RAE2026

Anisotropic Textile Brace for Adolescent Idiopathic Scoliosis (AIS)

Prof. Joanne Yiu-wan Yip
MCO 2

12.2025

Contents

Title: Anisotropic Textile Brace for Adolescent Idiopathic Scoliosis (AIS)

Descriptor

AIS is a prevalent spinal condition in adolescents that progresses during puberty and causes three-dimensional deformities. AIS with moderate scoliosis (Cobb angle of 20°–40°), is traditionally managed through rigid bracing, which often causes discomfort, skin irritation, and restricted mobility, thus resulting in poor compliance and an increased risk of curve progression. To address these challenges, a multidisciplinary research programme was initiated in 2016 to develop an anisotropic textile brace (ATB) for adolescents with early-stage AIS. This programme was supported by two funded projects: GRF (152061/15E, $495,728, 2016–2018) and GRF (P152101/16E, $844,559, 2017–2019) that were submitted to RAE2020. Building on previous findings, additional funding from PolyU internal seed grants (P0001310, $2M, 2019-2022), the Lee Hysan Foundation (P0034236, $3M, 2021–2026), and the Research Impact Fund (R5039-23, $5M, 2024–2028) has supported advanced development and is submitted to RAE2026.

From 2020, the programme integrated engineering and biomedical techniques to refine the ATB. Finite element (FE) models of the adolescent torso were developed to simulate tissue biomechanics and optimise corrective force distribution. Large-scale Hong Kong school screenings recruited participants for iterative wear trials. Insights from objective data and feedback informed a redesigned ATB, with textile material upgrades enhancing comfort and breathability as well as modified artificial bone construction and materials to enhance strength and durability. The findings demonstrate that 23 out of 23 AIS subjects showed an immediate correction rate (≥5° Cobb angle reduction) after two hours of wear, and eight out of nine (89%) had promising outcomes indicating curve correction/stabilisation over six months.

Research outputs include patents (US12,129,886B2 and ZL 202330553930.X), peer-reviewed publications, and conference presentations. Industry partnerships – fostered through exhibitions, workshops, and public talks – support clinical validation and translation. These efforts advance brace-mediated rehabilitation strategies for AIS with moderate curves.

PERSONAL PROFILE: Prof. Joanne Yip

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Prof. Joanne Yip is Professor and Associate Dean (Industrial Partnership) at the School of Fashion and Textiles, The Hong Kong Polytechnic University. She specialises in developing innovative textile-based medical devices for AIS, integrating smart materials and biomechanics to improve brace effectiveness and their quality of life. She pioneers textile braces for AIS, leading the development of the following innovations:
MCO 1: Posture correction girdle (PCG) for adolescents with mild scoliosis (Cobb angles of 10°–20°). This device provides a crucial early-intervention option for a patient group that previously had no active treatment beyond observation. Its innovations include integrated sensors for real-time posture monitoring and scalable fitting protocols.
MCO 2: ATB for adolescents with moderate scoliosis (Cobb angles of 20°–40°). It is certified as a Class II medical device in Mainland China (clinically proved to be effectiveness to treat AIS), which provides a breathable, flexible, and comfortable alternative to traditional braces. She has been instrumental in driving these projects, from methodological development to clinical application and commercialisation of the products, coordinating among healthcare providers, manufacturers, and government agencies from Mainland China and Hong Kong. Her work has been recognised with Gold Medals at the Silicon Valley International Invention Festival (2019, 2024) and the International Exhibition of Inventions Geneva (2023). Together, these multicomponent outputs advance understanding of nonrigid orthotic systems, establish new methodological frameworks for integrating biomechanics and textiles, and provide empirical evidence supporting early intervention in AIS management.

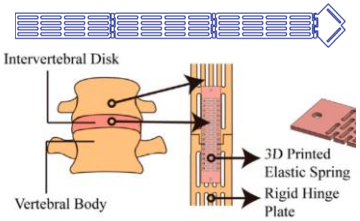
Research Timeline

- This study is a cross-disciplinary one, spanning textile materials science, intimate apparel design, biomechanical engineering, and biomedical engineering.

RAE 2020 ATB

Refined ATB [1-5]

Artificial hinged bone [6]



Final version

RAE 2020

RAE 2026

2020

- ✓ Problem identification
- ✓ Material selection and testing
- ✓ ATB prototyping
- ✓ Initial wear trials

2021

- ✓ School screening and participant recruitment
- ✓ Refinement of the ATB on textile materials to improve wear comfort and user-friendliness
- ✓ Three conference paper publications
- ✓ US Patent (artificial hinged bone)

2022

- ✓ Certificate application for further commercialisation
- ✓ One paper publication (ATB)
- ✓ One conference paper publication

2023

- ✓ Improve effectiveness and durability of ATB
- ✓ Clinical wear trials
- ✓ Obtained certificate of conformance
- ✓ Licensed for sale
- ✓ One paper publication (artificial hinged bone)
- ✓ US patent (ATB)

2024

- ✓ Application and commercialisation phase
- ✓ Showcased at exhibitions and competitions
- ✓ Obtained Mainland China Medical Device Registration Certificate (MDRC) as a Class II medical device, which means available for purchase by patients
- ✓ One conference paper publication

2025

Research Coinvestigators

Role in the Programme:
Leads the project, overseeing the design and optimisation of the ATB. She directs FEM spinal biomechanics modelling, anthropometric studies, and iterative design trials, and drives clinical translation

Prof. Kit-Lun YICK

Professor, SFT, PolyU
Members of RISports, PolyU

Expertise:
- Advanced fashion production technologies
- 3D anthropometric body measurement

Role in the programme:
- Conducts fit analysis using 3D body scanning technology
- Develops comfort assessment protocols for wear trials

Prof. Jason Cheung

Department Chairperson and Clinical Professor of the Department of Orthopaedics and Traumatology, HKU

Expertise:
- Clinical management of AIS
- Radiographic assessment methodologies

Role in the programme:
- Designs and oversees clinical trial implementation
- Validates efficacy through Cobb angle measurements

Prof. Raymond Tong

Professor and Chairman in the Department of Biomedical Engineering, CUHK

Expertise:
- Soft robotics applications
- Dynamic force adjustment systems

Role in the programme:
- Advises on adaptive hinge mechanism design
- Integrates soft robotic principles for dynamic correction

Dr. Sun-Pui Ng

Associate Division Head (SEHS) and Associate HoR, Division of Science, Engineering and Health Studies, PolyU

Expertise:
- Composite materials stress analysis
- Mechanical failure testing

Role in the programme:
- Evaluates material durability under cyclic loading
- Ensures compliance with medical device regulations
- Validates biomechanical safety of corrective components

Research Questions

To translate the proof-of-concept ATB from a functional prototype into a validated, commercially viable, and user-centric medical device for moderate AIS, this research addresses the following key questions in the context of moderate-stage AIS management:

1. What specific material and design modifications to the RAE 2020 prototype ATB **optimises the trade-off between biomechanical efficacy and user-centred outcomes,** and how do these modifications impact **wearability** and **quality of life**?

2. How does the refined ATB perform in terms of long-term structural integrity (at three, six, and nine months), consistent corrective force application, and ultimate **clinical effectiveness** in correcting spinal curvature?

3. Which design-for-manufacturing strategies, modular sizing schemes, and material selections are required to transform the RAE 2020 ATB prototype into a scalable mass-production design , and clinically effective **commercial product** suitable for a diverse demographic of AIS patients?

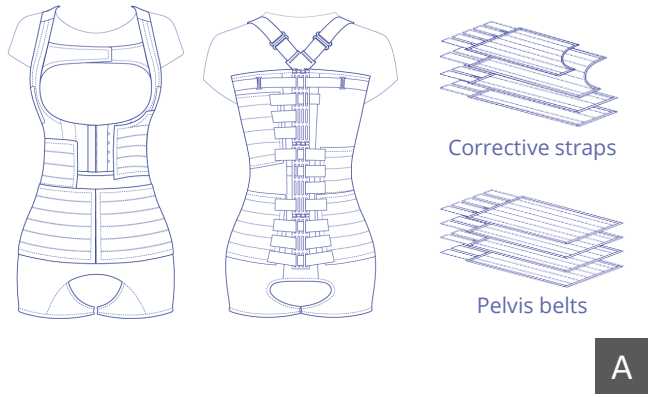
4. Which evidence-based implementation strategies, training programmes for clinicians, and reimbursement pathways are necessary to successfully **integrate the refined ATB into standard scoliosis management protocols**?

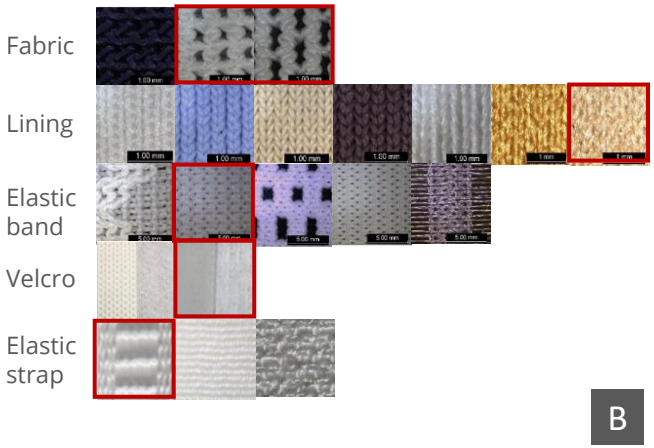
Research Outputs

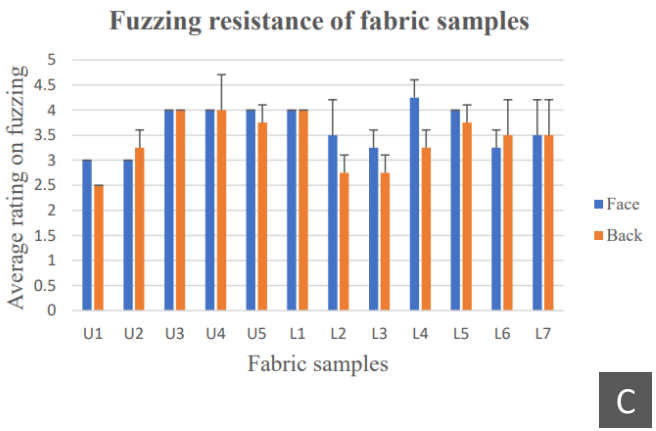
Category	Details
Product	a) Refinements of ATB's design and textile materials b) Refinements to ATB's hinged bone design and materials c) Detailed refinements of the ATB
Academic Papers	• Fok, Q., **Yip, J.**, Yick, K. L., & Ng, S. P. (2022). Design and fabrication of anisotropic textile brace for exerting corrective forces on spinal curvature. *Journal of Industrial Textiles, 51*(1_suppl), 1682S-1702S. https://doi.org/10.1177/15280837211032619 • Lei, Q. E., Shu, J., Wang, J., Cheung, H. Y., Cheung, J. P., Wong, W. F., Lau, S.C.Y., **Yip, J**., & Tong, R. K. (2023). Design and characterise of kirigami-inspired springs and the application in vertebrae exoskeleton for adolescent idiopathic scoliosis brace treatment. *Frontiers in Mechanical Engineering*, *9*, 1152930. https://doi.org/10.3389/fmech.2023.1152930
Conference papers	• Wong, S.H., **Yip, J.**, Yick, K.L., & Ng, S.P. (2020). Preliminary wear trial of anisotropic textile brace for adolescent idiopathic scoliosis. In *International Society for Engineering Research and Development International Conference (ISERD International Conference*), Zurich, Switzerland, 16-17 February. • Fok, Q., & **Yip, J.** (2021). Applying numerical simulation to predict effect of brace wear for scoliosis. In *Advances in human factors and ergonomics in healthcare and medical devices,* pp. 217–223. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-79763-8_26 • Wong, C. S. H., **Yip, J.**, Yick, K. L., & Ng, Z. S. P. (2021). A case study of initial In-brace spinal correction of anisotropic textile brace and Boston brace. In: *Kalra, J., Lightner, N.J., Taiar, R. (eds) Advances in Human Factors and Ergonomics in Healthcare and Medical Devices*. AHFE 2021. Lecture Notes in Networks and Systems, vol 263, pp. 109-115. Springer, Cham. https://doi.org/10.1007/978-3-030-80744-3_14 • Cheung, H., **Yip, J.**, Yick, K., Ng, S. (2022). Preliminary wear trial of anisotropic textile brace designed for adolescent idiopathic scoliosis. In: *Jay Kalra and Nancy Lightner (eds) Healthcare and Medical Devices. AHFE (2022) International Conference*. AHFE Open Access, vol 51. AHFE International, USA. https://ira.lib.polyu.edu.hk/handle/10397/115893 • Ma, J., Lee, K., Cheung, K., Tong, K., **Yip, J.** (2025). Advancing Scoliosis Treatment: Development and Evaluation of Anisotropic Textile Brace (ATB) for Enhanced Patient Compliance. In: *Jay Kalra (eds) Healthcare and Medical Devices. AHFE (2025) International Conference*. AHFE Open Access, vol 171. AHFE International, USA. http://doi.org/10.54941/ahfe1006193
Patent	• Orthopaedic Hinge Assembly. US12,129,886B2. Pub. date: 30 Jan 2020 • Anisotropic Textile Brace. ZL 202330553930.X. Application date: 14 Mar 2024

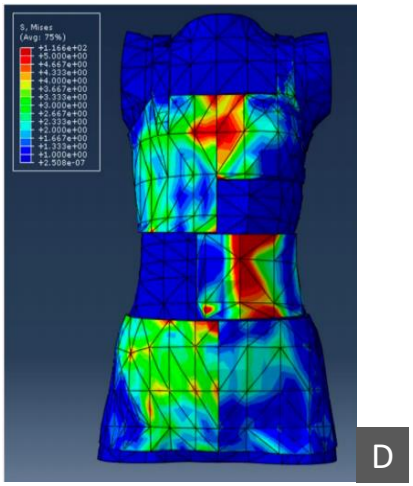
Research Outputs

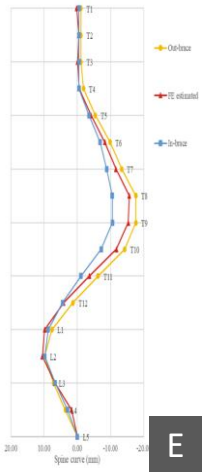
a. Refinements of ATB's Design and Textile Materials (2020–2025)











A. Refined ATB design: Four corrective straps and four pelvis belts to accommodate a wider range of body shapes. Supports mass commercialisation through improved adaptability.

B. Potential textile materials to enhance ATB fit, effectiveness and comfort. Shell Fabric 2 and 3, Lining 7, Elastic 2, Velcro 2, Elastic strap 1 were selected due to exceptional fabric recovery and good fabric extension; good heat, air, sweat and moisture transfer; better handfeel; better pilling resistance; elasticity; dimensional stability even after laundering.

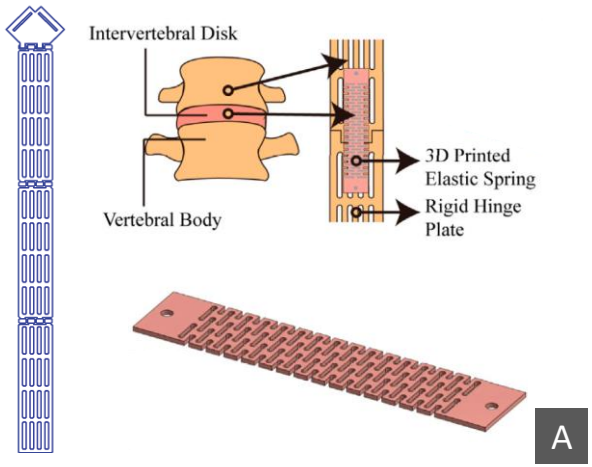
C. Various fabric testing was conducted to evaluate the behaviour of different materials.

D. Developed finite element models (FEM) to analyse spinal biomechanical responses to various levels of pressure.

E. Plotted graph based on the FEM to identify the optimal corrective force on thoracic and lumber areas.

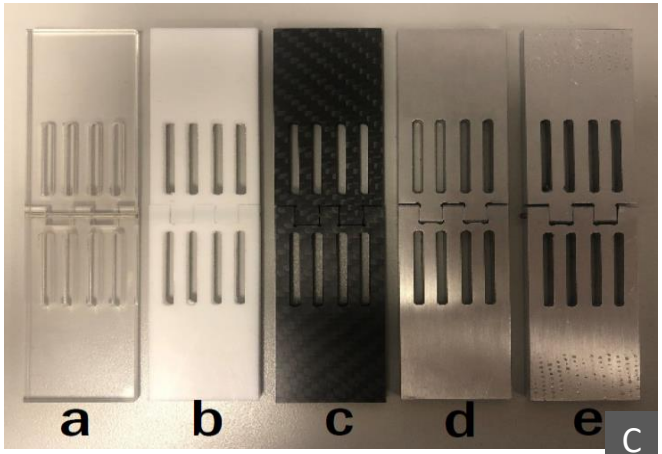
Research Outputs

b. Refinement of ATB and Hinged Bone Design (2020–2025)

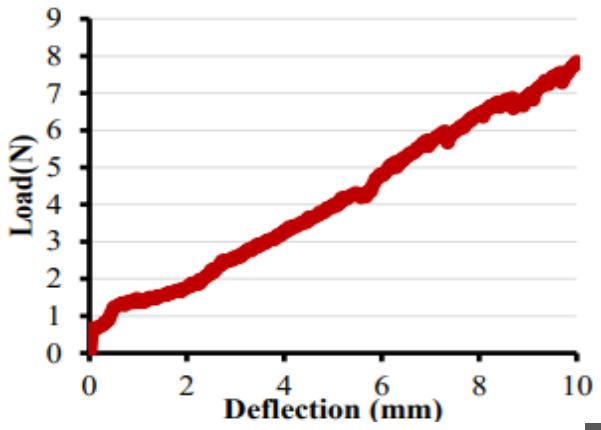


A

B



C



Plot of three-point bending test result (ASTM D790)

D

A. New hinged bone with integrated 3D-printed elastic spring to enhance fitting accuracy and long-term durability as well as prevents shifting and accidental disassembly.

B. Material testing (ASTMD638-22) was conducted to evaluated the tensile strength of the elastic spring. Testing confirmed a tensile strength of 0.9 MPa, thus ensuring optimal flexibility while resisting deformation.

C. Potential artificial bone materials to avoid breakage. Aluminium (d) is selected because of higher tensile and torque strength.

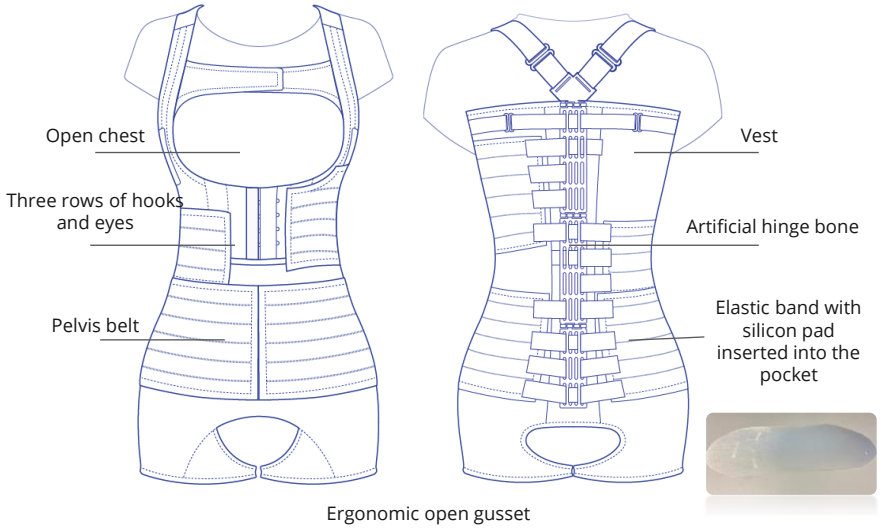
A. Material testing (ASTM D790) was conducted on the aluminium hinge's bone torque. A force of 7 N was required to achieve a deflection 10 mm, thereby demonstrating improved rigidity and load-bearing capacity.

Research Outputs

c. Detailed refinements of the ATB (2020–2025)

- **ATB** for moderate curvature AIS adolescents (Cobb angle : 20°–40°)
- The ATB is is a tight-fitting, vest-like undergarment that extends from the shoulders to the pelvis, combining biomechanical engineering with wearable comfort for noninvasive spinal correction. Its innovative design integrates **artificial hinge bones** for flexible support, **adjustable corrective straps** to apply targeted pressure based on spinal curvature, and customisable **silicone pads** within pocket linings for adaptive comfort.
- This **noninvasive, preintervention treatment** employs an **invisible** posture-correcting design to reduce or prevent spinal curve progression, prioritising high compliance through discreet, breathable materials and customisable biomechanical support.

Refined ATB



Front and back views

Research Field and Key References

AIS and its clinical management

AIS is is a complex 3D spinal deformity, defined by a lateral curvature >10° with vertebral rotation. It affects 0.9%–12% of adolescents globally [7-9] , causing trunk asymmetry, pain, and functional impairment. For 10% of patients (aged 10–16 years) with curves progressing to ≥ 20°, rigid bracing for 18–23 hours daily until skeletal maturity is the standard of care [10], to improve QoL [11].

This treatment's primary objective is to halt progression and prevent surgery. Its effectiveness is exclusively determined by two factors: the biomechanical corrective force of the brace and patient compliance to brace. However, current protocols disproportionately focus on the corrective force and **neglect the psychosocial factors essential for adherence**. Long-term effectiveness is ultimately determined by patient compliance. For example, adherence of ≥18 hours daily achieves a success rate of 90%-93%, compared to merely 42% for wear duration of less than six hours [12].

[Image]

Image not included. Please contact the author for permission to view or reuse.

Research Field and Key References

Global Research Landscape and Key Developments:

Rigid Braces

Braces are generally classified as rigid or flexible [13]. Rigid braces, typically constructed from thermoplastics such as polyethylene, are the standard of care due to their proven biomechanical efficacy in applying strong, consistent corrective forces [14].

However, their rigid nature is the source of significant patient burdens, including **skin irritation, discomfort, thermal discomfort, poor aesthetics, poor self esteem** due to their bulk, and associated psychological distress. These adverse effects frequently lead to **poor compliance**, thus directly **undermining the treatment's potential effectiveness**.

[Image]

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The Boston Brace

Knowledge gap 1: Neglecting the Importance of Brace Adherence
Brace physical and mental comfort is not sufficiently integrated into brace design criteria.

Research Field and Key References

Global Research Landscape and Key Developments:

Flexible braces

In an effort to mitigate these limitations, flexible braces were developed [15]. Designs such as the TriaC (which utilises a three-point pressure system) and the SpineCor (which employs dynamic elastic bands) aimed to improve comfort, mobility, and aesthetics to enhance wearability and compliance [16-20].

Nonetheless, a growing body of clinical evidence suggests that these designs often achieve their improved comfort at the **expense of corrective biomechanical force**. Studies indicate that flexible braces may provide inadequate in-brace correction and possess **insufficient strength to effectively prevent curve progression**, thus raising questions regarding their overall therapeutic effectiveness [20-23].

Knowledge gap 2: The Fundamental Design Trade-Off
No existing solution successfully integrates both comfort and corrective force

Research Field and Key References

A summary of the limitations of existing braces

Effectiveness	Factors	Rigid brace	Other textile braces
Corrective effect	Mechanism and force	• Relies on rigid shell for high, often uncomfortable three-point pressure • Risk of over-correction and muscle atrophy	• Inadequate, poorly directed force due to lack of rigid elements • Only suitable for younger users with a mild curve (~15°) • Short-term studies only; long-term efficacy unproven
	Durability	• Structurally durable but outgrown quickly, requiring frequent replacements	• Prone to material fatigue; loss of corrective force over time
	Usability and fit	• Custom-made for initial fit but becomes quickly obsolete with growth • Difficult to put on independently	• Often a complex harness of straps, which are difficult to fit and secure correctly
Compliance	Physical comfort	• Causes skin irritation, pain, and pressure ulcers due to rigid edges and poor breathability	• More comfortable than rigid braces but can still cause chafing from straps and poor moisture management
	Mobility	• Severely restricts torso movement (bending, flexing).	• Good mobility but can occasionally feel unstable or unsupportive
	Aesthetics and discretion	• Bulky and highly visible under clothing, leading to stigma	• Less bulky but often uses external straps, creating an obvious ‘medical’ appearance
	Psychological issues	• Strongly linked to low self-esteem, anxiety, and social isolation due to its appearance and discomfort	• Improves on rigid braces but the visible nature of straps can still cause self-consciousness

Research Advancements

Bridging the Gap: Comfort Meets Correction:

- **Patient-centric design:** Features enhanced breathability, conformable textiles, and improved aesthetics to optimise comfort and compliance.
- **Biomechanical efficacy:** Incorporates innovative aluminium-hinged supports to deliver targeted corrective forces, addressing limitations of traditional flexible braces.

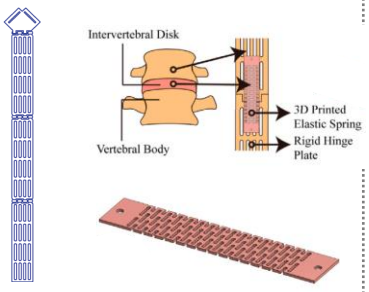
Advancements Over Existing Solutions:

- **Hybrid material system**: Merges the flexibility of textiles with the stability of semi-rigid components, thereby balancing comfort and efficacy
- **Rigorous clinical validation**: A long-term trial with standardised recruitment to eliminate prior methodological biases
- **Compliance-driven metrics**: Tracks wear-time, skin tolerance, and psychological feedback—key factors neglected in earlier studies

Research Methods, Prototypes, and Materials

Milestone 1: Refine the design of ATB to improve comfort and durability

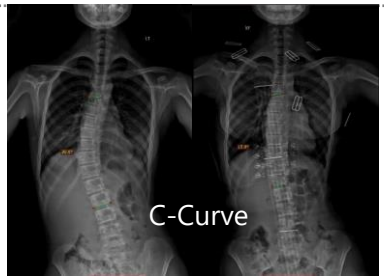
Refined the ATB according to the functional, expressive, and aesthetic model. This includes subject recruitment, design frameworks, material selection, pattern drafting, garment assembling, and fitting modification.



Milestone 2: Evaluation of the effectiveness of the Refined ATB

Conduct a preliminary trial of the refined ATB design & revise the design. This includes subject recruitment, wear trial protocol, fitting modification, and clinical results.

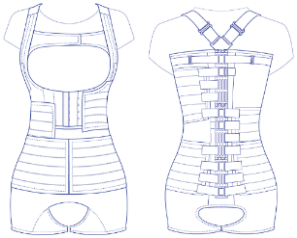
Before After

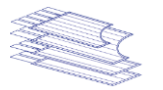


Before After

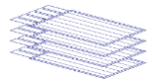
Milestone 3: Evaluation of the effectiveness of the mass-produced ATB & implementation

Conduct a clinical study to investigate the effectiveness of the mass-produced ATB by comparing Cobb angles and quality of life before and after wearing the ATB. Confirm final design and implementation.





Corrective straps



Pelvis belts

The project workflow

Research Methods, Prototypes, and Materials

Milestone 1.1 RAE 2020 Prototype ATB Strength and Problem Identification

The FE model was built to prove the long-term biomechanical effects of the RAE 2020 prototype ATB. It aims to provide convincing clinical data to recruit AIS patients to wear the ATB for three months or longer.

Key research findings regarding the RAE 2020 Prototype ATB

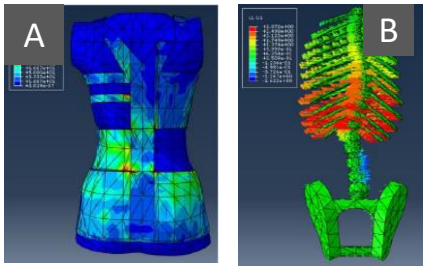
FE Model Testing: The FEM consisted of a scoliotic torso, skeletal structure, and the RAE 2020 prototype ATB. Fifteen FE models were developed with varying thoracic and lumbar loadings to analyse force distribution and optimise strap tension and pad placement.

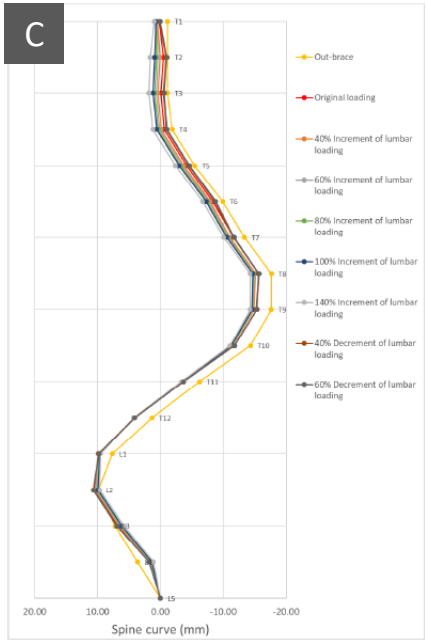
1. Hinge placement and comfort

- **Wear trials:** Feedback indicated that the hinge effectively matched the intervertebral region, thus enabling natural spinal motion while maintaining corrective alignment.
- **Stress distribution analysis**: FE analysis revealed peak pressure at the pelvic pad, thus indicating minimal hinge discomfort.

2. Optimal configuration of straps and belts

- Critical finding: Proper lumbar force management is essential to prevent thoracic overcorrection and maintain balanced spinal alignment.
- Key trade-off: Overloading the thoracic region disrupted lumbar alignment





A. Stress distribution on AIS torso to identify the area with the highest pressure

B. Skeletal model displacement under loading conditions matching clinical wear trials to validate the FE model.

C. Spinal curve response to varying thoracic and lumbar loadings to identify maximised spinal correction.

Theoretically proven biomechanical effectiveness
of the RAE 2020 prototype ATB

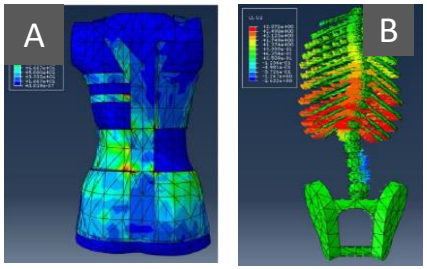
Research Methods, Prototypes, and Materials

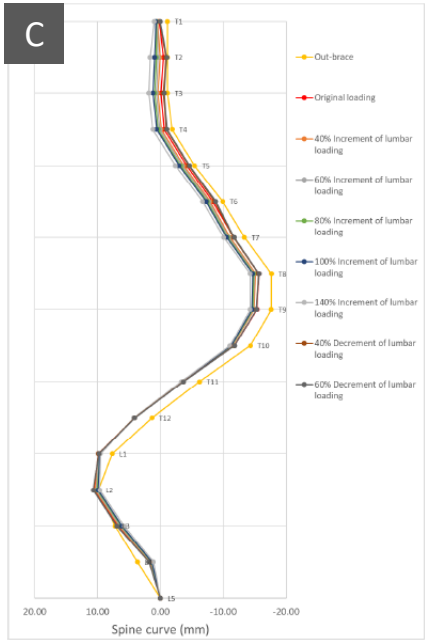
Milestone 1.1 RAE 2020 Prototype ATB Strength and Problem Identification

The FE model was built to prove the long-term biomechanical effects of the RAE 2020 prototype ATB. It aims to provide convincing clinical data to recruit AIS patients to wear the ATB for three months or longer.

3. Spinal curvature reduction

- An increase of 140% in lumbar load maximised spinal correction.
- Pad positioning was critical for effectiveness.





A. Stress distribution on AIS torso to identify the are with the highest pressure

B. Skeletal model displacement under loading conditions matching clinical wear trials to validate the FE model.

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Theoretically Proven Biomechanical Effectiveness
of the RAE 2020 Prototype ATB

Research Methods, Prototypes, and Materials

Milestone 1.1 RAE 2020 Prototype ATB Strength and Problem Identification

❖ Due to the lengthy research and development process, the wear trials for the RAE 2020 Prototype ATB lasted only two hours to evaluate its initial corrective effects. However, its **long-term effects on the AIS body remain questionable**.

❖ The RAE 2020 ATB prototype suffered from **significant usability issues**. The following are the key shortcomings:

a) **Poor strap and elastic design:** Multiple tight straps dug into the skin, and sharp-edged elastics created considerable discomfort.
b) **Nonadjustable fit:** A single, standard bra cup size failed to accommodate different body types.
c) **Inconvenient shorts design:** The open-gusset shorts were impractical for users.
d) **Overly complex construction:** The multipiece assembly made the garment unnecessarily complicated to put on and take off.

RAE 2020 Prototype ATB

Raw edges of the corrective bands caused a prickly sensation

The **long-term efficacy** of the device on the AIS body is **unproven**, and it has several **usability issues** that would need to be addressed in a long-term clinical trial.

Research Methods, Prototypes, and Materials

Milestone 1.2 Refine the Design of ATB to Improve Comfort

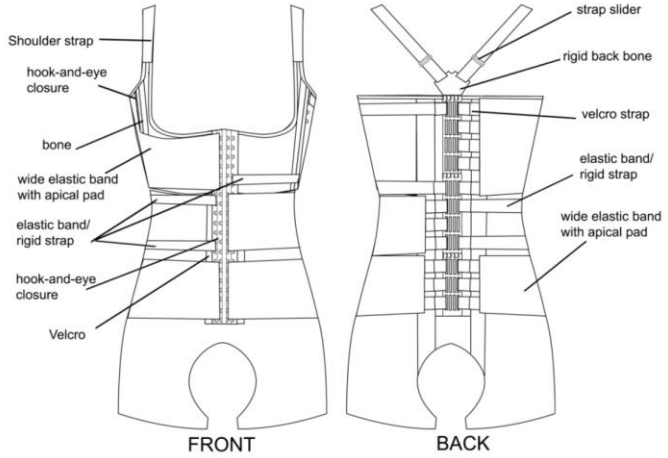
First attempt

- Two main components: a cupless bra top + shorts
- Cupless design improves fit and avoids compressing the breasts
- Hook-and-eye closures replace the Velcro fasteners to accommodate different body proportions & addresses the discomfort and inconvenience

Limitations and solutions:

- Adjust the hooks and eyes to ensure they are centred
- Shorten the front opening
- Modify the low and curved underbust band
- Shorten the straps to improve the fit.

Second attempt



- A one-piece garment for improved user-friendliness.
- Made from cupless, stretchable fabrics for comfort and fit.
- Maintain an open crotch design for convenience.
- The hooks-and-eyes closure was extended to the bottom of the brace to prevent shifting.
- Cushioning pads were added behind the hinges to prevent discomfort or pain.

Research Methods, Prototypes, and Materials

Milestone 1.2 Refine the Design of ATB to Improve Comfort

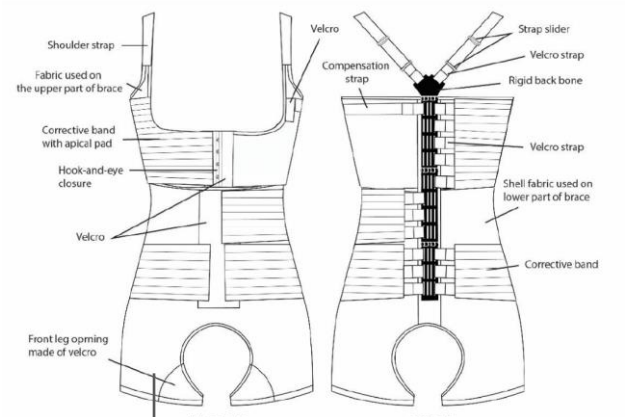
Third attempt

Limitations and solutions

- Caused discomfort and abdomen bulge due to rigid hook and eyes displacement of the brace

→ Reduce the thickness and rigidity of the panel
→ Changed to thinner and softer Velcro
→ Shorten the length of the hooks and eyes

Fourth attempt



No front opening | Velcro opening | Button opening

- The design features a front opening, thus allowing the thigh tightness to be adjusted.
- The leg opening can also be torn away if needed.
- Although the plastic button opening is the most secure, it is difficult to fasten and causes puckering.
- Velcro was selected for this function due to its neat appearance and the ease with which it can be torn open.

Research Methods, Prototypes, and Materials

Milestone 1.3 Refine the Materials of ATB to Improve Comfort and Durability

Potential textile materials to enhance comfort, ATB fit, and effectiveness

Physical tests

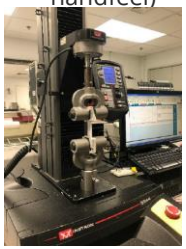
KES-F Thermo Labo II
(Tests thermal comfort)

KES-F8-AP1 Air Permeability Tester
(Tests breathability)

KESFB4-AUTO-A Automatic Surface Tester
(Tests smoothness/ handfeel)

Instron 4411 Tensile Strength Tester
(Tests tensile strength)

Instron 4411 tester used for peel strength test
(Tests peeling strength of Velcro)



Instron 5944 used for repeated stretch test
(Tests durability)

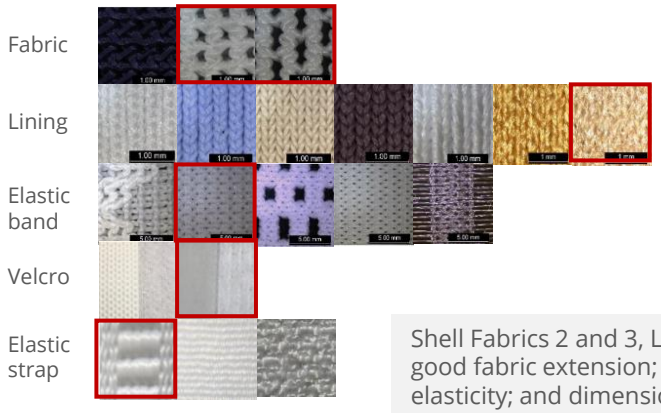
Apparatus for fabric evaluation
(Observe pilling effect)

Martindale abrasion tester
(Tests abrasion

Dimensional changes of fabrics after home Laundering

Water vapor permeability test

Data Analyse

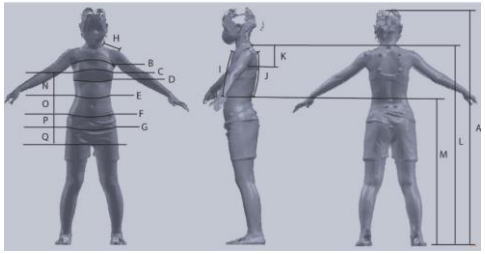


Selected textile materials

Shell Fabrics 2 and 3, Lining 7, Elastic 2, Velcro 2, Elastic strap 1 were selected due to exceptional fabric recovery and good fabric extension; good heat, air, sweat and moisture transfer; better hand feel; better pilling resistance; elasticity; and dimensional stability even after laundering.

Research Methods, Prototypes, and Materials

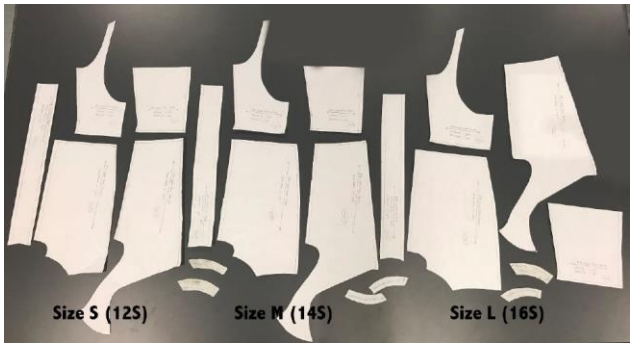
Milestone 1.4 Pattern Grading to Fit AIS with Diverse Body Shapes



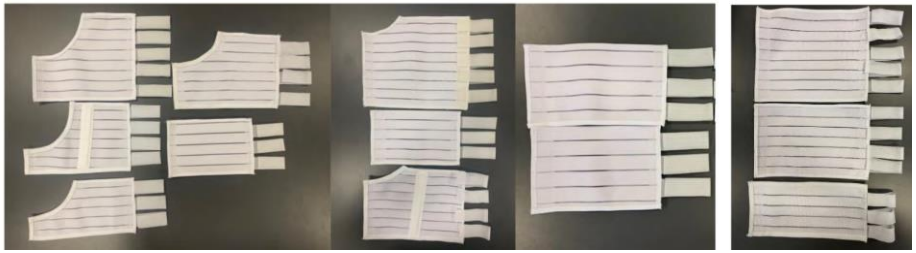
	Size	12S	14S	16S
	Body weight (mean), kg	84	99	109
	Body weight (range), kg	79-89	93-104	103-114
A	Height (cm)	147.55	155.18	159
B	Upper-chest girth (inches)	27	28 1/4	29 7/8
C	Chest/ Bust girth (inches)	27 1/2	29	30 1/2
D	Under-bust girth (inches)	25 1/4	26 3/8	27 5/8
E	Waist girth (inches)	24	25	26
F	High-hip girth (inches)	26 5/8	27 7/8	29 1/8
G	Hip/ Seat girth (inches)	28	29 1/2	31
H	Shoulder length (inches)	3 5/8	3 3/4	3 7/8
I	Centre front waist length (inches)	11 3/4	12 3/8	12 3/4
J	Centre back waist length (inches)	13 1/8	13 7/8	14 1/4
K	Scye depth (inches)	5 1/2	5 1/2	5 3/4
L	Cervicale height (inches)	49 3/4	52 1/4	53 5/8
M	Waist height (inches)	36 3/4	38 7/8	39 7/8
N	Bottom scye to waist height (inches)	7 1/2	7 7/8	8
O	Waist to high-hip height (inches)	3 3/8	3 5/8	3 6/8
P	High-hip to hip/seat height (inches)	3 1/4	3 1/2	3 3/4
Q	Hip/Seat to crotch height (inches)	2 1/2	2 5/8	2 3/4

ASTM D6192M standard tables of body measurements for girls, sizes 2 to 20 (reg & slim) and plus-size girls

Grading



Size XS ATB and shorter artificial hinged bone are developed to meet the needs of shorter patients in Hong Kong under 147.5 cm.



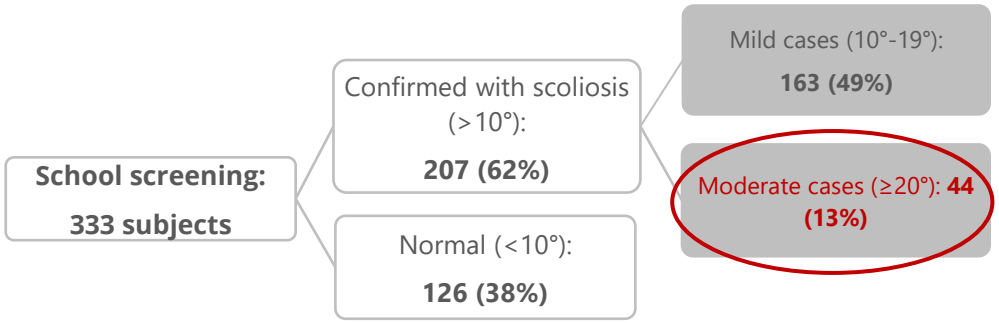
Different types of corrective bands for thoracic, thoracolumbar, lumbar curves, and pelvis belts

Research Methods, Prototypes, and Materials

Milestone 1.5 Subject Recruitment

Adam's forward bend test

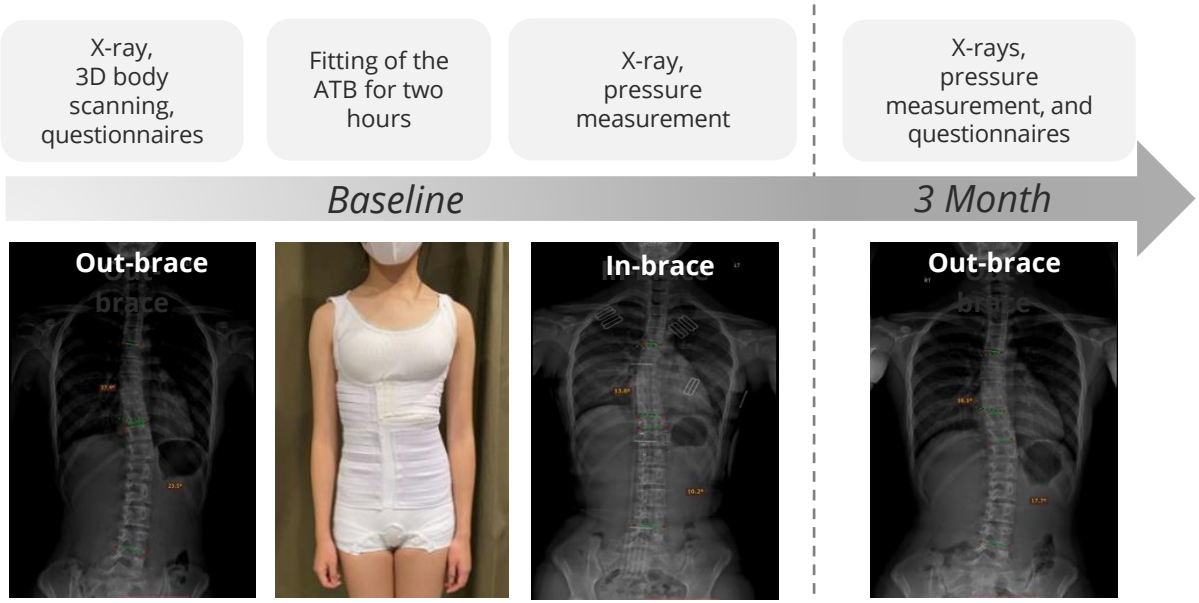
School screening: Began from 2020, 642 out of 3209 students had shown signs of scoliosis, and 333 of them accepted our offer to conduct EOS low-dose X-ray radiograph imaging.



Inclusion criteria:

- Female; aged 10–13 years
- Skeletally immature (Risser grade 0,1, or 2)
- Primary Cobb angle: 20°–40°
- Pre-menarche or post-menarche by no more than one year

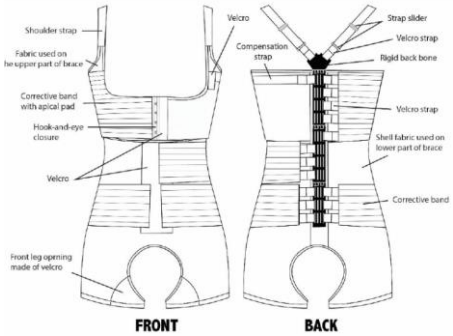
Protocol for the three-month clinical wear trials:



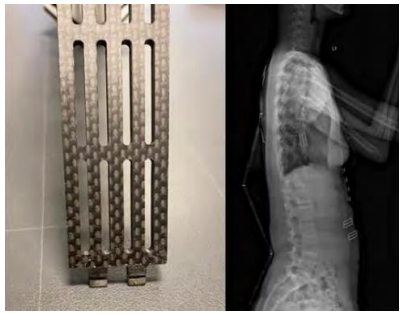
Research Methods, Prototypes, and Materials

Milestone 1.6 Fourth Attempt ATB Preliminary Trials

Fourth attempt ATB



Fuzzing problem



The bone often breaks at the connecting part; fitting issue: easily flip upwards

Comparison of pre- and post-intervention of ATB (Version 2) after three-month wear trials

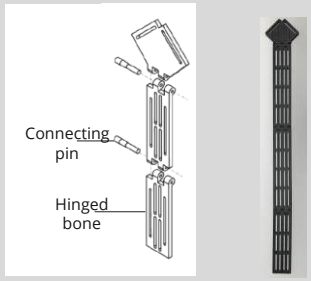
Subject	Curves (start-apex-end)	Baseline (out-Brace)	After two hours (In-brace)	Three month (out-brace)	Differences
B1	T11-L1-L3	21.0°	15.4°	21.8°	0.8°
B2	T1-T9-T11	18.8°	14.7°	Dropped out	/
B3	T10-T12-L3	22.2°	15.2°	20.8°	-1.4°
B4	T6-T9-T11 T12-L1-L5	21.8° 16.7°	16.2° 18.3°	21.6° 19.7°	-0.2° 3.0°
B5	T10-T12-L3	31.3°	21.5°	29.2°	-2.1°
B6	T6-T9-T11 T11-L1-L3	23.1° 27.8°	14.8° 22.4°	15.7° 21.6°	-7.4° -6.2°
B7	T11-T12-L2	22.0°	14.5°	23.6°	1.6°

4/7 (57%) showed a reduction in Cobb angles

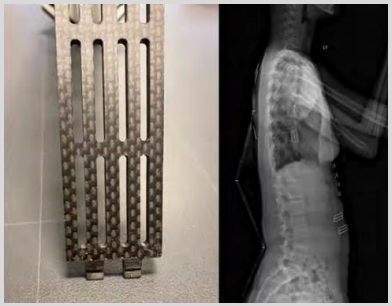
This brace has clinically proven effectiveness. However, it **cannot be worn for a long time** due to the poor durability of its textile and artificial bone components.

Research Methods, Prototypes & Materials

Milestone 1.7 Refinement of Hinged Bone Design and Materials

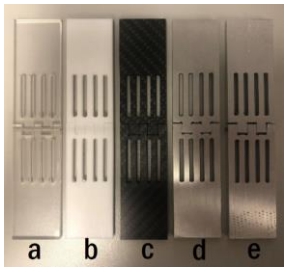


Previously used carbon fibre hinged bone



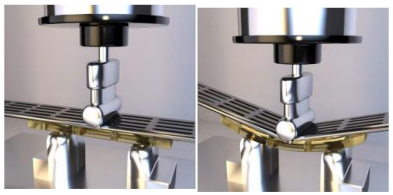
Limitation:
- Often breaks at connecting part
- Fitting issue: easily flips upwards

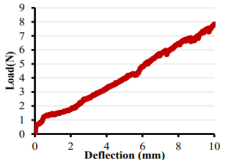
Solution:
- Change to new material and refine the bone design
- Compare the test results



3D printed bone with different materials

A

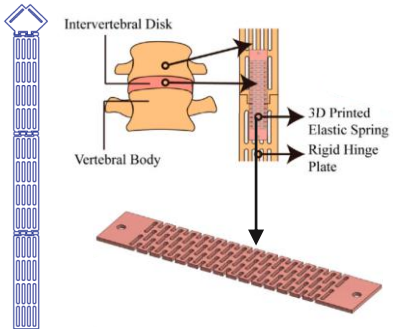




Plot of three-point bending test result (ASTM D790)

B

C



D

A. 3D printed bone with different materials

B. Material testing (ASTMD638-22) was conducted to evaluate the tensile strength of the elastic spring. Testing confirmed a tensile strength of 0.9 MPa, thus ensuring optimal flexibility while resisting deformation.

C. Material testing (ASTM D790) was conducted to evaluate the artificial bone torque with aluminium hinges. A force of 7 N was required to achieve a deflection of 10 mm, thereby demonstrating improved rigidity and load-bearing capacity.

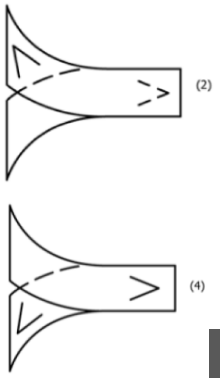
D. New hinged bone with integrated 3D-printed elastic spring enhances fitting accuracy and long-term durability as well as prevents shifting and accidental disassembly.

Research Methods, Prototypes, and Materials

Milestone 1.7 Refinement of Hinged Bone Design and Materials

Limitations:
- Fuzzing after three months of bracing
- Insufficient elasticity of the elastic band

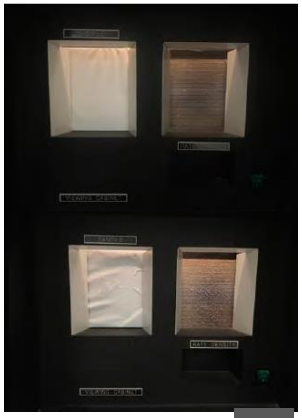
Solution:
- Change to new Velcro
- Compare the previous and new materials based on the physical tests



A

	Direction 1 (Maximum Load)	Direction 2 (Maximum Load)	Direction 3 (Maximum Load)	Direction 4 (Maximum Load)
1	14.76	14.76	13.69	16.24
2	11.4	11.27	10.46	13.28
3	8.85	12.34	11.27	11.4
4	9.39	10.46	10.2	10.6
5	11.4	10.46	12.21	9.93
Mean	**11.16**	**11.86**	**11.57**	**12.29**
S.D.	2.32	1.80	1.42	2.54

B



C

D

Elastic band	Extension (Average)	Growth (Average)	Recovery (Average)
Modified ATB from Wong (2021)	48.3%	3.2%	93.3%
Newly sourced	44.7%	1.53%	96.6%

E

A. Peeling in Directions 2 and 4 based on ASTM D5170. The highest peel strength can be found in Direction 4.

B. Peel strength of newly sourced Velcro: mean peel strength ranges from 11.16 N to 12.29 N, which indicated better fuzzing resistance. (Previous: 0.085 N)

C. Pilling resistance of newly sourced Velcro: Grade 5 (the best) i.e., no visual change on the front of the fabric.

D. Demonstration photo after three months of brace wear with new Velcro

E. Elasticity and recovery of newly sourced Velcro (ASTM D6614-07) : The recovery rate is 96.6% , higher than the previous elastic band (i.e. 93.3%)

Research Methods, Prototypes, and Materials

Milestone 1.8 Summary on Refinement of ATB and Hinged Bone Design

1. Upgraded wear comfort to improve QoL

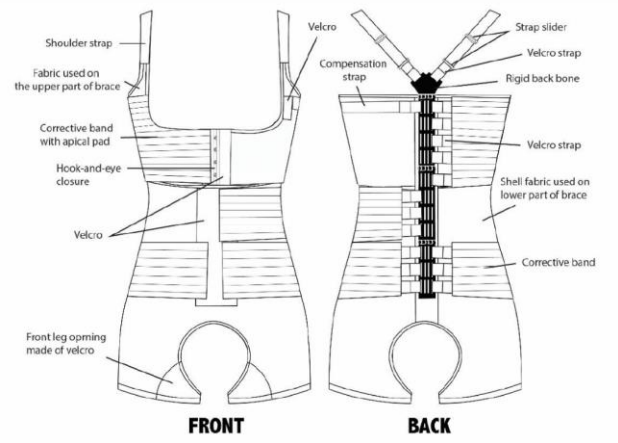
- **Integrated vest design:** Reduces strap pressure to prevent skin irritation.
- **Softer Velcro & edge-free elastics:** Eliminates discomfort from sharp edges.
- **Advanced textile materials:** Improved breathability (air permeability), moisture-wicking (water vapor permeability), and softer hand feel.

2. Enhanced user-friendliness to enhance treatment compliance rates

- **Open-gusset shorts:** Allows convenient bathroom access without removing the garment.
- **One-piece design:** Simplifies dressing and undressing for independent use.

3. Reinforced durability

- **High-performance textiles:** Enhanced elastic recovery, pilling resistance, and wash durability for long-term use.
- **Material upgrade for artificial bones:** Switched from carbon fibre to aluminium for higher tensile and torque strength.
- **3D-printed elastic spring:** Secures bones to prevent accidental disassembly while maintaining flexibility.



Refined ATB

Research Methods, Prototypes, and Materials

Milestone 2 Clinical Evaluation of the Refined ATB

Six-month clinical wear trials protocol:

Baseline			Three months	Six months	Nine months (optional)
X-rays and questionnaires	Fitting of the ATB for two hours	X-ray and pressure measurement	X-rays, pressure measurement, and questionnaires	X-rays, pressure measurement, and questionnaires	X-rays and questionnaires
Out-brace		In-brace	Out-brace	In-brace	Out-brace





Questionnaires

- **SRS-22 questionnaire**
  - Measure QoL in five domains: pain, mental, self-image, function, treatment satisfaction
- **BrQ Assessment**
  - Measure QoL in Gernal health perception, physical functioning, emotional functioning, self-esteem and aesthetic, vitality, school activity, bodily pain, and social functioning
- **Bad Sobernheim Stress Questionnaire** (BSSQ)
  - Observes the psychological and physiological comfort of the brace

Pressure measurement


Pliance® pressure sensors

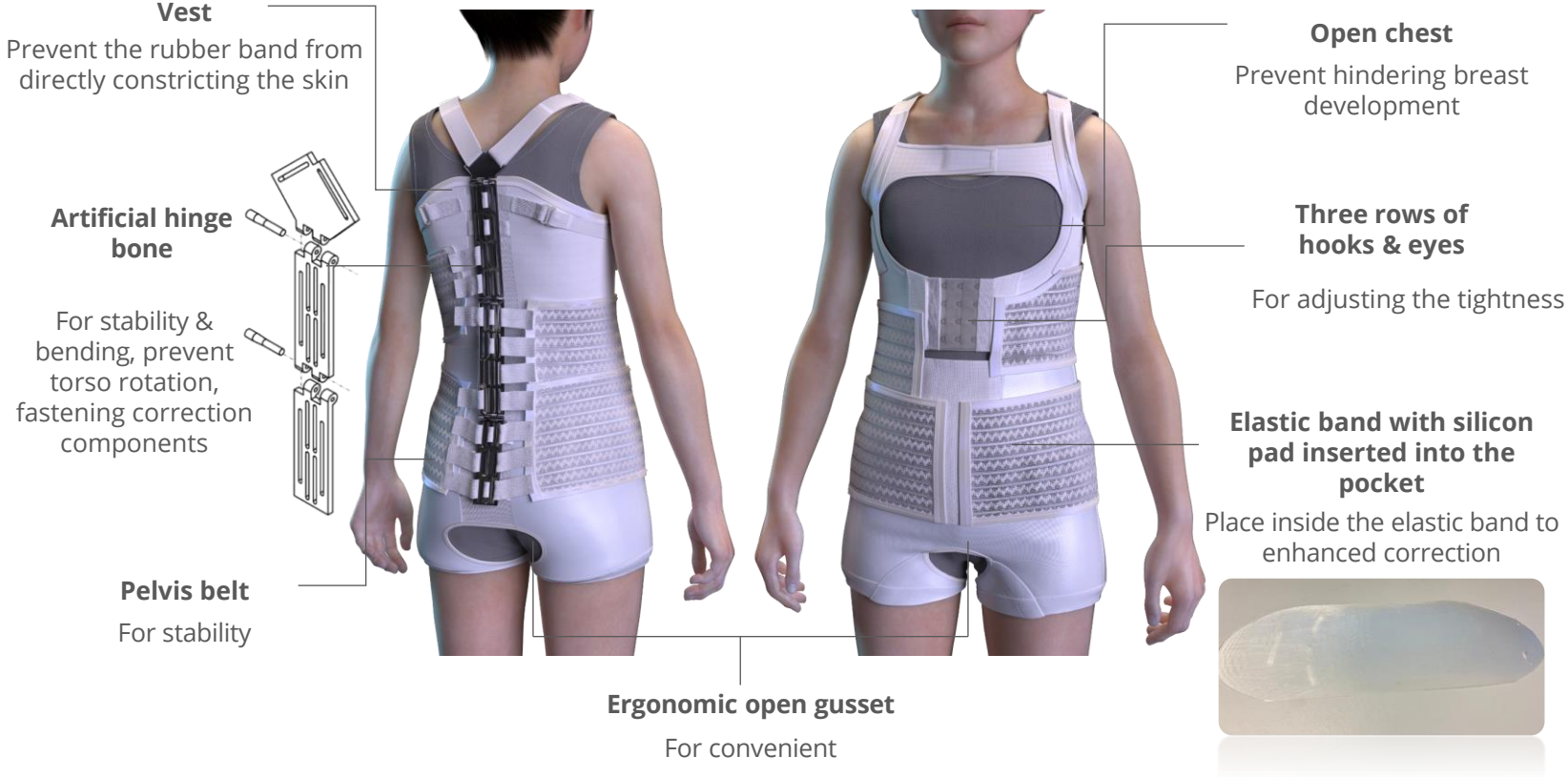
Location of pressure sensors for C/S-shaped subjects

Research Methods, Prototypes, and Materials

Milestone 3.1 Standardised the Mass-produced ATB

Based on subject feedback, the ATB design was refined to meet mass-production requirements. The new design is simpler, more comfortable, more durable, and more effective. The next step is clinical trials on the mass-produced units.

- **Anisotropic textile brace** for the adolescents who have moderate scoliosis (Cobb angle: 20°–40°)



Research Methods, Prototypes, and Materials

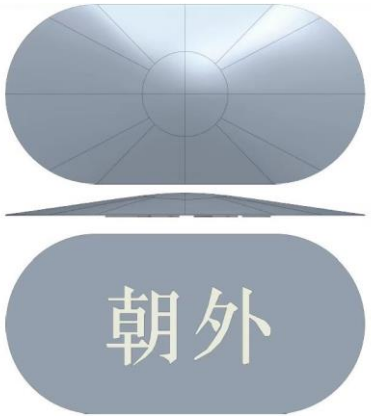
Milestone 3.1 Standardised the Mass-produced ATB

a) Manufacturing Process for Silicone Padding

Material: 100% Silicone
Manufacturing Process: Injection molding
Production Workflow:

1. Silicone raw material (typically in a paste or block form) is mixed with a vulcanising agent in a rubber mill to form sheets.
2. Pre-weighed amounts of this material are placed into the mold of a vulcanisation molding machine.
3. After complete vulcanisation, the mold is opened to remove the product.
4. The final step involves manual trimming of any flash (excess material) to produce the finished item.

Machinery: 250T Vacuum Vulcanisation Machine



Silicone Padding

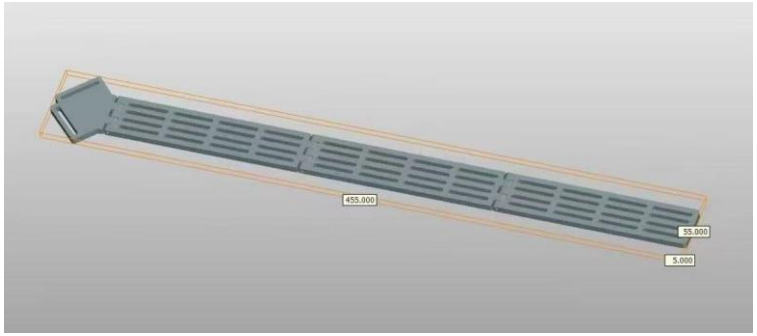
Adding Identification Marks to Solve Orientation Recognition Issues
Problem Description: Children find it difficult to identify the correct orientation of the silicone padding, frequently inserting it incorrectly.
Solution: Embossed braille or raised characters will be added to the flat surface of the padding. This provides a tactile cue for clear and correct placement orientation.

Research Methods, Prototypes, and Materials

Milestone 3.1 Standardised the Mass-produced ATB

b) Manufacturing Process for Hinged Bone

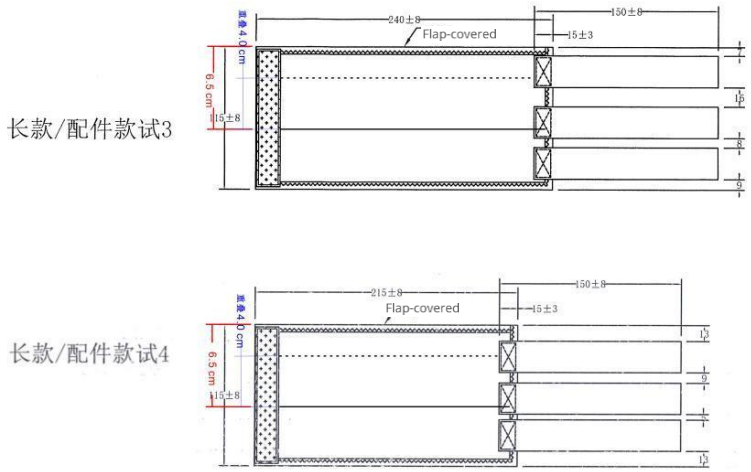
Material: 6063 Aluminium Alloy, Stainless Steel Pins
Manufacturing process: CNC Machining + Anodising
Production workflow: The movement of the CNC machine is pre-programmed based on 3D drawings, which define the tool path, speed, and cutting depth. Assembly is completed after all parts are completed.
Test conditions: 10,000 cycles of torsional stress at 4.6 ± 0.2 kg-cm torque in both clockwise and counterclockwise directions.
Acceptance criteria: No functional failure or structural damage after completion of the test.



Hinged Bone

c) Long Wide Elastic Band-Silicone Pad Loss Issue

Problem description: The long corrective elastic band is overly long, which causes the silicone pads to detach and get lost easily.
Solution: Redesign the pocket opening into a ‘flap-covered’ style to secure the pads.



Long wide elastic band with ‘flap-covered’ pocket

Research Methods, Prototypes, and Materials

Milestone 3.1 Standardised the Mass-produced ATB

d) Recommendatin for increase in leg circumference

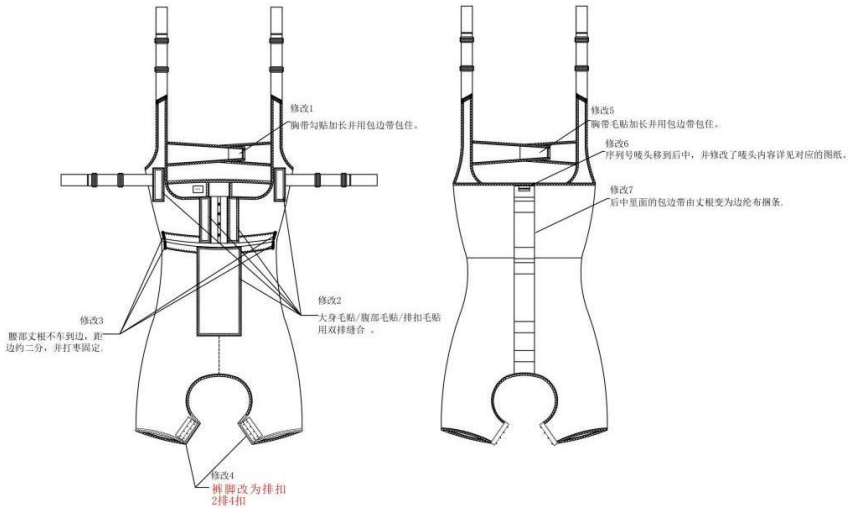
Problem description: The leg circumference is too small and this causes it to dig into and constrict the thighs.
Solution: Increase the leg circumference measurement by 2.5 cm to enhance wearing comfort and reduce pressure.

e) Improvement in the Leg Strap Design

Problem description: The original garment used a hook-and-loop fastener at the leg opening, which caused skin irritation and fabric pilling. Its peel strength also declined with prolonged use, raising durability concerns.
Solution: Change the leg strap closure from a Velcro (hook-and-loop) design to a snap-button design to further improve comfort and durability.

f) Improvement in the Front Strap Design

Problem description: The current front strap does not effectively prevent constriction, thus negatively impacting the wearing experience.
Solution: Either readjust the length of the front strap or adjust the ratio of the hook and loop areas on the Velcro



Commercialised ATB

Research Methods, Prototypes, and Materials

Milestone 3.1 Standardised the Mass-produced ATB

g) Pattern grading

Refined ATB: In this study, the pattern grading for key components of the ATB was based on the ASTM D6192M standard body measurement table for girls. Since patients with AIS tend to be slimmer and lighter compared to typical adolescents, sizes 12S, 14S, and 16S were adopted, which represented S, M, L sizes, respectively.

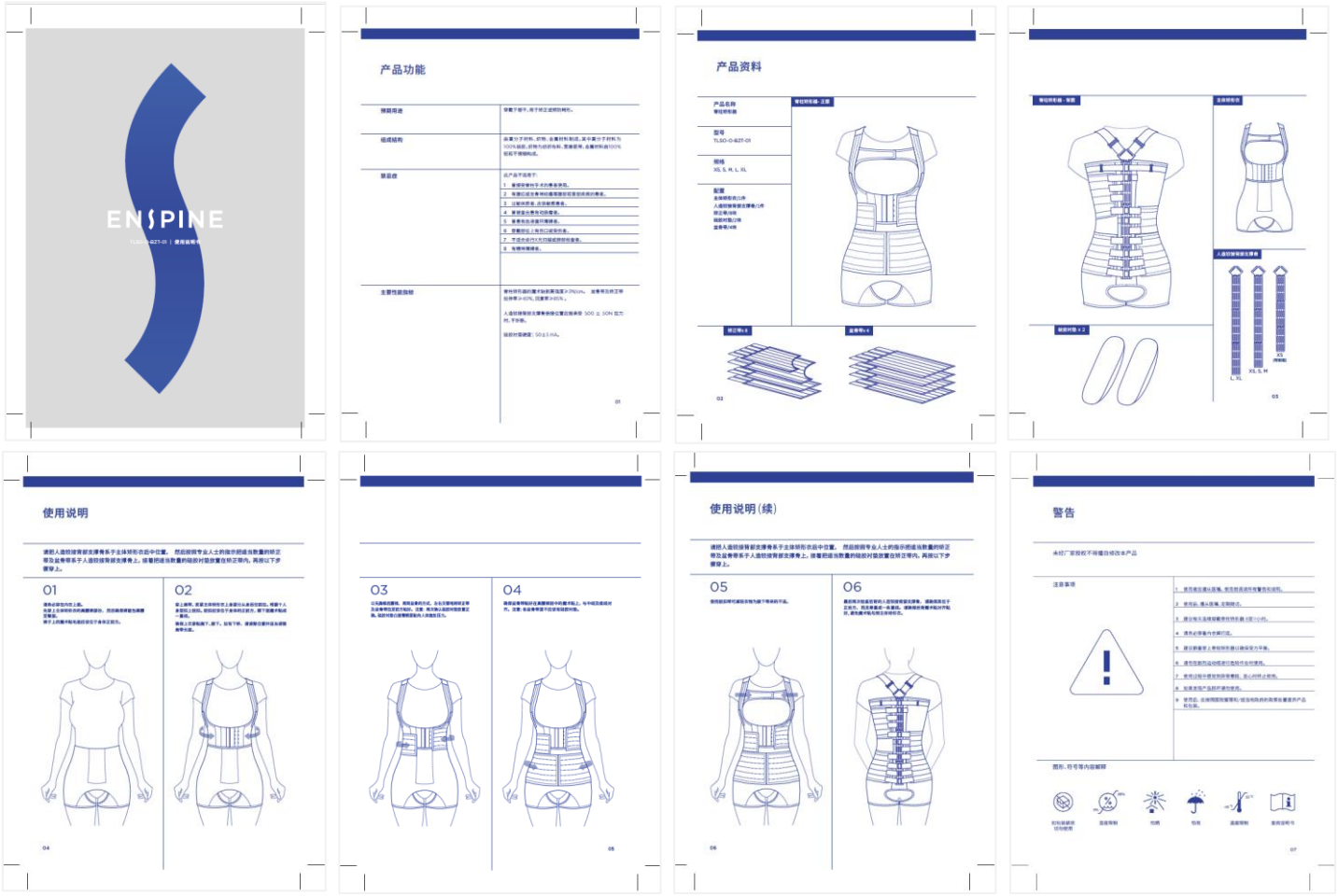
Mass-produced ATB: To better accommodate the needs of diverse patients, the latest version of the ATB design expands the size range to five sizes: 10S to 18S, corresponding to XS, S, M, L, and XL sizes, thus providing more options for patients with varying body types. Based on refinements derived from short- and long-term wear trials involving over 30 subjects, we provide the following table as a size reference for initial fitting of the ATB.

	XS	S	M	L	XL
Height	135 cm–145 cm	145 cm–165 cm			156 cm–175 cm
Weight	31 kg–36 kg	36 kg–42 kg	42 kg–47 kg	47 kg–52 kg	52 kg–57 kg
Bust	64 cm–68 cm	68 cm–72 cm	72 cm–76 cm	76 cm–79 cm	79 cm–85 cm
Under Bust	59 cm–63 cm	63 cm–65 cm	65 cm–69 cm	69 cm–71 cm	71 cm–75 cm
Waist	56 cm–60 cm	60 cm–62 cm	62 cm–65 cm	65 cm–67 cm	67 cm–71 cm
Hip	65 cm–69 cm	69 cm–73 cm	73 cm–77 cm	77 cm–80 cm	80 cm–90 cm

Size chart

Research Methods, Prototypes, and Materials

Milestone 3.2 Develop User Manual of Mass-produced ATB

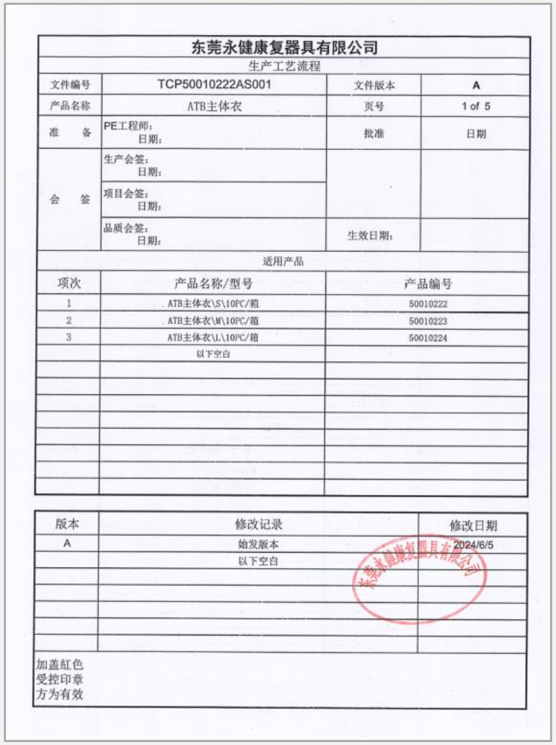


The ATB User Manual for customers, includes product instructions, application guidelines, safety warnings, an information sheet, and a consent form

Research Methods, Prototypes, and Materials

Milestone 3.3 Mass Production of Mass-produced ATB

A **fully operational production line** in Mainland China has been established in partnership with Dongguan Yongjian Rehabilitation Equipment Co., Ltd. (东莞永健康复器具有限公司). A **certificate of conformance** from Vincent Rehab Devices Co., Ltd. has also been received, thus ensuring that the ATB meets the highest industry standards.



东莞永健康复器具有限公司

生产工艺流程

文件编号	TCP50010222AS001	文件版本	A
产品名称	ATB主体衣	页号	1 of 5
准　备	PE工程师： 日期：	批准	日期
会　签	生产会签： 日期：		
	项目会签： 日期：		
	品质会签： 日期：	生效日期：	

适用产品

项次	产品名称/型号	产品编号
1	ATB主体衣\S\10PC/箱	50010222
2	ATB主体衣\M\10PC/箱	50010223
3	ATB主体衣\L\10PC/箱	50010224
	以下空白	

版本	修改记录	修改日期
A	始发版本	2024/6/5
	以下空白	

加盖红色受控印章方为有效

东莞永健康复器具有限公司
生产工艺流程

产品名称	产品编号	页码	文件编号	版本
ATB主体衣	参照封面	2 of 5	TCP50010222AS001	A

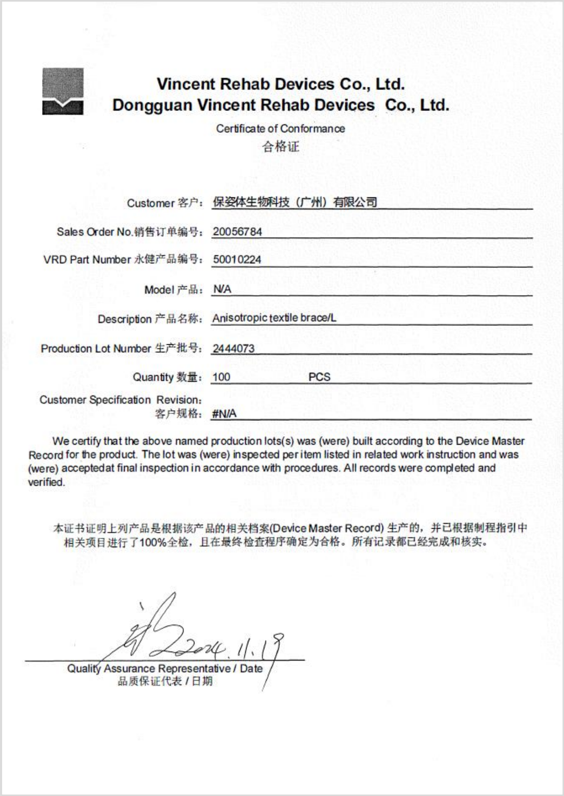
○ 生产　◇检查　▽ 贮存　◁ 特殊质量处理

东莞永健康复器具有限公司
生产工艺流程

产品名称	产品编号	页码	文件编号	版本
ATB主体衣	参照封面	3 of 5	TCP50010222AS001	A

○ 生产　◇检查　▽ 贮存　◁ 特殊质量处理

A fully operational production line



Vincent Rehab Devices Co., Ltd.
Dongguan Vincent Rehab Devices Co., Ltd.

Certificate of Conformance
合格证

Customer 客户：保姿体生物科技（广州）有限公司

Sales Order No.销售订单编号：20056784

VRD Part Number 永健产品编号：50010224

Model 产品：N/A

Description 产品名称：Anisotropic textile brace/L

Production Lot Number 生产批号：2444073

Quantity 数量：100 PCS

Customer Specification Revision:
客户规格：#N/A

We certify that the above named production lots(s) was (were) built according to the Device Master Record for the product. The lot was (were) inspected per item listed in related work instruction and was (were) acceptedat final inspection in accordance with procedures. All records were completed and verified.

本证书证明上列产品是根据该产品的相关档案(Device Master Record) 生产的，并已根据制程指引中相关项目进行了100%全检，且在最终检查程序确定为合格。所有记录都已经完成和核实。

2024.11.19

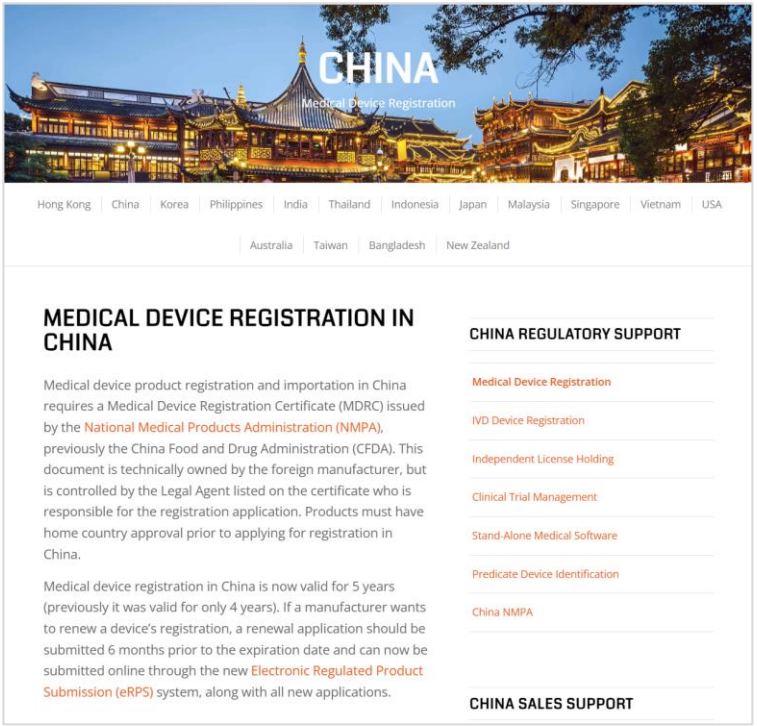
Quality Assurance Representative / Date
品质保证代表 / 日期

Certificate of Conformance

Research Methods, Prototypes, and Materials

Milestone 3.4 Implementation of Mass-produced ATB in the Hospital

Apply Mainland China Medical Device Registration Certificate (MDRC) as a Class II medical device, so that it can be purchased in clinical practice across Mainland China hospitals and clinics, with doctors recommending it to patients.



MEDICAL DEVICE CLASSIFICATION

Low Risk Class I medical devices are subject to a filing process with applications submitted to the NMPA. Administrative review and MDRC issuance takes about 4 weeks from application submission.

Medium Risk Class II and High Risk Class III medical devices are subject to a registration process with applications and supporting documentation submitted to the NMPA. Product testing certificates issued from a (local) NMPA-certified laboratory are a required element of the application. Local clinical test data is also required for most Class II and III devices.

As of October 2022, the NMPA has published their classification catalogue adjustments for comment. More information available here. Recently, the NMPA has updated the classification status of Sodium Hyaluronate products. Read more about the notice here.

Asia Actual's new tool for RA professionals, R.O.S.E., can help identify Same-Type devices (aka Predicate Devices) and their classification. Click here to learn more.

	NMPA REVIEW FEES	REVIEW TIMEFRAME
LOW RISK CLASS I	NA	4 weeks
MEDIUM RISK CLASS II	210,900 RMB (~$30,000 USD)	12-24 months
HIGH RISK CLASS III	308,800 RMB ($44,000 USD)	12-24 months

https://asiaactual.com/china/medical-device-registration/

Research Methods, Prototypes, and Materials

Milestone 3.4 Implementation of Mass-produced ATB in the Hospital

To ensure product safety for its Class II medical device application, the main components of the mass-produced ATB underwent testing by a recognised certification authority.

Produkte / Products — TÜVRheinland®

Test Report No.: 测试报告编号:	CN2491B5 001	Order No.: 订单编号:	170377166	Page 1 of 5 页码 1 of 5
Client Reference No.: 客户参考编号:	不适用	Order date: 订单日期:	07.05.2024	
Client: 客户:	保姿体生物科技（湖南）有限公司 湖南省湘潭市经开区和平街潭东风路 31 号创新创业中心 1 号楼 20 层 2010 室			
Test item: 测试样品:	100% 超复人造蛟接背部支撑骨 + 不锈钢销轴			
Identification/Type No.: 产品识别/ 型号:	Hinge Bone-V1.1			
Order content: 订单内容:	按客户要求提供测试报告			
Test specification: 测试规范:	根据客户要求 - 弯曲寿命试验（10000 次循环）			
Date of receipt: 收样日期:	07.05.2024			
Test sample No.: 样品编号:	A003712583-002			
Testing period: 测试周期:	07.05.2024 – 21.05.2024			
Place of testing: 测试地点:	广州市科珠路 199 号			
Testing laboratory: 测试实验室:	莱茵技术监督服务（广东）有限公司			
Test result*: 测试实验室:	通过			

tested by / 测试: 李舜豪 — 03.06.2024 李舜豪/ 工程师 Engineer

reviewed by /审核: 谢春生 — 03.06.2024 谢春生/ 审核人 Reviewer

Other / 其他:
1. 根据客户要求，本报告为参考报告编号 CN249ZJX 001 的中文补充报告，所有结果均来自原始报告编号 CN249ZJX 001.
2. 目的国：中国
3. 此报告仅限于委托方企业内部进行质量评估参。

Condition of the test item at delivery : 接收时样品的状况: — Test item complete and undamaged 样品完整无损坏

*Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor; P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable NT = not tested

This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
测试结果只对应提交的样品。未经测试中心许可，这个测试报告是不得重复摘取，此测试报告无权进行任何类似产品的安全标志

TÜV Rheinland (GuangDong) Ltd. · No.199 Kezhu Road, Guangzhou Science City · Guangzhou · 510663, P.R. China
Tel.: +86 20 2839 1888 · Fax: +86 20 2839 1999 · Mail: service-gc@tuv.com · Web: www.tuv.com

Hinged bone bending life test

Produkte / Products — TÜVRheinland®

Test Report No.: 测试报告编号:	CN24921B 001	Order No.: 订单编号:	170377166	Page 1 of 5 页码 1 of 5
Client Reference No.: 客户参考编号:	不适用	Order date: 订单日期:	07.05.2024	
Client: 客户:	保姿体生物科技（湖南）有限公司 湖南省湘潭市经开区和平街潭东风路 31 号创新创业中心 1 号楼 20 层 2010 室			
Test item: 测试样品:	100% 超复人造蛟接背部支撑骨 + 不锈钢销轴			
Identification/Type No.: 产品识别/ 型号:	Hinge Bone-V1.1			
Order content: 订单内容:	按客户要求提供测试报告			
Test specification: 测试规范:	根据客户要求 - 扭转轴寿命试验（10000 次循环）			
Date of receipt: 收样日期:	07.05.2024			
Test sample No.: 样品编号:	A003712583-001			
Testing period: 测试周期:	07.05.2024 – 21.05.2024			
Place of testing: 测试地点:	广州市科珠路 199 号			
Testing laboratory: 测试实验室:	莱茵技术监督服务（广东）有限公司			
Test result*: 测试实验室:	通过			

tested by / 测试: 李舜豪 — 03.06.2024 李舜豪/ 工程师 Engineer

reviewed by /审核: 谢春生 — 03.06.2024 谢春生/ 审核人 Reviewer

Other / 其他:
1. 根据客户要求，本报告为参考报告编号 CN246DGM 001 的中文补充报告，所有结果均来自原始报告编号 CN246DGM 001.
2. 目的国：中国
3. 此报告仅限于委托方企业内部进行质量评估参。

Condition of the test item at delivery : 接收时样品的状况: — Test item complete and undamaged 样品完整无损坏

*Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor; P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable NT = not tested

This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
测试结果只对应提交的样品。未经测试中心许可，这个测试报告是不得重复摘取，此测试报告无权进行任何类似产品的安全标志

TÜV Rheinland (GuangDong) Ltd. · No.199 Kezhu Road, Guangzhou Science City · Guangzhou · 510663, P.R. China
Tel.: +86 20 2839 1888 · Fax: +86 20 2839 1999 · Mail: service-gc@tuv.com · Web: www.tuv.com

Hinged bone twisting axis life test

湖南新领航检测技术有限公司　资料编号：ME20241953　R12/CXWJ-37

检验项目		标准规定	实验周期和结果	
			第 0 天	第 78 天
尺寸（2.2）		矫形衣腰围：60cm-62cm	61cm	61 cm
		矫形衣臀围长：69cm-73cm	70cm	70 cm
		铰链支撑骨长：42.3cm±0.2cm	42.2cm	42.3 cm
		铰链支撑骨宽：5.5cm±0.1cm	5.5cm	5.5 cm
		铰链支撑骨厚：0.5cm±0.1cm	0.5cm	0.5 cm
		硅胶衬垫长：17.8cm±0.5cm	18.0cm	18.1 cm
		硅胶衬垫宽：9.1cm±0.5cm	9.1cm	9.1 cm
		硅胶衬垫顶点厚度：0.9cm±0.2cm	1.0cm	1.0 cm
性能要求（2.3）	2.3.1	魔术贴的剥离强度应≥2N/cm	5N/cm	5N/cm
	2.3.2	盆骨带拉伸率≥40%	107%	111%
		矫正带拉伸率≥40%	55%	56%
		盆骨带回复率≥85%	97%	95%
		矫正带回复率≥85%	96%	93%
	2.3.3	支撑骨嵌接位置应能承受 500±50N 拉力时，不折断	嵌接位置能承受 500N 拉力，不折断	嵌接位置能承受 500N 拉力，不折断
	2.3.4	硅胶衬垫硬度：50±5HA	51HA	49HA

4.结论
保姿体生物科技（湖南）有限公司（脊柱矫形器）的有效期可定为 3 年

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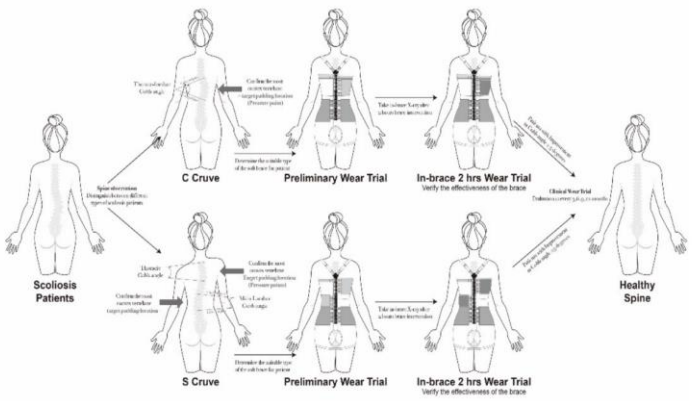
ATB aging tests with a shelf life of up to three years

Research Methods, Prototypes, and Materials

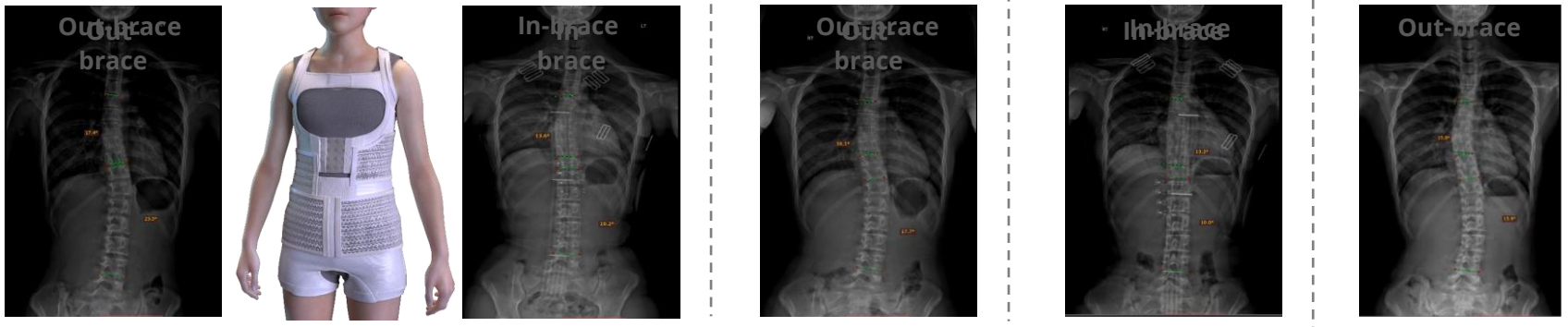
Milestone 3.5: Clinical Evaluation of the Mass-produced ATB

Two-hour clinical wear trial protocol



Six-month clinical wear trial protocol:

Baseline			Three months	Six months	Nine months (optional)
X-ray and questionnaires	Fitting of the ATB for two hours	X-ray and pressure measurement	X-ray, pressure measurement, and questionnaires	X-ray, pressure measurement, and questionnaires	X-ray and questionnaires

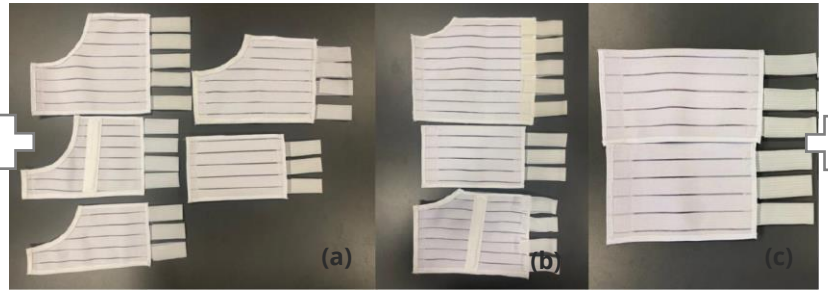


Research Outcomes and Findings

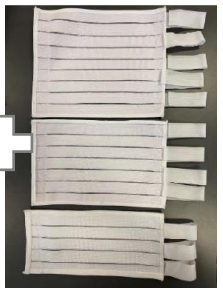
Clinical Evaluation of the Refined ATB

Refined ATB

The basic textile brace



Elastic bands for (a) thoracic, (b) thoracolumbar, and (c) lumbar curve



Three types of pelvis belt

Comparison of pre- and post-intervention of remodified ATB after two-hour wear trials

Subject	Curves (Start-Apex-End)	Baseline (Out-Brace)	After two hours (In-brace)	Differences
C1	T6-T10-L1	34.2°	25.1°	**-9.1°**
C2	T4-T8-T11	28.5°	25.8°	-2.7°
	T11-L2-L3	27.3°	26.3°	-1°
C3	T1-T2-T4	29.9°	26.5°	-3.4°
	T5-T9-T12	24.2°	21.5°	-2.7°
C4	T6-T9-T11	34.1°	27.9°	**-6.2°**
	T11-L2-L3	25°	21.7°	-3.3°
C5	T6-T8-T11	21.5°	18.7°	-2.8°
	T11-L2-L4	16.5°	19.2°	2.7°
C6	T6-L1-L3	39°	34.2°	-4.8°
C7	T6-T8-T11	22.7°	14.1°	**-8.6°**
	T10-L2-L4	20.7°	14.1°	**-6.6°**
C8	T5-T7-T9	17.4°	13.6°	-3.8°
	T10-L1-L3	23.5°	10.2°	**-13.3°**
C9	T8-T9-T11	16.1°	15.4°	-0.7°
	T11-L1-L3	25.3°	19.7°	**-5.6°**

Subject	Curves (Start-Apex-End)	Baseline (Out Brace)	After two hours (In-brace)	Differences
C10	T11-L1-L3	22.7°	18°	-4.7°
C11	T12-L2-L4	35°	24.1°	**-10.9°**
C12	T8-T10-T12	29.1°	25.2°	-3.8°
	T12-L2-L4	12.7°	12.3°	-0.4°
C13	T11-L1-L3	20.2°	12.9°	**-7.3°**
C14	T8-T10-L2	20.3°	13.9°	**-6.4.°**
	L2-L4-L5	18.1°	7.4°	**-10.7°**
C15	T6-T8-T10	38.6°	32.8°	**-5.8°**
	T11-L1-L3	38.1°	37°	-1.1°
C16	T3-T8-T10	25°	21.9°	-3.1°
C17	T6-T4-T6	16.7°	16.2°	-0.5°
	T6-T9-T11	18.1°	16.8°	-1.3°
	T11-L2-L4	25.1°	17.0°	**-8.1°**
C18	T6-T10-L2	30.6°	15°	**-15.6°**

- **18/18 (100%)** showed a reduction in Cobb angles
- **11/18 (61%) improved ≥5 °**

Research Outcomes and Findings

Clinical Evaluation of the Refined ATB

Comparison of pre- and post-intervention of ATB after 9 months wear trials

Subject	Baseline (Out-brace)	After 2 hours (In-brace)	3 months (Out-brace)	6 months (In-brace)	Differences	9months (Out-brace)	Differences
C8	17.4° 23.5°	13.6° 10.2°	16.1° 17.7°	13.2° 10.0°	-4.2° **-13.5°**	15.8° 15.9°	-1.6° -2.4°
C9*	16.1° 25.3°	15.4° 19.7°	17.6° 27.8°	19.9° 25.8°	3.8° 0.5°	21.6° 30.0°	5.5° 4.7°
C13	20.2°	12.9°	20°	14.1°	**-6.1°**	/	/
C17	16.7° 18.1° 25.1°	16.2° 16.8° 17.0°	14.6° 18.6° 24.3°	14.7° 17.7° 24.4°	2.0° -0.4° -0.7°	/	/

**No longer wear brace after six-month intervention*

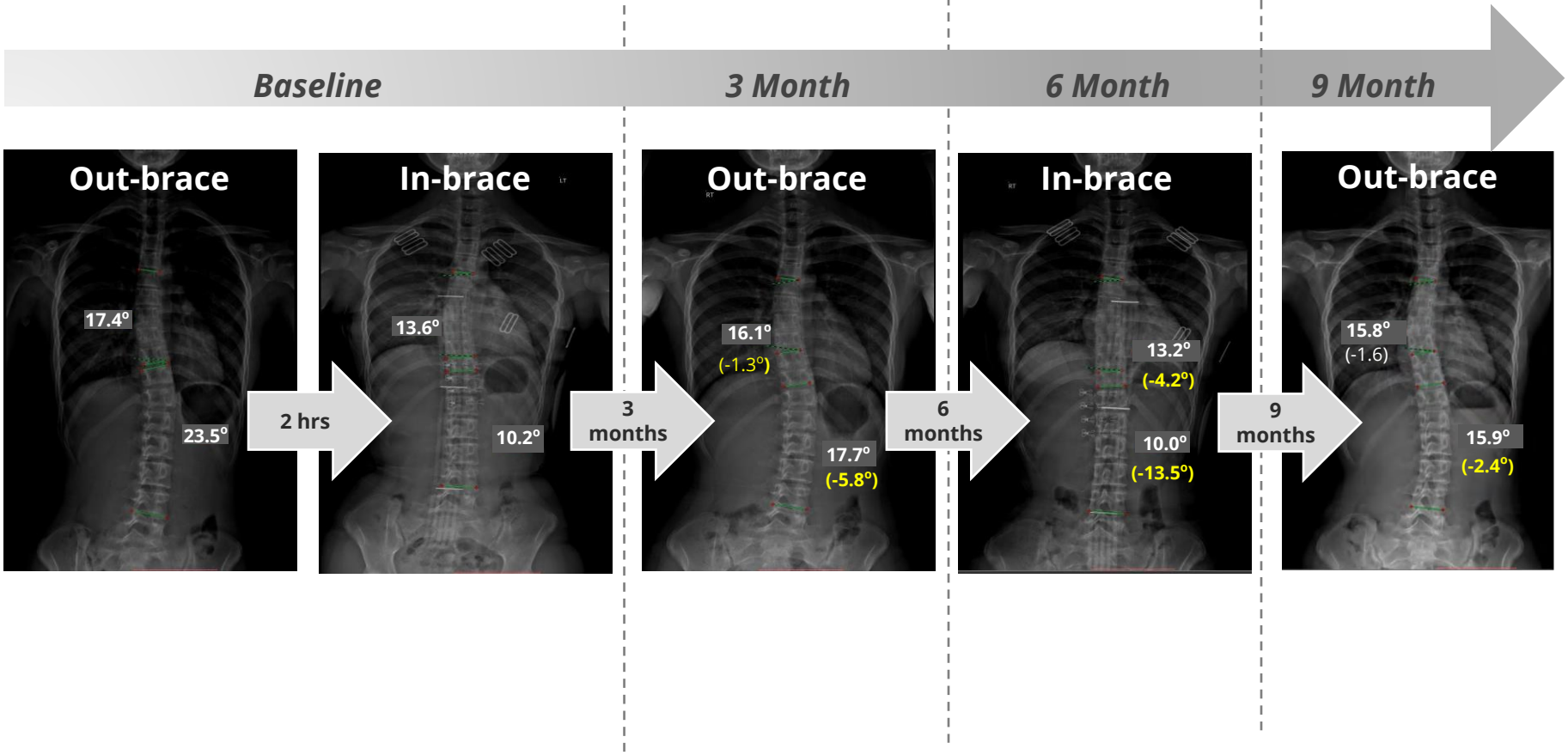
- Six-month wear trials: Four subjects completed the treatments
  Two subjects showed no deterioration
  Two subjects improved ≥ 5°
- Largest percentage of correction: **-13.5°**

Common definition of
- **treatment success**
  ≤5° curve progression
- **remarkable improvement**
  ≥5 curve reduction

Research Outcomes and Findings

Clinical Evaluation of the Refined ATB

Example: Subject C8



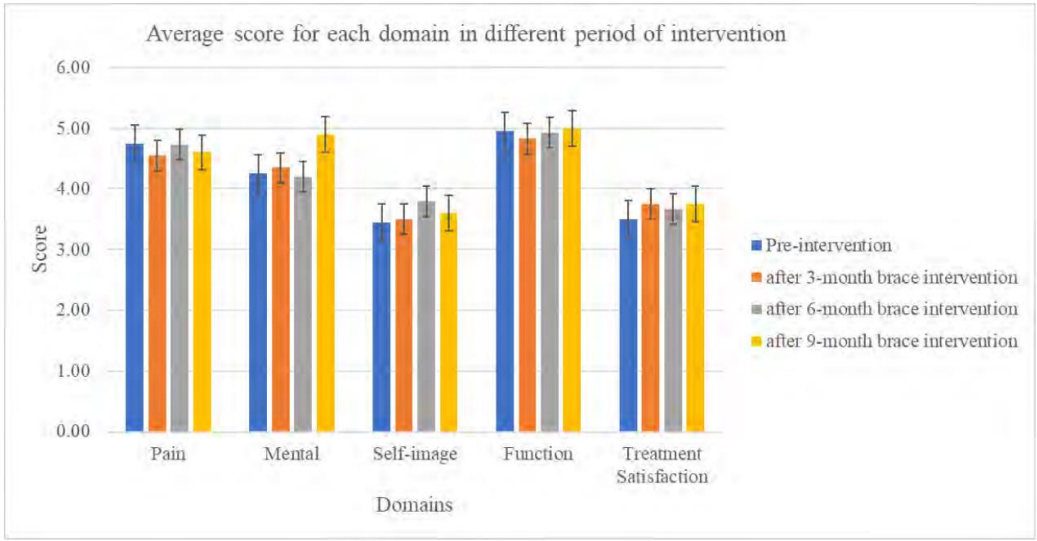
Research Outcomes and Findings

Evaluation of the Effectiveness of Refined ATB on QoL

SRS-22 questionnaire

- To evaluate the efficacy of various treatment standards for AIS
- Subjects completed the BrQ at baseline, three-month, six-month, and nine-month follow-ups

- **Scoring system**:
  - Scale: 1 (worst) to 5 (Best)
  - Five domains are summed for a total score
  - Summary score range:
    - 110 = Optimal QoL
    - 22 = Poor QoL
- **Study results**:
  - Mean overall score: **93.25** (baseline) to **100** (after nine months)
  - Highest average score : **Function**



Average score of each domain in SRS-22 for different durations of the intervention

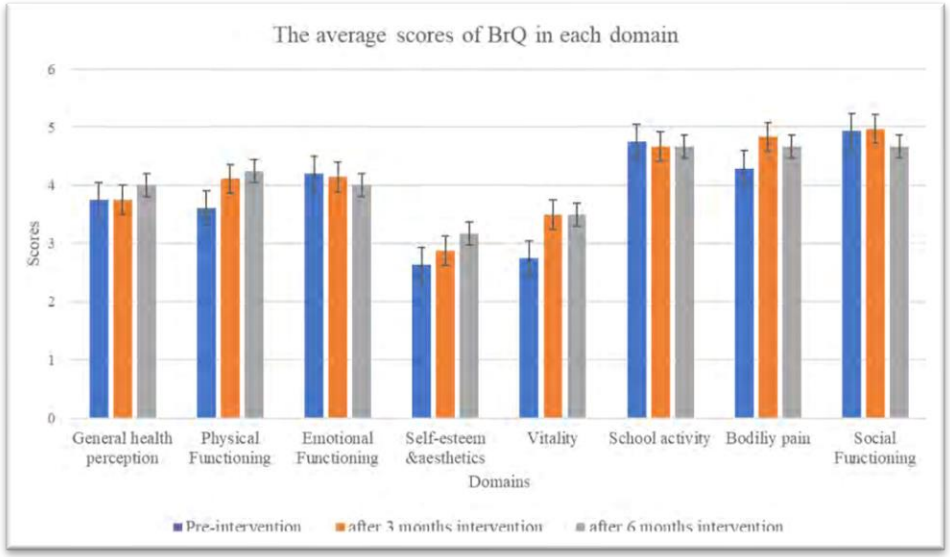
Research Outcomes and Findings

Evaluation of the Effectiveness of Refined ATB on QoL

BrQ Assessment

- The BrQ is a valid and reliable questionnaire used to measure the quality of life of scoliosis adolescents aged between 9 and 18 years who are receiving treatment with a brace.
- Subjects completed the BrQ after two hours of bracing, three-month, six-month, and nine-month follow-ups.

- **Scoring system:**
  - Scale: 1 (worst QoL) to 5 (Best QoL)
  - Eight domains are summed for a total score
  - Summary score range:
    - 100 = Optimal QoL
    - 20 = Poor QoL
- **Study results**:
  - Mean overall score: **80.15** (after two hours) to **85.49** (after six months)
  - Improvement in the QoL



Average score in each domain of BrQ for different durations of intervention

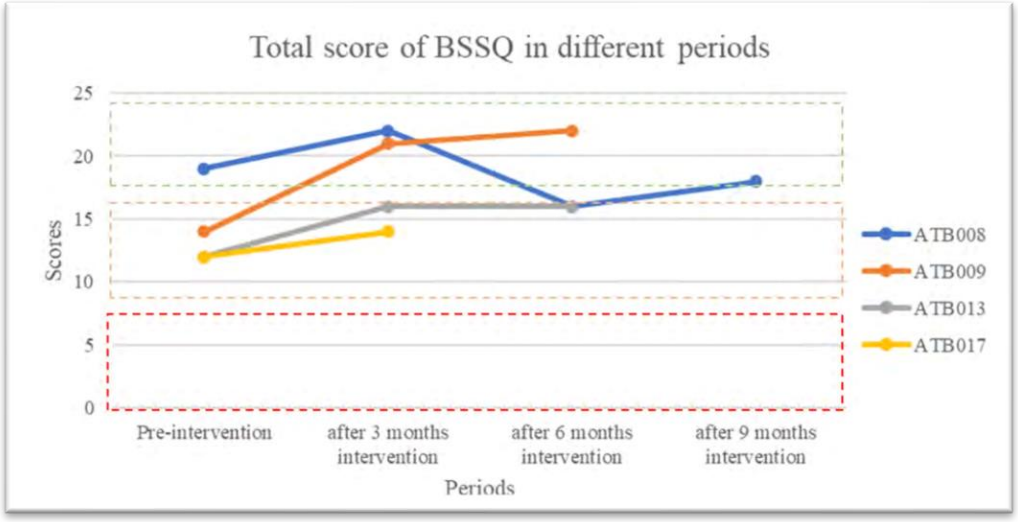
Research Outcomes and Findings

Evaluation of the Effectiveness of Refined ATB on QoL

Bad Sobernheim Stress Questionnaire (BSSQ)

- Observes the psychological and physiological comfort of the brace
- Subjects completed the BrQ after two hours of bracing, three-month, six-month, and nine-month follow-ups

- **Scoring system**:
  - Scale: 0 (lowest stress) to 3 (highest stress)
  - Eight questions are summed for a total score
    - 0–8 (high stress)
    - 9–16 (medium stress)
    - 17–24 (little stress)
- **Study results**:
  - Mean score : **14.25** (baseline) to **18** (after six months)
  - Manageable increase in stress during long-term use



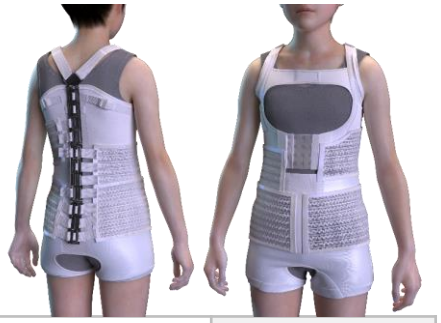
Total BSSQ score with different lengths of intervention

Previous data on Milwaukee brace [24]:

- 38.46% of the patients showed high levels of stress
- 61.54% of patients suffer a moderate level of stress

Research Outcomes and Findings

Clinical Evaluation of the Mass-produced ATB



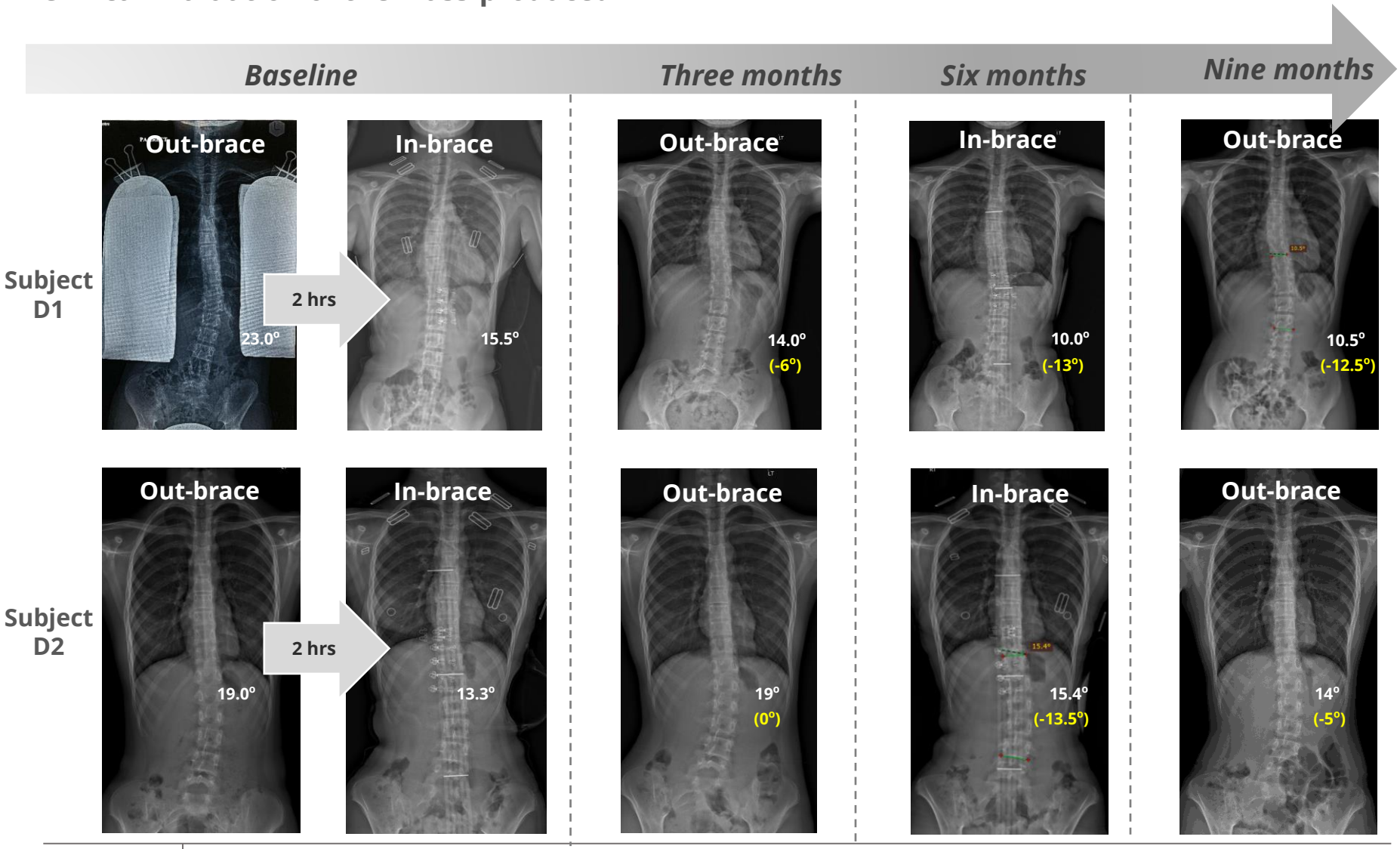
Subject	Baseline (Out-Brace)	After two hours (In-brace)	Three months (Out-brace)	SIx months (In-brace)	Differences	Nine months (Out-brace)	Differences
D1	23.0	15.0\5	14.0	10.0	**-13.0**	10.5	**-12.5**
D2	19.0	13.3	19.0	15.4	-3.6	14	**-5.0**
D3	8.5 18.0	8.1 11.7	8.5 13.1	8.2 10.7	-0.3 **-7.3**	8.5 17	0 -1
D4	14.9 14.7	13.0 2.0	9.0 2.1	17.1 3.6	2.2 **-11**	14.0 4.8	-0.9 **-10.9**
D5	15.0 18.0	11.3 11.0	10.0 17.0	9.1 15.0	-5.9 -3.0	10.0 17.0	**-5.0** -1.0

- Two-hour effect: all showed a reduction in Cobb's angles
- Three-month wear trials: **3/5 (60%) improved ≥5 °**
- Six-month wear trials: **3/5 (60%) improved ≥ 5 °**
- Nine-month wear trials: all subjects completed the treatments
  all subjects showed no deterioration
  4/5 (80%) improved ≥ 5 °
- Largest percentage of correction: **-12.5°**

Common definition of
- **treatment success**
  ≤5° curve progression
- **remarkable improvement**
  ≥5 curve reduction

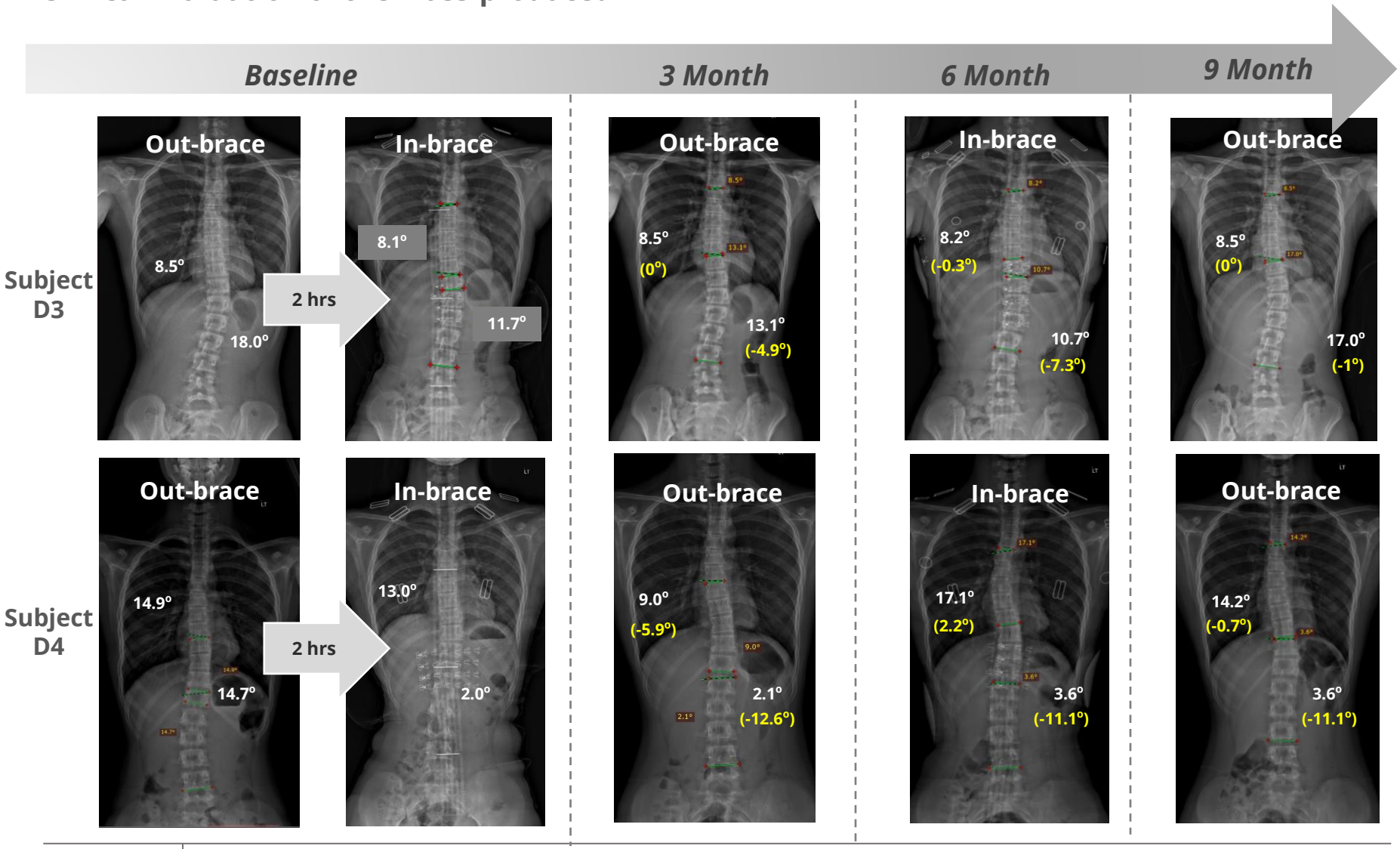
Research Outcomes and Findings

Clinical Evaluation of the Mass-produced ATB



Research Outcomes and Findings

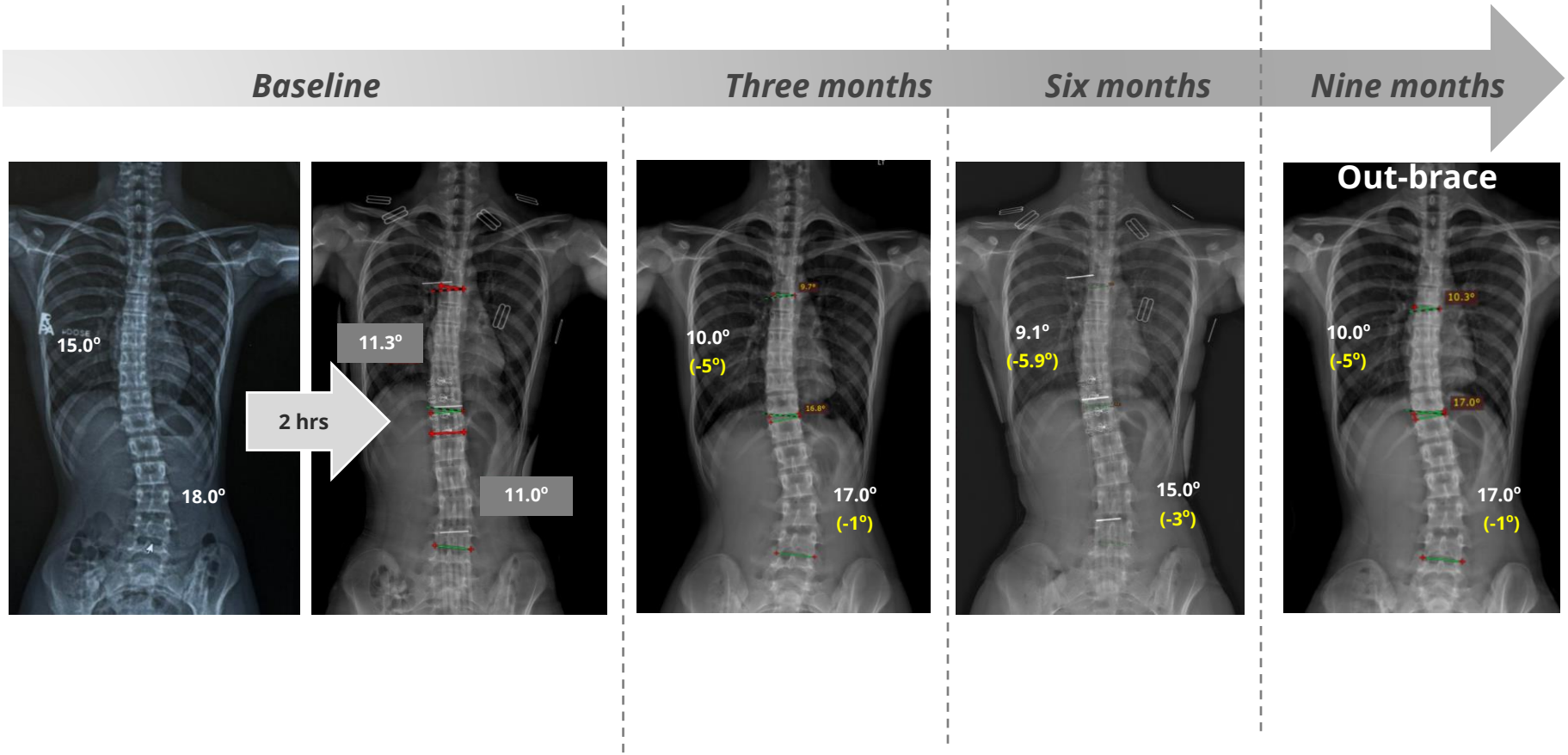
Clinical Evaluation of the Mass-produced ATB



Research Outcomes and Findings

Clinical Evaluation of the Mass-produced ATB

Subject D5



Research Outcomes and Findings

A summary of the refined and mass-produced ATB

Effectiveness	Factors	Refined and mass-produced ATB
Corrective effect	Mechanism and force	• Aluminium-hinged supports deliver precise, controlled three-point forces without over-correction • Clinically validated in long-term trials to effectively reduce Cobb angle
	Durability	• Durable textile composites resist stretching and wear • Modular design allows for adjustments to accommodate growth, extending usable life
	Usability and Fit	• One-piece design for easy donning/doffing • Open-gusset shorts allow for convenient bathroom use • Ergonomic fit requires minimal adjustments
Compliance	Physical comfort	• Advanced, breathable fabrics with superior moisture-wicking. • Softer hook-and-loop (Velcro) and edge-free elastics prevent skin damage • Strategic ventilation reduces heat buildup
	Mobility	• Hybrid design provides support without sacrificing the ability to bend and move naturally
	Aesthetics and discretion	• Low-profile garment resembling intimate wear is easily concealed • No external straps to tie; clean and simple appearance
	Psychological aspects	• Improved comfort and mobility reduce treatment-related distress • Compliance tracking focuses on holistic patient well-being

Research Outcomes and Findings

1) Successfully refined an ATB for adolescents aged 10–13 years with AIS and Cobb angles ranging from 20°–40°. This ATB demonstrates high compliance, flexibility, and wearability, with a discreet, clothing-like design that reduces social stigma and psychological burden. The ATB can be customised for each subject to provide targeted biomechanical support tailored to their spinal curvature.

2) Proved immediate reduction in Cobb angle : In two-hour wear trials, 100% (23/23) of the subjects showed a reduction in the Cobb angle reduction, with 70% (16/23) achieving improvements of ≥5°.

3) Proved long-term Cobb's angle control effectiveness: After six-month wear trials, 89% (8/9) of subjects demonstrated improvements in Cobb angle of ≥5°. The greatest correction observed was -13.5° .

4) Proved improvement in quality of life: SRS-22 scores improved from 93.25 (baseline) to 100 (6 months), with the highest gains in function. BrQ scores rose from 80.15 (two hours) to 85.49 (six months), thus indicating modest QoL improvements.

5) Observed slight increase in brace-related stress: BSSQ scores rose from 14.25 to 18 over six months, thus suggesting a manageable increase in stress during long-term use.

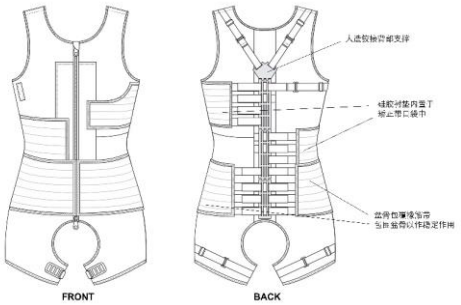
6) Children were found to be 'trainable', adopting better postural habits through consistent girdling, which carried over into their daily lives.

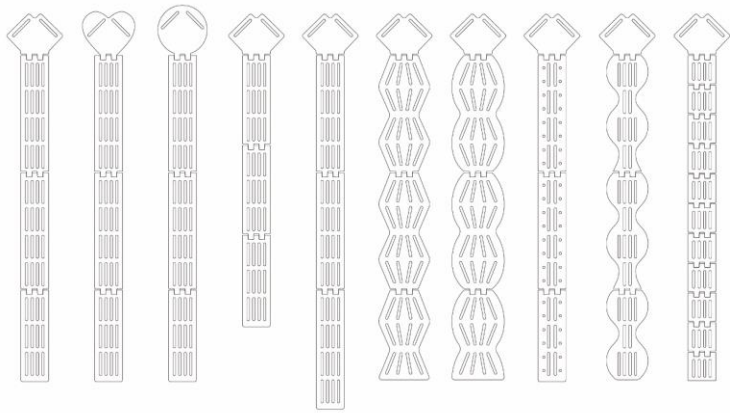
Research Outcomes and Findings

Future Research:

- **Expanding trials with a larger sample size** in collaboration with leading hospitals in Mainland China, including Peking Union Medical College Hospital and The First Affiliated Hospital of Sun Yat-sen University, to validate long-term efficacy.

- **Male-specific ATB development**: A specialised ATB will be engineered to cater to the unique physiological requirements of male patients.
- **Hinge bone optimisation:** Multiple hinge bone geometries and materials will be prototyped and subjected to rigorous mechanical testing to assess their structural strength and long-term durability.





Research Dissemination

Category	Details
Academic Papers	• Fok, Q., **Yip, J.**, Yick, K. L., & Ng, S. P. (2022). Design and fabrication of anisotropic textile brace for exerting corrective forces on spinal curvature. *Journal of Industrial Textiles, 51*(1_suppl), 1682S-1702S. https://doi.org/10.1177/15280837211032619 • Lei, Q. E., Shu, J., Wang, J., Cheung, H. Y., Cheung, J. P., Wong, W. F., Lau, S.C.Y., **Yip, J**., & Tong, R. K. (2023). Design and characterize of kirigami-inspired springs and the application in vertebrae exoskeleton for adolescent idiopathic scoliosis brace treatment. *Frontiers in Mechanical Engineering*, *9*, 1152930. https://doi.org/10.3389/fmech.2023.1152930
Conference papers	• Wong, S. H., **Yip, J.**, Yick, K. L., & Ng, S. P. (2020). Preliminary wear trial of anisotropic textile brace for adolescent idiopathic scoliosis. In *International Society for Engineering Research and Development International Conference (ISERD International Conference*), Zurich, Switzerland, 16-17 February. • Fok, Q., & **Yip, J.** (2021). Applying numerical simulation to predict effect of brace wear for scoliosis. In *Advances in human factors and ergonomics in healthcare and medical devices,* pp. 217–223. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-79763-8_26 • Wong, C. S. H., **Yip, J.**, Yick, K. L., & Ng, Z. S. P. (2021). A case study of initial In-Brace Spinal Correction of Anisotropic Textile Brace and Boston Brace. In: Kalra, J., Lightner, N.J., Taiar, R. (eds) *Advances in Human Factors and Ergonomics in Healthcare and Medical Devices*. AHFE 2021. Lecture Notes in Networks and Systems, vol 263, pp. 109-115. Springer, Cham. https://doi.org/10.1007/978-3-030-80744-3_14 • Cheung, H., **Yip, J.**, Yick, K., Ng, S. (2022). Preliminary wear trial of anisotropic textile brace designed for adolescent idiopathic scoliosis. In: *Jay Kalra and Nancy Lightner (eds) Healthcare and Medical Devices. AHFE (2022) International Conference*. AHFE Open Access, vol 51. AHFE International, USA. https://ira.lib.polyu.edu.hk/handle/10397/115893 • Ma, J., Lee, K., Cheung, K., Tong, K., **Yip, J.** (2025). Advancing scoliosis treatment: Development and evaluation of anisotropic textile brace (ATB) for enhanced patient compliance. In: Jay Kalra (eds) *Healthcare and Medical Devices*. AHFE (2025) International Conference. AHFE Open Access, vol 171. AHFE International, USA. http://doi.org/10.54941/ahfe1006193
Patents	• Orthopaedic Hinge Assembly. US12,129,886B2. Pub. date: 30 Jan 2020 • Anisotropic Textile Brace. ZL 202330553930.X. Application date: 14 Mar 2024

Research Dissemination

Exhibitions/Interviews

Category **Details**

Events	Number	Number of people	Description
Public events	4	Around 100	• The International Scoliosis Awareness Day event held on 25 June 2022, 24 June 2023, 22 June 2024, and 8 June 2025 were a collaborative effort between prominent educational institutions and healthcare associations in Hong Kong.
Training sessions and Educational workshops and seminars	3	Over 100	• Visit The First Affiliated Hospital of Sun Yat-sen University, Guangzhou, Guangdong Province. Doctors, P&O specialists, and experts from various hospitals in Mainland China attended. • Presentation to clinicians/doctors in 2024 in Guangdong Province for the Public Welfare Training Programme & 'Spine Health Awareness' across 100 Cities. • A presentation at the 2025 Digital Intelligence-Empowered Scoliosis Academic Conference, which was attended by approximately 100 doctors from cities across Mainland China.
Expert consultants	2	Over 30	• Delivered a presentation and held discussions with doctors and clinicians at Nanjing Drum Tower Hospital. • The University of Hong Kong Shenzhen Hospital specialises in spinal development and a spectrum of related disorders, including the management of complex scoliosis cases, kyphosis, and other spinal deformities. The collaborations aim to enhance the ATB by leveraging this clinical expertise to address real-world challenges encountered during its practical use on AIS subjects.

Research Dissemination

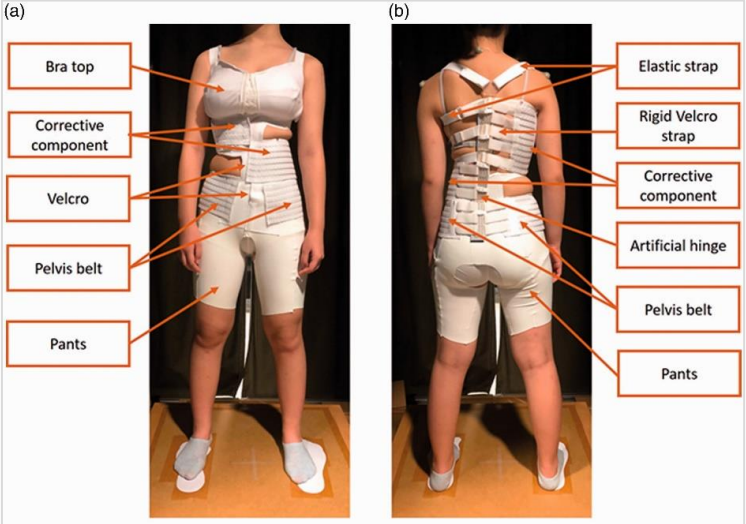
Exhibitions/Interviews

Category Details

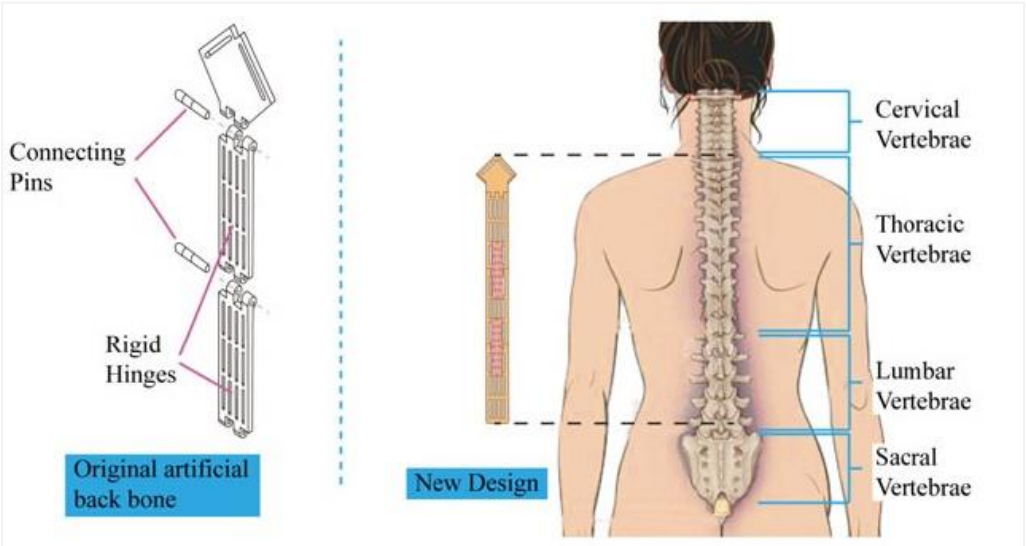
Events	Number	Number of people	Description
Exhibitions	1	Almost 10,000 buyers	• International exhibition • ATB's poster was presented at the 2025 Design Research Impact and Global Insights Colloquium Cum Exhibition.
Competitions	4	Over 300	• Champion – Fourth Hong Kong Innovation Day, The Global Healthcare Innovation Academy, Toronto, Canada, 2020 • Gold Medal with the Congratulations of the Jury – The 48th International Exhibition of Inventions Geneva, Switzerland, 26 to 30 April 2023 • Gold Medal – FITMI Asia International Innovative Invention Exhibition, Hong Kong, 20–23 June 2023 • Innovation Project Nomination Award – Hong Kong Chamber of Commerce in Shanghai: Innovation is Everywhere' Hong Kong Enterprise Innovation Project, Shanghai, China, 14 Oct 2024
Symposia and colloquia	1	Over 200	• Travelled to Zhongshan, Guangdong Province, to attend the 2024 Guangdong Province Rehabilitation Medicine – Spine Rehabilitation Academic Annual Conference – Flexible Correction Technology Training Programme.

Research Dissemination

Academic papers



Fok, Q., & **Yip, J.** (2021). Applying numerical simulation to predict effect of brace wear for scoliosis. In Advances in human factors and ergonomics in healthcare and medical devices, pp. 217–223. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-79763-8_26



Lei, Q. E., Shu, J., Wang, J., Cheung, H. Y., Cheung, J. P., Wong, W. F., Lau, S.C.Y., **Yip, J.**, & Tong, R. K. (2023). Design and characterisation of kirigami-inspired springs and the application in vertebrae exoskeleton for adolescent idiopathic scoliosis brace treatment. *Frontiers in Mechanical Engineering*, 9, 1152930. https://doi.org/10.3389/fmech.2023.1152930

Research Dissemination

Conference articles

Proceedings of ISERD International Conference

16–17 Feb, 2020
Zurich, Switzerland

PRELIMINARY WEAR TRIAL OF ANISOTROPIC TEXTILE BRACE FOR ADOLESCENT IDIOPATHIC SCOLIOSIS

[1]S.H. WONG, [2]J. YIP, [3]K.L. YICK, [4]S.P. NG

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Abstract - While the effectiveness of non-rigid braces remains controversial, in fact, some have applied proven corrective mechanisms and provided good spinal corrective results which mean that they might be a feasible treatment for scoliosis as long as their shortcomings are addressed, such as discomfort. To this end, this study designs a semi-rigid brace(anisotropic textile brace) modified from a previous brace design. The newly designed brace is developed for patients with adolescent idiopathic scoliosis and provides a good bracing effect and wear experience. A preliminary wear trial is conducted after fabricating the brace. The obtained results show that the performance of the brace in correcting spinal curvature is comparable to that of the original brace but provides an even more superior bracing experience.

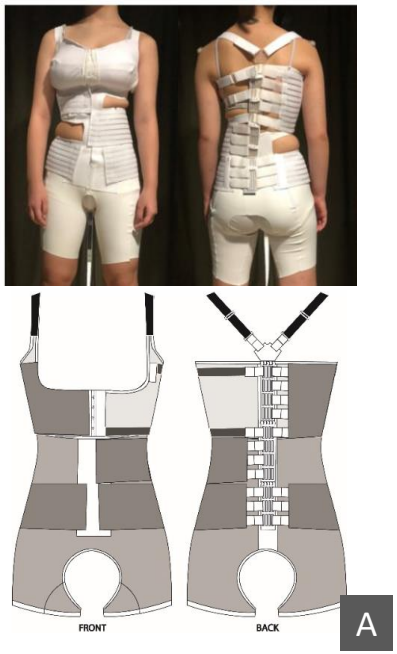
Keywords - Adolescent Idiopathic Scoliosis, Semi-Rigid Brace, Spinal Correction, Anisotropic Textile Brace

I. INTRODUCTION

Scoliosis is a three-dimensional spinal condition and adolescent idiopathic scoliosis (AIS) is the most common form. A sideways curve that is "C-" or "S-" shaped is always found in youths with scoliosis, particularly during puberty. If patients with mild AIS are not properly monitored and given treatment, the progression of their spinal curvature may increase in severity [1]-[2]. To cope with these situations, there are various types of medical care for scoliosis patients which depend on the curvature of their spine, such as observation, non-invasive treatment, and surgical correction [3].

subject by 6.6 degrees (26.1%) after intervention which proves that the brace applies the appropriate corrective mechanism, there is still room for improvement because there are other problems, such as the fit, donning and doffing the brace, and discomfort [11].

The aim of this study is to thus design a semi-rigid bracefor AIS patients that is based on modifications of the FIA. This new brace is dubbed an anisotropic textile brace (with different corrective forces based on rigid, semi-rigid and flexile materials), and a preliminary wear trial is carried out to determineits ability to correct spinal curvatures.



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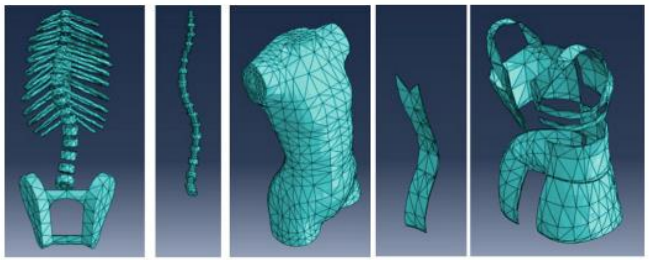
A. Wong, S. H., **Yip, J.**, Yick, K. L., & Ng, S.P. (2020). Preliminary wear trial of anisotropic textile brace for adolescent idiopathic scoliosis. In International Society for Engineering Research and Development International Conference (ISERD International Conference), Zurich, Switzerland, 16-17 February. Available at https://www.researchgate.net/publication/347973683_PRELIMINARY_WEAR_TRIAL_OF_ANISOTROPIC_TEXTILE_BRACE_FOR_ADOLESCENT_IDIOPATHIC_SCOLIOSIS

Research Dissemination

Conference articles



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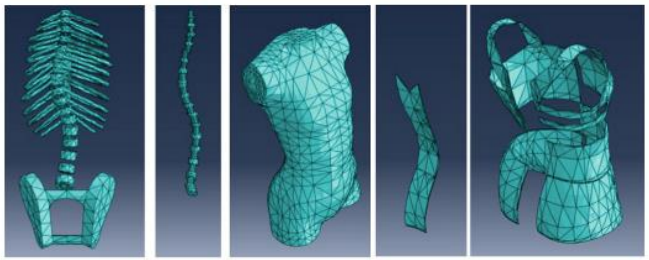
B. Fok, Q., & **Yip, J**. (2021). Applying numerical simulation to predict effect of brace wear for scoliosis. In: Wright, J.L., Barber, D., Scataglini, S., Rajulu, S.L. (eds) *Advances in Simulation and Digital Human Modeling.* AHFE 2021. *Lecture Notes in Networks and Systems,* vol 264, pp. 217-223, Springer, Cham. https://doi.org/10.1007/978-3-030-79763-8_26

C. Wong, C. S. H., **Yip, J.**, Yick, K. L., & Ng, Z. S. P. (2021). A case study of initial in-brace spinal correction of anisotropic textile brace and Boston brace. In: Kalra, J., Lightner, N.J., Taiar, R. (eds) *Advances in Human Factors and Ergonomics in Healthcare and Medical Devices*. AHFE 2021. Lecture Notes in Networks and Systems, vol 263, pp. 109-115. Springer, Cham. https://doi.org/10.1007/978-3-030-80744-3_14

Research Dissemination

Conference articles



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D. Cheung, H., **Yip, J.**, Yick, K., Ng, S. (2022). Preliminary wear trial of anisotropic textile brace designed for adolescent idiopathic scoliosis. In: Jay Kalra and Nancy Lightner (eds) *Healthcare and Medical Devices. AHFE (2022) International Conference*. AHFE Open Access, vol 51. AHFE International, USA. https://ira.lib.polyu.edu.hk/handle/10397/115893

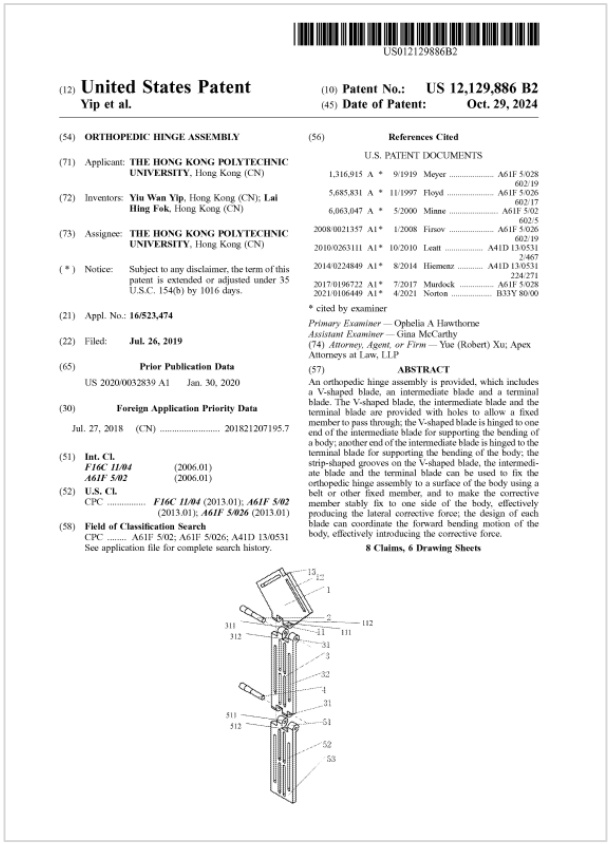
E. Ma, J., Lee, K., Cheung, K., Tong, K., **Yip, J.** (2025). .Advancing scoliosis treatment: Development and evaluation of anisotropic textile brace (ATB) for enhanced patient compliance. In: Jay Kalra (eds) *Healthcare and Medical Devices*. AHFE (2025) International Conference. AHFE Open Access, vol 171. AHFE International, USA. http://doi.org/10.54941/ahfe1006193

Research Dissemination

Patents

Orthopedic Hinge Assembly

US Patent:
US12,129,886B2



US012129886B2

(12) **United States Patent**
Yip et al.

(10) **Patent No.: US 12,129,886 B2**
(45) **Date of Patent: Oct. 29, 2024**

(54) **ORTHOPEDIC HINGE ASSEMBLY**

(71) Applicant: **THE HONG KONG POLYTECHNIC UNIVERSITY**, Hong Kong (CN)

(72) Inventors: **Yiu Wan Yip**, Hong Kong (CN); **Lai Hing Fok**, Hong Kong (CN)

(73) Assignee: **THE HONG KONG POLYTECHNIC UNIVERSITY**, Hong Kong (CN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1016 days.

(21) Appl. No.: **16/523,474**

(22) Filed: **Jul. 26, 2019**

(65) **Prior Publication Data**

US 2020/0032839 A1 Jan. 30, 2020

(30) **Foreign Application Priority Data**

Jul. 27, 2018 (CN) 201821207195.7

(51) **Int. Cl.**
F16C 11/04 (2006.01)
A61F 5/02 (2006.01)

(52) **U.S. Cl.**
CPC ***F16C 11/04*** (2013.01); ***A61F 5/02*** (2013.01); ***A61F 5/026*** (2013.01)

(58) **Field of Classification Search**
CPC A61F 5/02; A61F 5/026; A41D 13/0531
See application file for complete search history.

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2021/0106449	A1 *	4/2021	Norton	B33Y 80/00

* cited by examiner

Primary Examiner — Ophelia A Hawthorne
Assistant Examiner — Gina McCarthy
(74) *Attorney, Agent, or Firm* — Yue (Robert) Xu; Apex Attorneys at Law, LLP

(57) **ABSTRACT**

An orthopedic hinge assembly is provided, which includes a V-shaped blade, an intermediate blade and a terminal blade. The V-shaped blade, the intermediate blade and the terminal blade are provided with holes to allow a fixed member to pass through; the V-shaped blade is hinged to one end of the intermediate blade for supporting the bending of a body; another end of the intermediate blade is hinged to the terminal blade for supporting the bending of the body; the strip-shaped grooves on the V-shaped blade, the intermediate blade and the terminal blade can be used to fix the orthopedic hinge assembly to a surface of the body using a belt or other fixed member, and to make the corrective member stably fix to one side of the body, effectively producing the lateral corrective force; the design of each blade can coordinate the forward bending motion of the body, effectively introducing the corrective force.

8 Claims, 6 Drawing Sheets

Pub. date: 30 Jan 2020

ATB

China Patent (application no.): ZL 202330553930.X.

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常雪莹(0755-88274088)

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申请号或专利号：202330553930.X　　发文序号：2024031400811180

申请人或专利权人：立刚健生物科技(香港)有限公司 叶晓云 霍丽兴 张海欣 黄思涵

发明创造名称：矫形衣（非等向性）

办 理 登 记 手 续 通 知 书

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联系电话：010-62356655

审查部门：初审及流程管理部
专利审查业务章

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Pub. date: 14 Mar 2024

Research Dissemination

Public events

A. The International Scoliosis Awareness Day event held on 25 June 2022. Experts from HKU Department of Orthopaedics and Traumatology, Hong Kong Scoliosis Awareness Group, Hong Kong Academy of Orthopaedic Surgeons, and Hong Kong Physiotherapy Association, etc.

B. The International Scoliosis Awareness Day held on 8 June 2025

C. The International Scoliosis Awareness Day hold on 22 June 2024

D. Poster of The International Scoliosis Awareness Day hold on 25 June 2022

E. Poster of The International Scoliosis Awareness Day held on 24 June 2023

Research Dissemination

Training sessions, educational workshops, and seminars

A & B: Educational workshop to explain the design principles, usage methods, and applications of the ATB to doctors at the First Affiliated Hospital of Sun Yat-sen University in Guangzhou.

C. A presentation on the research regarding the effects of the flexible brace on posture and proprioception at the 2025 Digital Intelligence-Empowered Scoliosis Academic Seminar.

D. The seminar in Fig. C was attended by approximately 100 doctors specialising in orthopaedics, surgery and rehabilitation from various cities across mainland China.

Research Dissemination

Expert consultants

Presentation to Nanjing Drum Tower Hospital

This talk outlined the development and clinical rationale of a specialised ATB aimed at improving the noninvasive management of early adolescent scoliosis through ergonomic design and guided support.

Presentation to The University of Hong Kong – Shenzhen Hospital

Prof. Yip presents the comfort-focused ATB that supports spinal alignment in adolescents with moderate scoliosis, emphasising practical integration into daily life and conservative treatment plans.

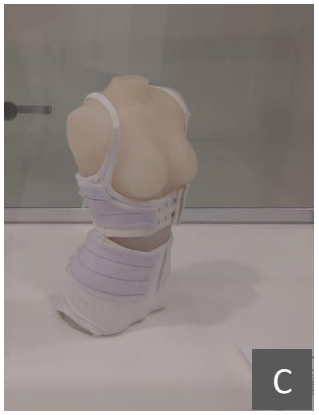
Research Dissemination

Expert consultants

Presentation to clinicians/doctors in The First Affiliated Hospital of Sun Yat-sen University, Guang Zhou, Guang Dong Province

Research Dissemination

Exhibitions



A. The ATB was exhibited at PolyU Zhongshan Life Science Park, where Prof. Yip introduced the ATB to visitors and government officials.

B. During PolyU Alumni Coming Day 2024, visitors came to see the ATB exhibition.

C. An ATB mini model was displayed at the School of Fashion and Textiles, PolyU (2024-Now).

D. The ATB was exhibited in The First Affiliated Hospital of Sun Yat-sen University, Guangzhou, Guang Dong Province, China

E. Municipal leaders from Shanghai, China, visited Prof. Yip's lab to view the ATB.

F. The ATB was also featured in a newspaper article highlighting its innovation.

G. ATB's poster was presented at the 2025 Design Research Impact and Global Insights Colloquium Cum Exhibition.

Research Dissemination

Competition

The Fourth Hong Kong Innovation Day, The Global Healthcare Innovation Academy (Champion)

The 4th Hong Kong Innovation Day

The 4th Hong Kong Innovation Day was held online in February 2020 due to the outbreak of COVID-19. The award winners and their projects were as follows:

CHAMPION

Project Title: Flexible Scoliosis Brace with Artificial Hinge
Project Leader: Dr Joanne YIP, Associate Professor, Institute of Textiles & Clothing, PolyU
YouTube Link https://youtu.be/YwFEqbGGwU8

The Hong Kong Innovation Day

To nourish a culture of innovations in healthcare, the School of Nursing, The Hong Kong Polytechnic University is organising **The 5th Hong Kong Innovation Day (HKIA)**.

HKIA aims to stimulate innovative ideas and concepts that bring immediate benefits to the patients, clinicians as well as the healthcare industry. We cordially invite healthcare institutions (public or private), universities and colleges, as well as entities and small private enterprises focusing on health innovations in Hong Kong and the Greater Bay Area of China to submit their contributions regarding the solutions, discoveries and innovations in healthcare science to participate in **The 5th Hong Kong Innovation Day**.

The winner will be awarded with a trophy, a certificate and a cash prize. Outstanding team(s) selected by the jury at the Hong Kong Innovation Day will also join **The Global Healthcare Innovation Day** (GHID) to be held in **Brighton, UK in 2023** to compete for the *Innovation for Health Award of Excellence.*

Initially developed by leading healthcare organisations in Geneva, Switzerland, GHIA has grown into an international collaboration between Switzerland, Canada, Hong Kong and UK. The international event is to provide a platform that allows entrepreneurs, academics and healthcare professionals to showcase and promote their healthcare innovations, as well as to exchange ideas that benefit medical and healthcare sciences.

The 5th Hong Kong Innovation Day Organising Committee

General Chair	**Prof. Engle Angela Chan** Professor & Interim Head, School of Nursing, PolyU Associate Director, International Research Centre for Advancement of Healthcare Communication (IRCAHC), Department of English and Communication, PolyU		
Programme Chair	**Dr Harry Qin** Associate Professor Centre for Smart Health School of Nursing, PolyU	**Dr Vivian Hui** Assistant Professor Centre for Smart Health School of Nursing, PolyU	**Prof. Thomas Choi** Professor Centre for Smart Health School of Nursing, PolyU
Academy Secretariat	**Ms Helen HSU** Communications Manager School of Nursing, PolyU		

Toronto, Canada, 22–23 June 2020

https://sn.polyu.edu.hk/hkia/

Research Dissemination

Competition

The 48th International Exhibition of Inventions Geneva
(Gold Medal with Congratulations of the Jury)

DIPLÔME

Inventions Geneva

SALON INTERNATIONAL DES INVENTIONS

GENÈVE

Après examen, le Jury International a décidé

de remettre à: Yiu Wan Joanne YIP, T.H. Alex MAK, Wai Sum LO, Hoi Yan CHEUNG, Pak Yiu LIU, Ruixin LIANG, Jun ZHANG, Jingyi MA, Y. Brian CHEN, Kit Lun YICK

pour l'invention: Conception assistée par l'IA de vêtements fonctionnels pour le traitement de la scoliose

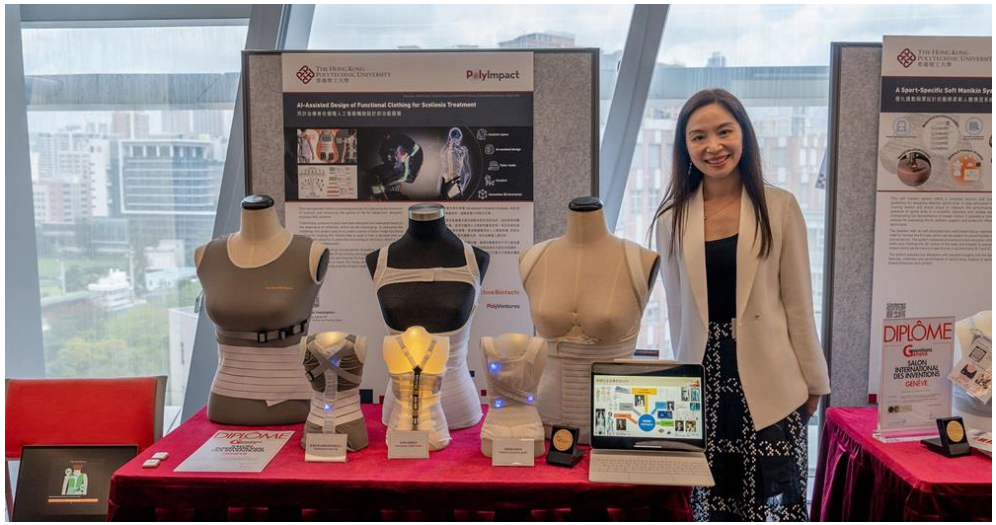
MÉDAILLE D'OR
GOLD MEDAL
GOLDMEDAILLE

Avec les félicitations du jury
With the congratulations of the jury
Mit höchsten Empfehlungen des Preisgerichtes

Genève, le 28 avril 2023

Le Président du Jury: David Toji

Le Président du Salon: Jean-Luc Vincent



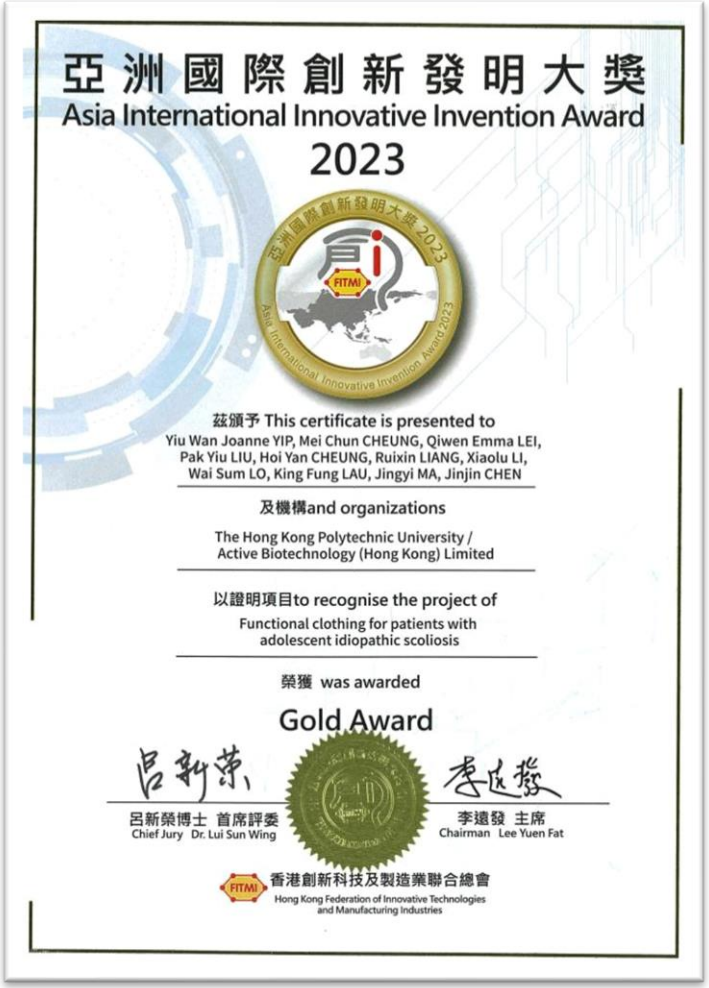
Gold Medal with the Congratulations of Jury: AI-Assisted Design of Functional Clothing for Scoliosis Treatment

Switzerland, 26–30 April 2023

Research Dissemination

Competition

Asia International Innovative Invention Exhibition **(Gold medal)**



亞洲國際創新發明大獎
Asia International Innovative Invention Award
2023

茲頒予 This certificate is presented to
Yiu Wan Joanne YIP, Mei Chun CHEUNG, Qiwen Emma LEI, Pak Yiu LIU, Hoi Yan CHEUNG, Ruixin LIANG, Xiaolu LI, Wai Sum LO, King Fung LAU, Jingyi MA, Jinjin CHEN

及機構and organizations
The Hong Kong Polytechnic University / Active Biotechnology (Hong Kong) Limited

以證明項目to recognise the project of
Functional clothing for patients with adolescent idiopathic scoliosis

榮獲 was awarded
Gold Award

呂新榮博士 首席評委 Chief Jury Dr. Lui Sun Wing
李遠發 主席 Chairman Lee Yuen Fat

香港創新科技及製造業聯合總會
Hong Kong Federation of Innovative Technologies and Manufacturing Industries

School of Fashion & Textiles
ABOUT US MEMBERS PROJECTS PUBLICATIONS PATENTS NEWS CONTACT US

Hong Kong Polytechnic University Researchers Win Gold Award for Medical Textile Inventions

July 3, 2023

Researchers from the medical textiles and functional clothing research cluster at the Hong Kong Polytechnic University have developed AI-assisted functional clothing to address scoliosis. The team presented their inventions at the Asia International Innovation Invention Exhibition and received a gold award for their work. This innovative technology includes a Biofeedback tank top, Anisotropic textile brace, and Posture Correction Girdle, aimed at providing relief for scoliosis symptoms.

The Anisotropic textile brace is designed to provide support and flexibility at the same time, catering to the individual needs of scoliosis patients. The technology uses a special weaving technique that reinforces the areas of the brace where support is needed most, while remaining flexible in other areas. This allows for a custom fit that improves the effectiveness of the brace and provides better support for the spine.

The Biofeedback tank top was designed to help scoliosis patients sense their spinal curvature, enhancing posture and support. Equipped with sensors, it monitors spine movements and offers real-time data for adjustments. A significant advancement in scoliosis treatment, it has the potential to greatly enhance the quality of life for those affected.

The biofeedback tank top, anisotropic textile brace, and posture correction girdle (from left to right) being displayed at the exhibition.

The Posture Correction Girdle is designed to improve posture and provide necessary support to the spine, allowing for increased mobility and comfort. It helps alleviate discomfort or pain caused by scoliosis.

The scoliosis treatment developed by researchers at Hong Kong Polytechnic University is a remarkable innovation in medical textiles. With AI-assisted functional clothing technology, scoliosis patients now enjoy personalized support and feedback, enhancing their quality of life and mobility. The gold award received at the Asia International Innovation Invention Exhibition is a testament to the researchers' hard work and dedication, inspiring future advancements in medical technology.

ATB displayed at the exhibition

Hong Kong, 20–23 June 2023
https://www.mtl-sft.com/news/hong-kong-polytechnic-university-researchers-win-gold-award-for-medical-textile-inventions

Research Dissemination

Competition

The Hong Kong Chamber of Commerce in Shanghai: 'Innovation is Everywhere' Hong Kong Enterprise Innovation Project (Flexible Scoliotic Brace- Innovation Project Nomination Award)


荣誉证书

CERTIFICATE

OF ACHIEVEMENT

立刚健生物科技(香港)有限公司

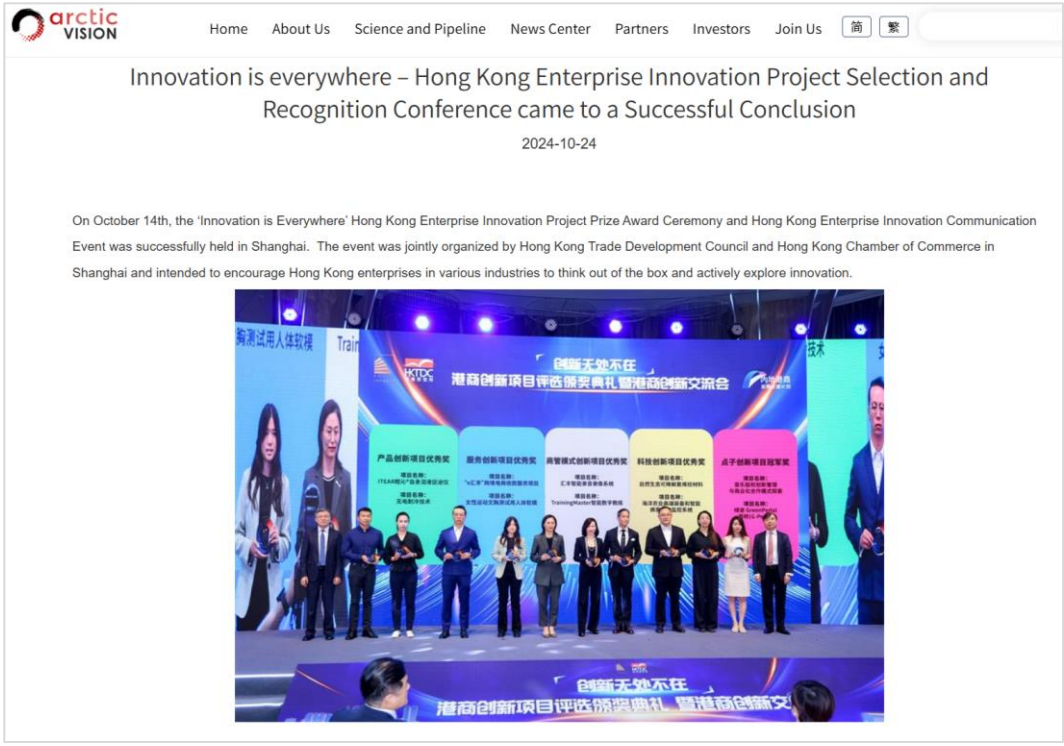
在2024年『创新无处不在，港商创新项目评选』年度活动中，所参赛的项目（产品创新类）：柔性脊柱矫形器，荣获：

创新项目提名奖

发证日期

2024年12月

上海市香港商会


arctic VISION

Home About Us Science and Pipeline News Center Partners Investors Join Us 简 繁

Innovation is everywhere – Hong Kong Enterprise Innovation Project Selection and Recognition Conference came to a Successful Conclusion

2024-10-24

On October 14th, the 'Innovation is Everywhere' Hong Kong Enterprise Innovation Project Prize Award Ceremony and Hong Kong Enterprise Innovation Communication Event was successfully held in Shanghai. The event was jointly organized by Hong Kong Trade Development Council and Hong Kong Chamber of Commerce in Shanghai and intended to encourage Hong Kong enterprises in various industries to think out of the box and actively explore innovation.

ATB being nominated in the competition

Shanghai, China, December 2024
https://www.arcticvision.com/newsdetail/id/69.html

Research Dissemination

Symposia and colloquia

A. Prof. Yip was photographed with experts and doctors at the Guangdong Province Rehabilitation Medicine – Spine Rehabilitation Academic Annual Conference & Flexible Correction Technology Training Programme.

B. Prof. Yip delivered a presentation on the mechanism of spinal correction using the ATB.

C. The ATB was also exhibited to clinicians and doctors at the 2024 Guangdong Province Public Welfare Training, introducing its design and clinical applications.

D. Prof. Yip's team attended the conference to demonstrate the product and engage with medical professionals.

Research Dissemination

License and Certificate

The Anisotropic Textile Brace (ATB) has successfully **transitioned from research to a commercial product**. This innovative brace is now licensed under 保姿体生物科技(广州)有限公司 for sale, thereby marking a significant milestone in our efforts to bring cutting-edge solutions to the market.

Prof. Joanne Yip and PolyU jointly hold Active Biotechnology (Hong Kong) Company Limited, which has established 利康云医学科技(上海)有限公司) in Mainland China. They are also collaborating with 脊客医疗信息科技（广州）有限公司 to jointly set up 保姿体生物科技(广州)有限公司) and 保姿体生物科技(湖南)有限公司.

LA23-444

Dated this 5th day of June 2024

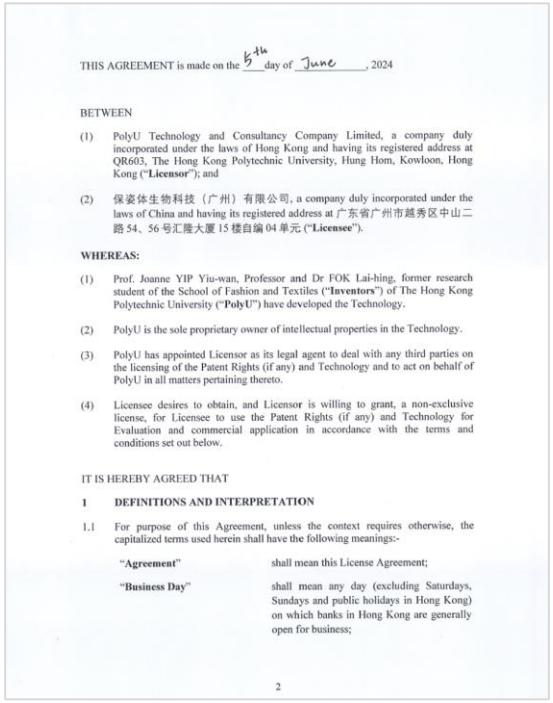
POLYU TECHNOLOGY AND CONSULTANCY COMPANY LIMITED

and

保姿体生物科技（广州）有限公司

LICENSE AGREEMENT

1



THIS AGREEMENT is made on the 5th day of June, 2024

BETWEEN

(1) PolyU Technology and Consultancy Company Limited, a company duly incorporated under the laws of Hong Kong and having its registered address at QR603, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong ("**Licensor**"); and

(2) 保姿体生物科技（广州）有限公司, a company duly incorporated under the laws of China and having its registered address at 广东省广州市越秀区中山二路 54、56 号汇隆大厦 15 楼自编 04 单元 ("**Licensee**").

WHEREAS:

(1) Prof. Joanne YIP Yiu-wan, Professor and Dr FOK Lai-hing, former research student of the School of Fashion and Textiles ("**Inventors**") of The Hong Kong Polytechnic University ("**PolyU**") have developed the Technology.

(2) PolyU is the sole proprietary owner of intellectual properties in the Technology.

(3) PolyU has appointed Licensor as its legal agent to deal with any third parties on the licensing of the Patent Rights (if any) and Technology and to act on behalf of PolyU in all matters pertaining thereto.

(4) Licensee desires to obtain, and Licensor is willing to grant, a non-exclusive license, for Licensee to use the Patent Rights (if any) and Technology for Evaluation and commercial application in accordance with the terms and conditions set out below.

IT IS HEREBY AGREED THAT

1 DEFINITIONS AND INTERPRETATION

1.1 For purpose of this Agreement, unless the context requires otherwise, the capitalized terms used herein shall have the following meanings:-

"**Agreement**"	shall mean this License Agreement;
"**Business Day**"	shall mean any day (excluding Saturdays, Sundays and public holidays in Hong Kong) on which banks in Hong Kong are generally open for business;

2

IN WITNESS whereof the parties hereto have signed this Agreement on the date first above written.

SIGNED for and on behalf of PolyU Technology and Consultancy Company Limited	SIGNED for and on behalf of 保姿体生物科技（广州）有限公司
Wing-tak WONG	何鹏飞
Director	董事长

10

ATB license agreement

Research Dissemination

License and Certificate

ATB has obtained its **Mainland China Medical Device Registration Certificate (MDRC) as a Class II medical device**, which was approved in February 2025. Following this milestone, ATB has been adopted in clinical practice across hospitals and clinics in Mainland China , with doctors recommending it to patients. It is now officially **available for purchase**, providing a new treatment option in the region. Currently, the Spinal Research Team at Sun Yat-sen University (中山大學脊柱研究團隊) is collaborating with us to market the ATB.

中华人民共和国医疗器械注册证

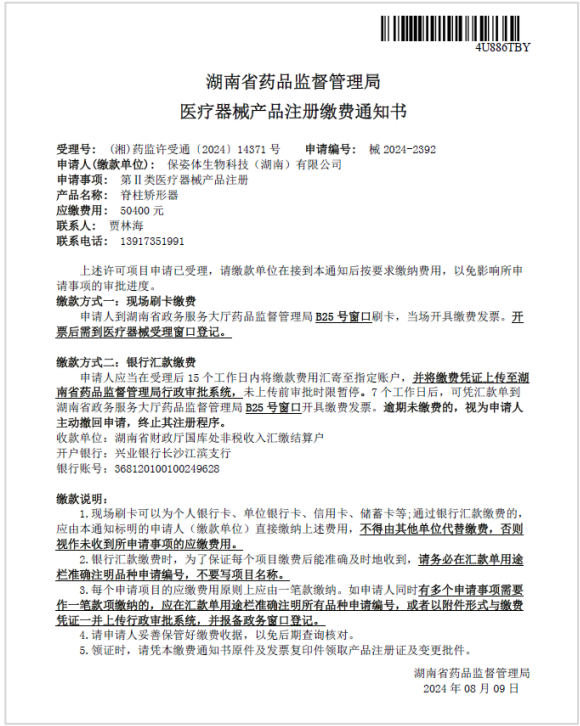
注册证编号:湘械注准 20252190170

注册人名称	保姿体生物科技（湖南）有限公司
注册人住所	湘潭经开区和平街道东风路 31 号创新创业中心 1 号楼 20 层 2010 室
生产地址	湘潭经开区东风路 31 号创新创业中心 9 号楼 3 层（委托生产）
代理人名称	不适用
代理人住所	不适用
产品名称	脊柱矫形器
型号、规格	型号：TLSO-O-BZT-01，规格：XS、S、M、L、XL。
结构及组成	由高分子材料、织物、金属材料制成。其中高分子材料为100%硅胶，织物为纺织布料、宽橡筋带，金属材料由100%铝和不锈钢构成。
适用范围	穿戴于躯干，用于矫正或预防畸形。
附 件	产品技术要求
其他内容	
备 注	

审批部门：湖南省药品监督管理局

批准日期:2025 年 02 月 18 日
生效日期:2025 年 02 月 18 日
有效期至:2030 年 02 月 17 日

Mainland China Medical Device Registration Certificate (MDRC)Class II medical device



4U886TBY

湖南省药品监督管理局

医疗器械产品注册缴费通知书

受理号：（湘）药监许受通（2024）14371 号　　申请编号：械 2024-2392
申请人(缴款单位)：保姿体生物科技（湖南）有限公司
申请事项：第Ⅱ类医疗器械产品注册
产品名称：脊柱矫形器
应缴费用：50400 元
联系人：贾林海
联系电话：13917351991

上述许可项目申请已受理，请缴款单位在接到本通知后按要求缴纳费用，以免影响所申请事项的审批进度。

缴款方式一：现场刷卡缴费

申请人到湖南省政务服务大厅药品监督管理局 B25 号窗口刷卡，当场开具缴费发票。开票后需到医疗器械受理窗口登记。

缴款方式二：银行汇款缴费

申请人应当在受理后 15 个工作日内将缴款费用汇寄至指定账户，并将缴费凭证上传至湖南省药品监督管理局行政审批系统。未上传前审批时限暂停。7 个工作日后，可凭汇款单到湖南省政务服务大厅药品监督管理局 B25 号窗口开具缴费发票。逾期未缴费的，视为申请人主动撤回申请，终止其注册程序。

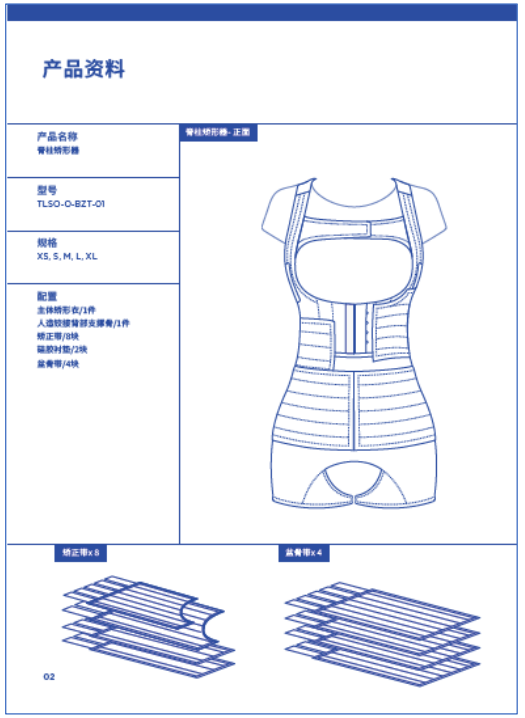
收款单位：湖南省财政厅国库处非税收入汇缴结算户
开户银行：兴业银行长沙江滨支行
银行账号：368120100100249628

缴款说明：

1. 现场刷卡可以为个人银行卡、单位银行卡、信用卡、储蓄卡等;通过银行汇款缴费的，应由本通知标明的申请人（缴款单位）直接缴纳上述费用，不得由其他单位代替缴费，否则视作未收到所申请事项的应缴费用。
2. 银行汇款缴费时，为了保证每个项目缴费后能准确及时地收到，请务必在汇款单用途栏准确注明品种申请编号，不要写项目名称。
3. 每个申请项目的应缴费用原则上应由一笔款缴纳。如申请人同时有多个申请事项需要作一笔款项缴纳的，应在汇款单用途栏准确注明所有品种申请编号，或者以附件形式与缴费凭证一并上传行政审批系统，并报备政务窗口登记。
4. 请申请人妥善保管好缴费收据，以免后期查询核对。
5. 领证时，请凭本缴费通知书原件及发票复印件领取产品注册证及变更批件。

湖南省药品监督管理局
2024 年 08 月 09 日

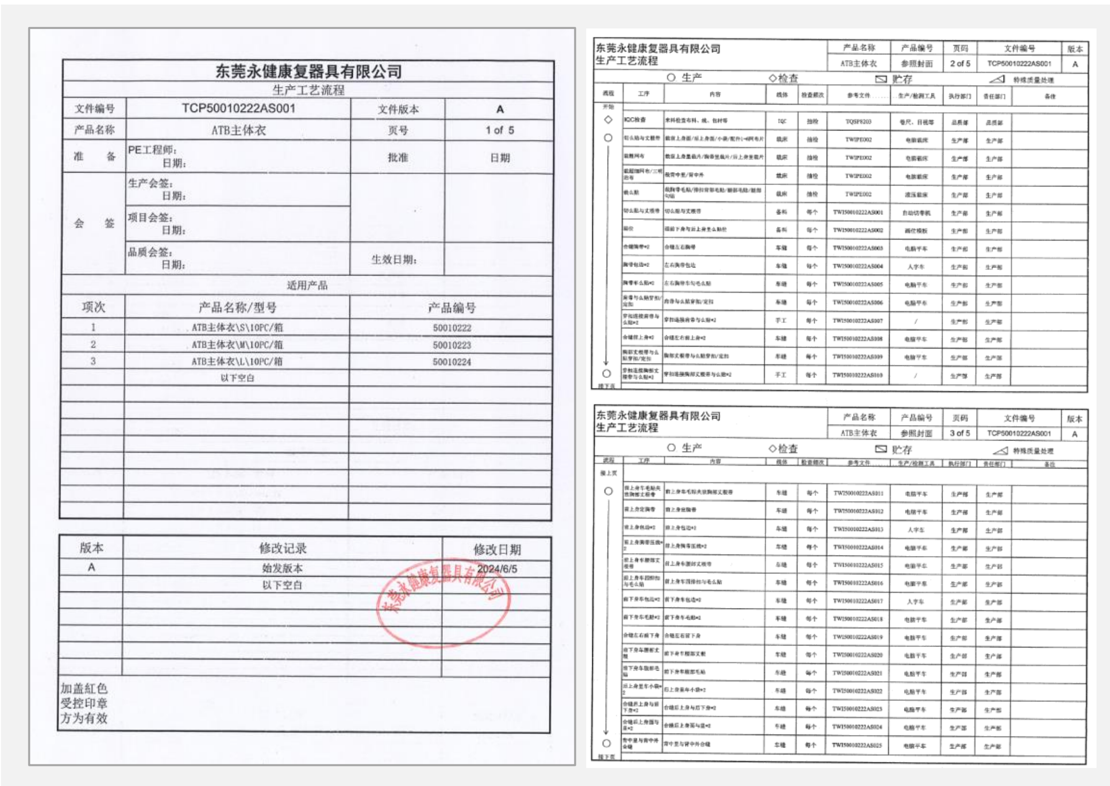
Payment Notification of MDRC – Class II medical device



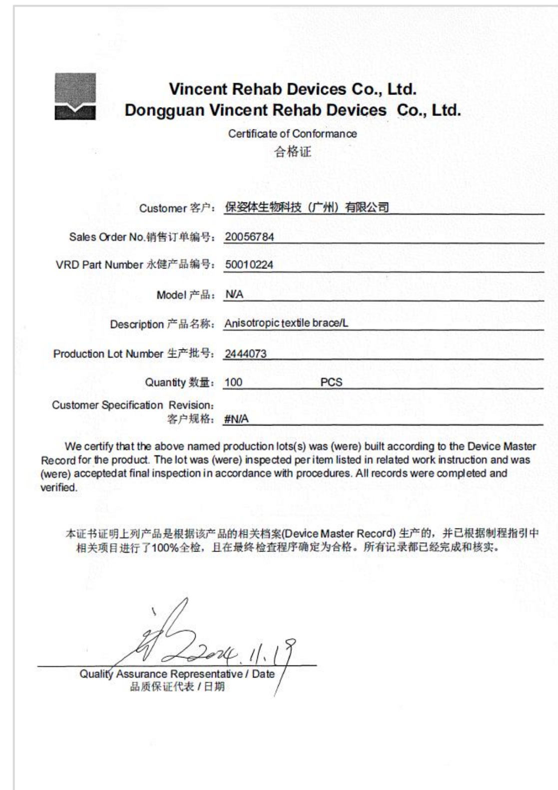
The ATB User Manual for customers

Research Dissemination

License and Certificate



A fully operational production line



Certificate of conformance

Research Dissemination

Category	Details

Media Reports

1. 理大在日內瓦發明展囊括多個最高殊榮大獎冠本港參展團隊 (PolyU). 29 April 2023. Available online at https://www.polyu.edu.hk/sc/media/media-releases/2023/0429_polyu-wins-record-breaking-number-of-awards-at-geneva-inventions-expo/
2. 理大日內瓦國際發明展摘31獎 為歷年之最 (香港商報網). 4 May 2023. Available online at https://www.hkcd.com/content_app/2023-05/04/content_1398597.html
3. 理大奪日內瓦國際發明展多個獎項 歷來最多. 香港電台-港聞 (Yahoo). 4 May 2023. Available online at https://hk.news.yahoo.com/share/41ca72e8-8143-3b66-af8d-356730b80a51
4. 理大研相機登陸火星　防控鏡片助抑近視　功能服裝治療脊柱側彎 (東網). 4 May 2023. Available online at https://today.line.me/hk/v2/article/Qwyrg9z
5. 理大獲「日內瓦國際發明展」31個獎項 兒童近視防控鏡奪特別大獎 (晴報). 4 May 2023. Available online at https://www.bastillepost.com/hongkong/article/12739314-%E7%90%86%E5%A4%A7%E7%99%BC%E6%98%8E%E7%8D%B2%E3%80%8C2023%E5%B9%B4%E6%97%A5%E5%85%A7%E7%93%A6%E5%9C%8B%E9%9A%9B%E7%99%BC%E6%98%8E%E5%B1%95%E3%80%8D31%E5%80%8B%E7%8D%8E%E9%A0%85-%E7%A0%94%E9%98%B2
6. Hong Kong Polytechnic University Researchers Win Gold Award for Medical Textile Inventions (PolyU). 4 May 2023. Available online at https://www.mtl-sft.com/news/hong-kong-polytechnic-university-researchers-win-gold-award-for-medical-textile-inventions/
7. 理大研功能衣矯脊柱側彎 「服裝設計不止靚唔靚」(明報). 5 May 2023. Available online at https://news.mingpao.com/pns/%E6%95%99%E8%82%B2/article/20230505/s00011/1683218695352/%E7%90%86%E5%A4%A7%E7%A0%94%E5%8A%9F%E8%83%BD%E8%A1%A3%E7%9F%AF%E8%84%8A%E6%9F%B1%E5%81%B4%E5%BD%8E-%E3%80%8C%E6%9C%8D%E8%A3%9D%E8%A8%AD%E8%A8%88%E4%B8%8D%E6%AD%A2%E9%9D%9A%E5%94%94%E9%9D%9A%E3%80%8D

Research Dissemination

Category	Details
Media Reports	8. 【揚威海外】理大28項發明奪日內瓦發明展獎項 助治療脊柱側彎、減慢兒童近視加深 (香港經濟日報). 5 May 2023. Available online at https://inews.hket.com/article/3519159/
	9. 理大PolyImpact科創理念 日內瓦國際發明展放異彩來源網址：理大PolyImpact科創理念-日內瓦國際發明展放異彩 (星島網). 7 June 2023. Available online at https://www.stheadline.com/edu-news/3240256/%e7%90%86%e5%a4%a7PolyImpact%e7%a7%91%e5%89%b5%e7%90%86%e5%bf%b5-%e6%97%a5%e5%85%a7%e7%93%a6%e5%9c%8b%e9%9a%9b%e7%99%bc%e6%98%8e%e5%b1%95%e6%94%be%e7%95%b0%e5%bd%a9
	10. 郭玲麗關注學童脊柱側彎問題　籲及早識別和治療 (文匯報). 28 May 2024. Available online at https://www.wenweipo.com/a/202405/28/AP6655d156e4b00a6e8c39714f.html
	11. 議員關注學童脊柱側彎問題 及早識別和治療助改善情況 (香港商報網). 9 July 2025 . Available online at https://hkcd.com/content_app/2025-07/09/content_8703563.html
	12. PolyU Develops Innovative Soft Braces to enhance scoliosis treatment. (Hong Kong PolyU). July 2025 . Available online at https://www.instagram.com/p/DL4JtR4ySAh/
	13. 關注學童脊柱側彎問題 及早識別和治療有助改善情況 (DAB). 9 July 2025. Available online at https://www.dab.org.hk/post/關注學童脊柱側彎問題-及早識別和治療有助改善情況

Research Dissemination

Media and newspaper reports

Media and newspapers reported on The 48th International Exhibition of Inventions Geneva (Gold Medal with the Congratulations of Jury)

1. **PolyU**：理大在日內瓦發明展囊括多個最高殊榮大獎冠本港參展團隊.
2. **香港商報網** ：理大日內瓦國際發明展摘31獎 為歷年之最
3. **Yahoo**：理大奪日內瓦國際發明展多個獎項 歷來最多
4. **東網**：理大研相機登陸火星　防控鏡片助抑近視　功能服裝治療脊柱側彎.
5. **晴報**：理大獲「日內瓦國際發明展」31個獎項 兒童近視防控鏡奪特別大獎.
6. **PolyU**： Hong Kong Polytechnic University Researchers Win Gold Award for Medical Textile Inventions.
7. **明報**：理大研功能衣矯脊柱側彎 「服裝設計不止靚唔靚」.
8. **香港經濟日報**：【揚威海外】理大28項發明奪日內瓦發明展獎項 助治療脊柱側彎、減慢兒童近視加深.
9. **星島網**：理大PolyImpact 科創理念 日內瓦國際發明展放異彩來源網址：理大PolyImpact科創理念-日內瓦國際發明展放異彩

香港經濟日報: 理大28項發明奪31獎 揚威日內瓦 AI輔助設計功能服裝 治脊柱側彎

Research Dissemination

Media reports

10. 文匯報– 郭玲麗關注學童脊柱側彎問題　籲及早識別和治療

郭玲麗關注學童脊柱側彎問題　籲及早識別和治療

2024-05-28 20:43:00　香港

青少年突發性脊柱側彎是發育成長中常見的臨床問題，學童脊柱健康備受社會關注。民建聯教育事務發言人、立法會議員郭玲麗聯同香港理工大學時裝及紡織學院葉曉雲教授及其團隊討論學童脊柱側彎問題。會議上共同探討如何及早識別本港學童脊柱問題、政府支援措施、在校園推廣學童脊柱側彎知識，以及提升社會關注度。

期間，簡介脊柱側彎測試方法，利用脊柱測量儀(Scoliometer)篩查有問題的個案，作出跟進及協作。其後分享學童青春期脊柱健康數據，以及保守治療方法，例如支架和針對脊柱側彎的特定運動。葉教授與其團隊研發全新的功能性服裝，如姿勢矯正束身衣，柔性支架、生物反饋姿勢訓練系統等，目的是為了提供早期干預和提高治療的依從性。

郭玲麗表示，學童脊柱側彎問題對日後成長造成長遠的影響，不少家長和學童都忽視相關問題，建議政府加強宣傳和教育，例如為教師、家長和學生舉辦脊柱健康講座，提升社會對脊柱側彎的認知。

郭玲麗建議，政府可積極鼓勵家長參與學童保健計劃，其中包含脊柱側彎的篩查，以及早識別有脊柱側彎問題的學童。現時，如果學童的側彎角度在25°以上，政府會免費提供硬支架。她建議，政府善用本港的科研成果，在醫管局引入柔性支架治療給早期脊柱側彎病人（10°至25°），以把握治療的黃金時間，避免脊柱情況惡化，從而守護學童的健康。

葉曉雲表示，及早識別學童脊柱側彎問題，並採取及時治療，能有效減低側彎加劇的可能性。她呼籲，社界各界關注學童脊柱健康問題，本年6月22日舉辦國際關注脊柱側彎日，期盼市民積極參與，提升公眾的關注度。

Prof. Yip stated that early identification of scoliosis in schoolchildren and timely treatment can effectively reduce the likelihood of the condition worsening.
28 May 2024
https://www.wenweipo.com/a/202405/28/AP6655d156e4b00a6e8c39714f.html

Research Dissemination

Media reports

Key findings of the scoliosis screening programme in Hong Kong

11. **香港商報網**– 議員關注學童脊柱側彎問題 及早識別和治療助改善情況.

12. **Hong Kong PolyU:** PolyU develops innovative soft braces to enhance scoliosis treatment.

13. **Democratic Alliance for the Betterment and Progress of Hong Kong (DAB):** 關注學童脊柱側彎問題 及早識別和治療有助改善情況.

PolyU's research team is committed to leveraging innovative research to capitalise on the golden intervention period for mild scoliosis. Studies confirm that early intervention can effectively control curve progression and safeguard spinal health during children's growth phase.

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