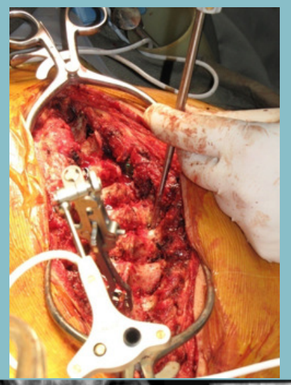


When patients need to undergo surgery?

Primary curve Cobb angle >50°

Cardiopulmonary Compromise

Back Pain



(1) Arrest progression

(2) Achieve max. permanent 3D correction

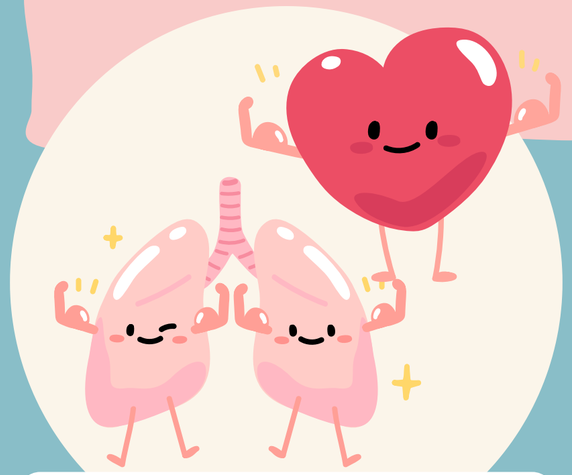
(3) Improve appearance by balancing the trunk

(4) Keep short-term and long-term complications to a minimum

(Sucato, 2010; Weinstein, et. al., 2008)

Physiotherapy Role in prehabilitation

- Impaired cardiopulmonary tolerance is a common presentation among AIS patients
- Abnormal pulmonary function ↔ spinal deformity severity
- Pulmonary problems more frequently reported in Cobb angle >45°
- FVC 40% less than predicted normal ↑ risk of failure in extubation



Cardiopulmonary

Aerobic Ex 3/week, 60min each (60-80% max HR)

↑ flexibility of spine, ↑ flexibility of the chest and anterior structures

➡ ↑ Pulmonary Function

(dos Santos Alves, Stirbulov, Avanzi, 2006; Sucato, 2010; Tsiligiannis, & Grivas, 2012)

Physiotherapy Role in prehabilitation

- ↓ Physical capabilities often present in AIS patients
  - Back Muscles imbalance in scoliosis patients were detected (QL, gluteus medius on convex side and ES and multifidus on concave side weaker)

Physical Capabilities

Preoperative physiotherapy back strengthening
(Trunk extensors, lateral muscles, flexors)
→ aimed to optimise patient's physical fitness

(Gadiya, et. al., 2021; Šarčević, 2010; Yang, et. al., 2021)

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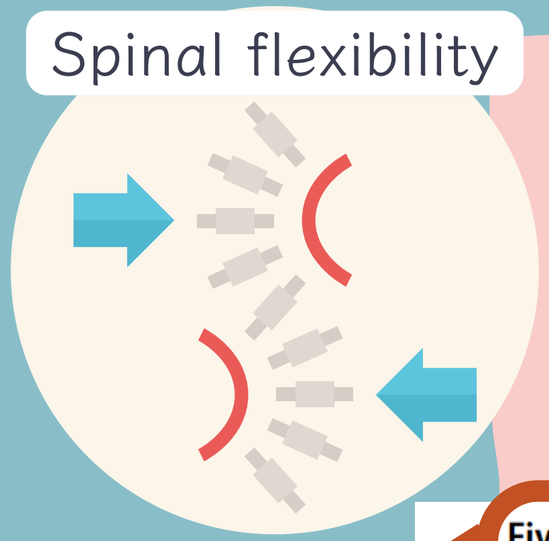
Physiotherapy Role in prehabilitation

Spinal flexibility



Spinal flexibility determines intraoperative correction

Rigid curves are difficult to correct and require osteotomy to achieve optimal intraoperative correction

➡ ↑ risk of postoperative neurological injuries

Five days of inpatient coliosis-specific exercises improve preoperative spinal flexibility and facilitate curve correction of patients with rigid idiopathic scoliosis

Yunli Fan[2,3] · Michael K. T. To[1,2] · Guan-Ming Kuang[1] · Nan Lou[1] · Feng Zhu[1] · Huiren Tao[1] · Guangshuo Li[3] · Eric H. K. Yeung[3] · Kenneth M. C. Cheung[1] · Jason P. Y. Cheung[2]

↑ curve correction
↓ hospitalization
↓ postoperative pain

(Fan, et. al., 2025)

OPD program:
↓ Hospital Stay Cost, School leave

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ERAS Program (Pilot)

2024

4:13

AGE

16.5 ± 3.9

22 Recruited, 17 Completed
3 Defaulted appointment
1 Cancelled OT
1 Postponed OT

- 10-18 years of age
- AIS patients under standard OT list

- Not follow instructions
- Diseases other than AIS
- With disability that may hinder exercises

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ERAS Program

Pre-op 6 week
(every 2 wks)

Onsite (1.5 hr)
Assessment +
Group Exercises

Onsite (1 hr)
Group Exercises

TeleHealth (1 hr)

Onsite (1.5 hr)
Assessment +
Group Exercises

Post-op : Early Mob

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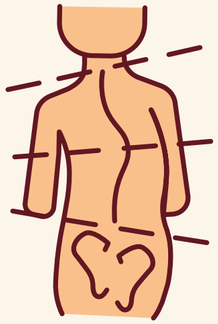
ERAS Program

1 to 1.5 hr Onsite
(Group)

Physiotherapy
Specific
Scoliosis
Exercise



Aerobic

Truncal
strengthening

Flexibility

Chest Physiotherapy

Transfer Training

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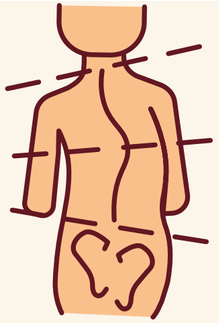
ERAS Program

Physiotherapy Specific Scoliosis Exercise



Curve-specific correction and postural exercises

Derotation of specific curve

Curve-specific Stretching

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ERAS Program

1 hr HAGo
TeleHealth
(Group)

Pre-op Physiotherapy
(Chest Physiotherapy, Pathway explanation)

Reinforcement of daily exercises and
Monitoring home exercises program

Revision of exercises

+/- Minor mode for carer to participate

- parent empowerment
- save space in PT dept
- save travelling time

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Outcome Measures

Cardiopulmonary

6-Minute Walk Test

(Guo, et. al., 2024)

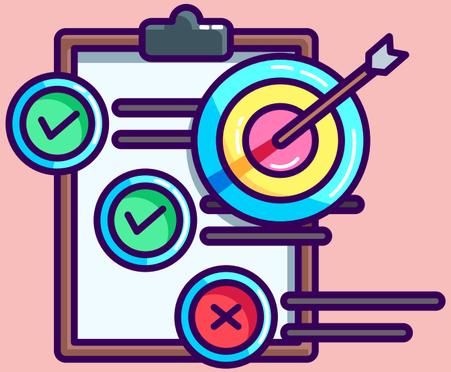
Spirometry

(Tsiligiannis, & Grivas, 2012)

Trunk muscle endurance

McGill's Torso Muscular Endurance Test Battery

(Budrienė, Sinkevičius, Aukštikalnis, & Ščiukaitė, 2017; Budrytė, Sinkevičius, & Budrienė, 2024; Esfahani, Rezaeian, & Dommerholt, 2019)



Flexibility

Back-saver sit-and-reach test

(Chillón et. al., 2010)

Popliteal Angle

(Kotiwicki, 2008)

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Result

			Mean (Pre)	Mean (Post)		p-value
Cardiopulmonary	6 Minute Walk Test		419.35	433.47	↑	0.140
	FEV1		2.17	2.24	↑	0.213
	FVC		2.31	2.34	↑	0.648
	FEV/FVC		94.71	95.35	↑	0.671
Flexibility	Popliteal Angle	R	23.53	18.82	↑	0.084
		L	23.82	20.29	↑	0.163
	Back Saver sit and reach	R	29.32	31.76	↑	0.002
		L	29.29	30.76	↑	0.044

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Result

				Mean (Pre)	Mean (Post)		p-value
Trunk muscle endurance	McGill's Torso Muscular Endurance Test Battery	Flexor		112.76	128.82	↑	0.123
		Extensor		72.94	99.65	↑	0.004
		Lateral	R	38.94	56.24	↑	0.001
			L	35.71	50.82	↑	0.004

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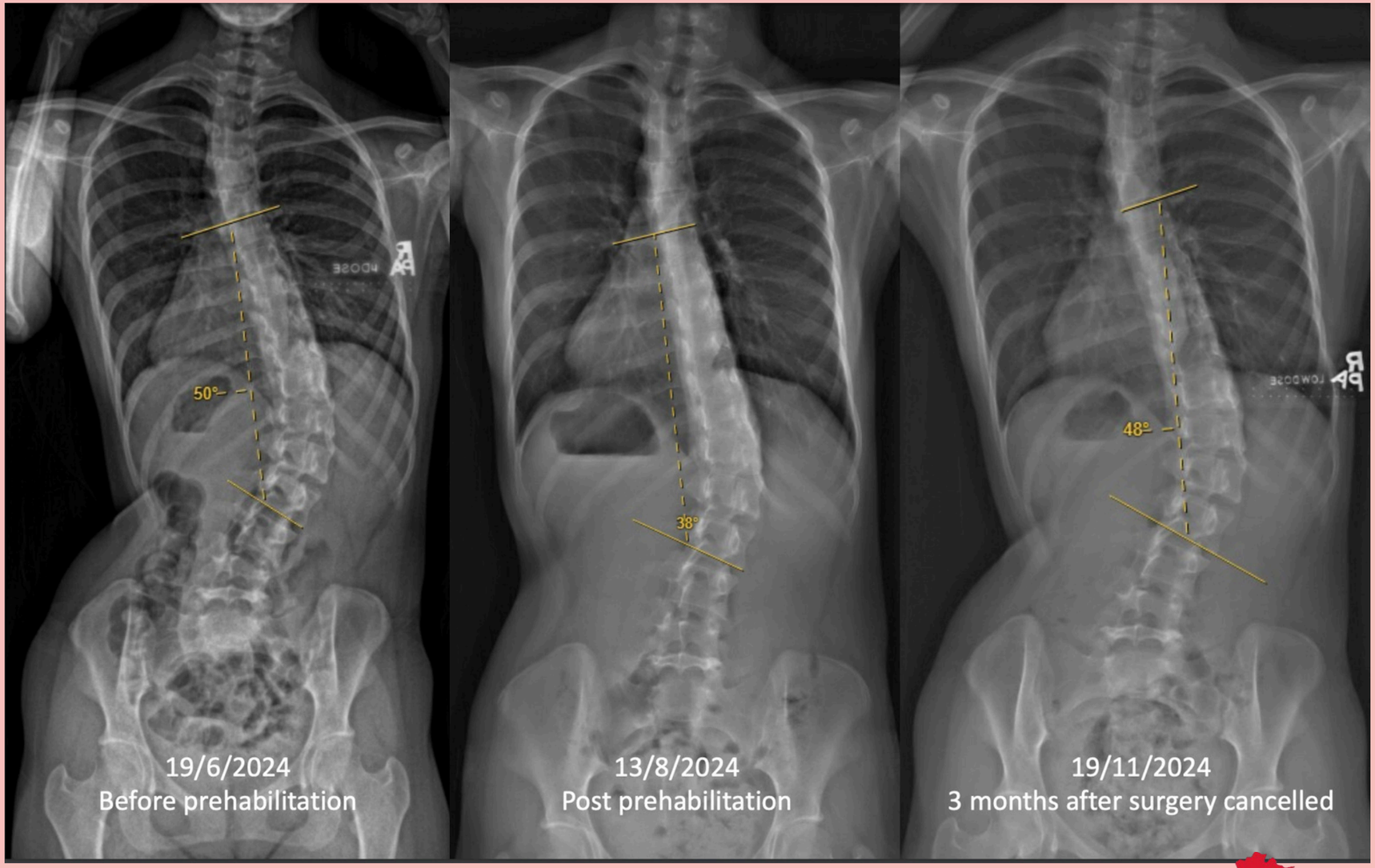
Curve improvement after prehabilitation?



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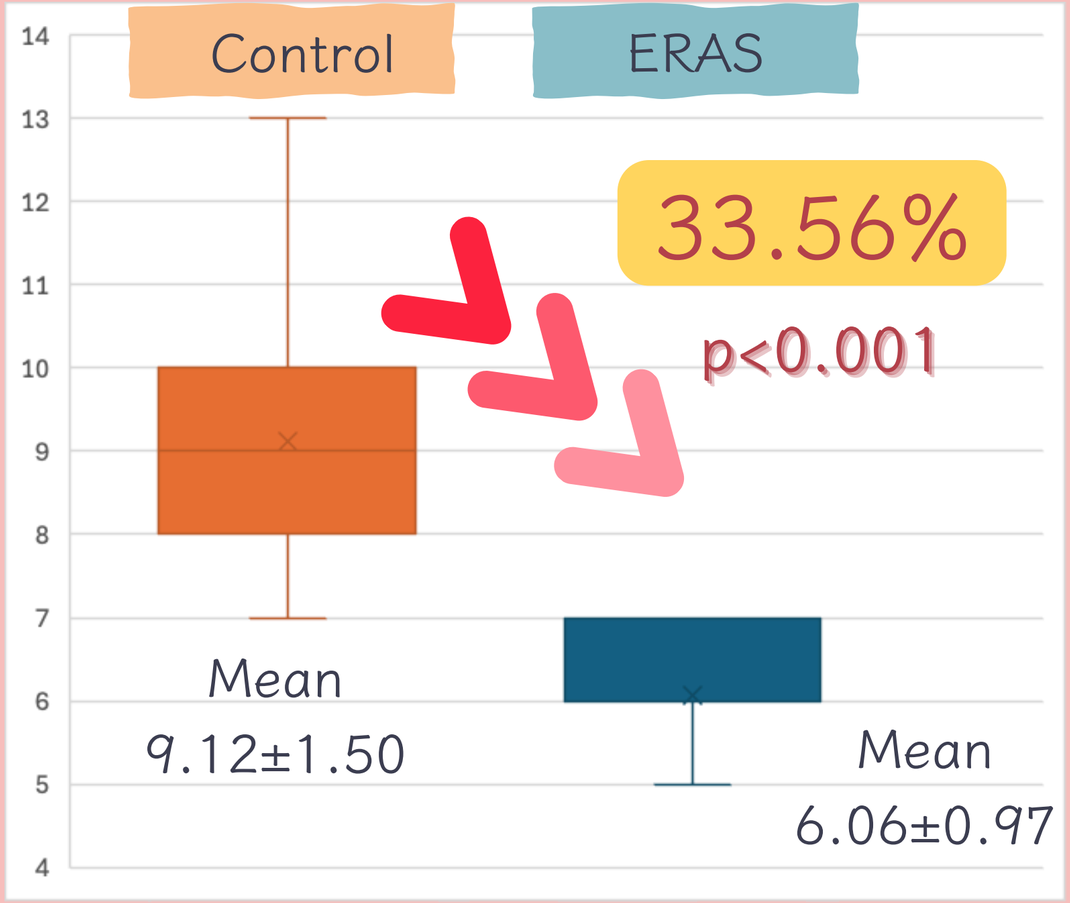
Length of Stay (Post-operative)



- Compared with 2023
- 17 cases before ERAS

- ↓Hospital Stay Cost
- More resources for other patient demands

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Conclusion

Hybrid Tele and onsite OPD Physiotherapy ERAS Program: PSSE, aerobic, flexibility and strengthening exercises

+

Early Mobilization

Preoperative muscles endurance and flexibility

Postoperative length of stay

Less Resources
(OP VS IP prehab)

Improved Outcome
(9 days ➡ 6 days)

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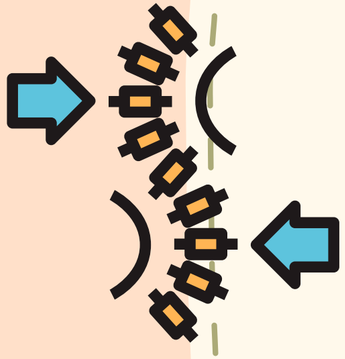
Future investigation

Post-operative outcome
(e.g. return to school,
long term outcome)



Biomechanical
effects on spinal
flexibility

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