Support Your Motion

INNOPHYS

Application of **MUSCLE SUIT** to Nursing Care & Functional Training

INNOVTION + PHYSICAL + SUPPORT

生きている限り自立した生活を。

INNOPHYS Co., Ltd. Founder
Tokyo Univ. of Science, Professor

Dr. Hiroshi Kobayashi

The beginning of the concept of robots

紀元前8世紀

ｷﾞﾘｼｱの詩人ホメロス，
世界最古の叙事詩『イーリアス』

8th century BC
Greek poet Homer,
The world's oldest epic "Iliad"

Background

Transport Technology

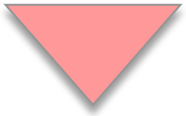
Industrial Robots

Release the man from hard labor

Mechanical system paradigm shift

～20th century (free from physical burden)

works hard instead of humans



21st century (free from mental burden)

maintains & supports independence

Goal

whoever lives can live independently.

If you don't have to worry about being bedridden.

If you could continue to work without hurting your body.

If there is no hard work that can hurt your body.

If there are no caregivers or no one to be cared for.

A life should be richer.

To create such a world, we are pursuing technologies that support humans physically.

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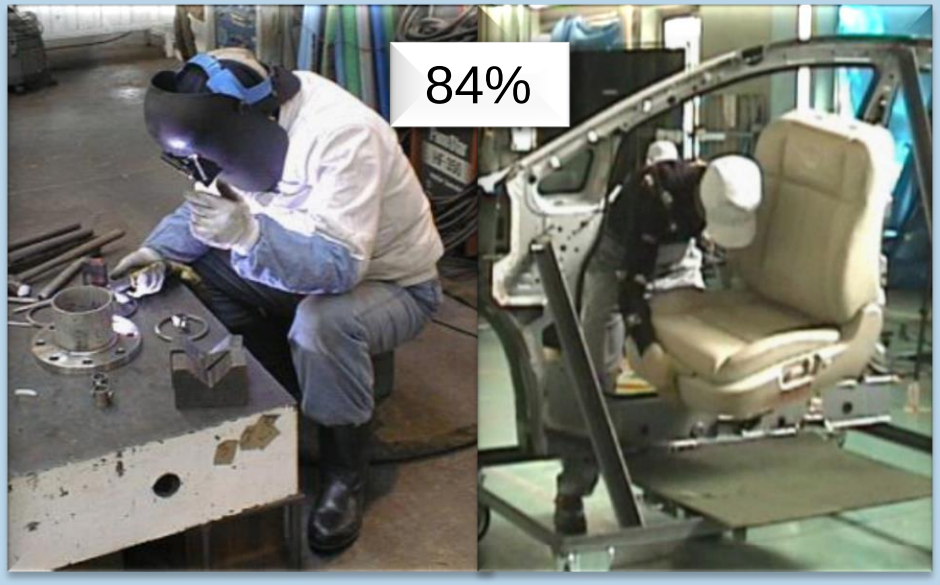
Background

Many tasks difficult to automation remained

Work-related disorders: Lower Back pain

Nursing care personnel



Automobile factory worker

Pneumatic McKibben artificial muscle

Light weight (< 200g)

High contraction power (2500N)

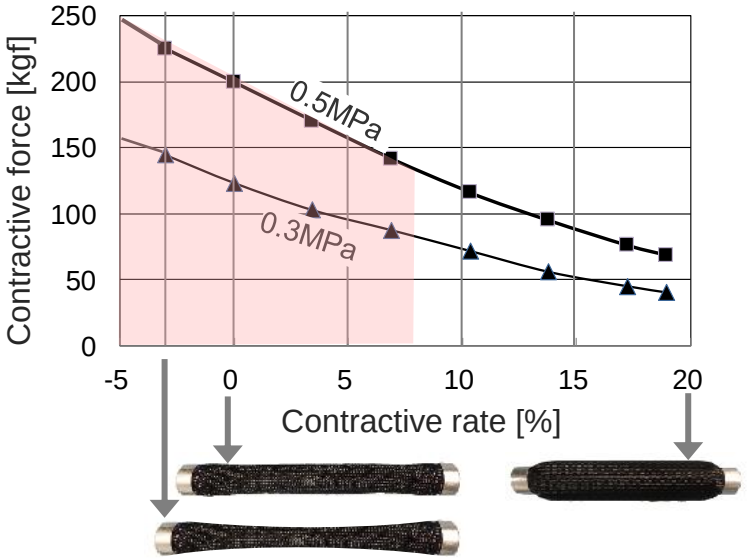
Inexpensive (< 3,000Yen=25US$)

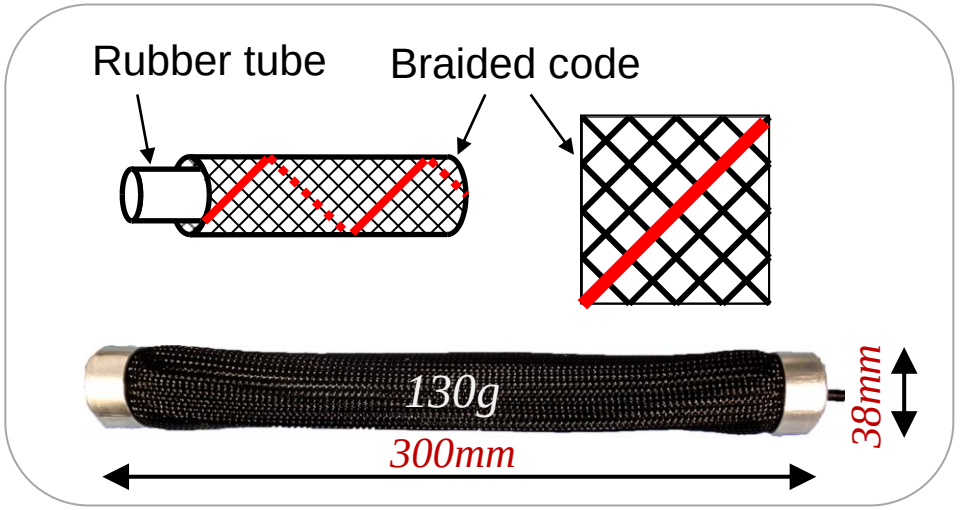
Simple structure

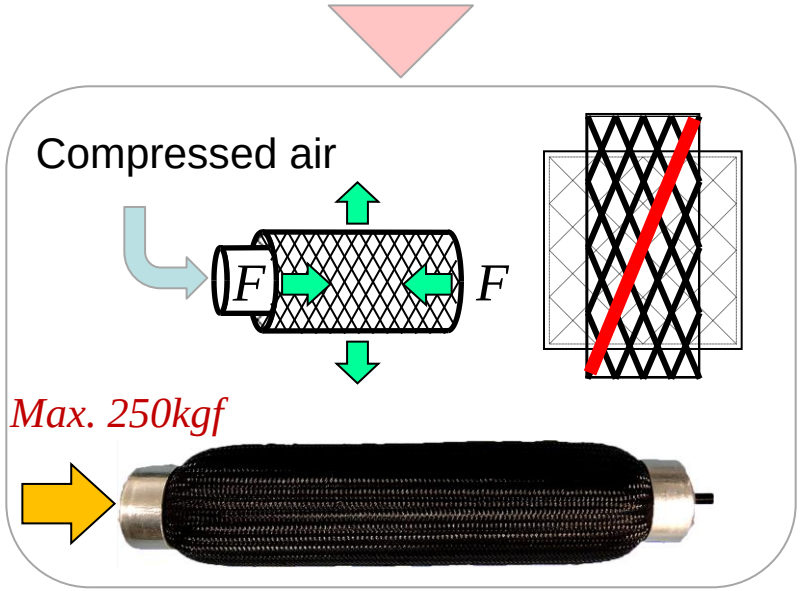
Soft material

Only contraction (<30%)

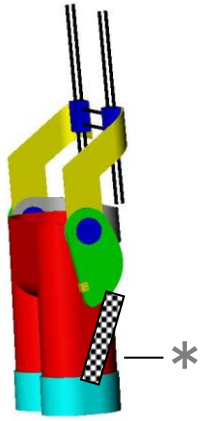
Compressed air is required



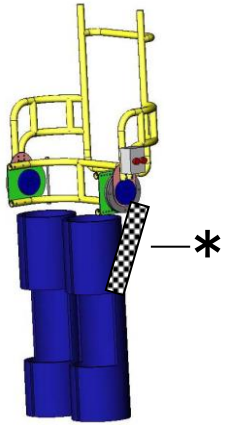




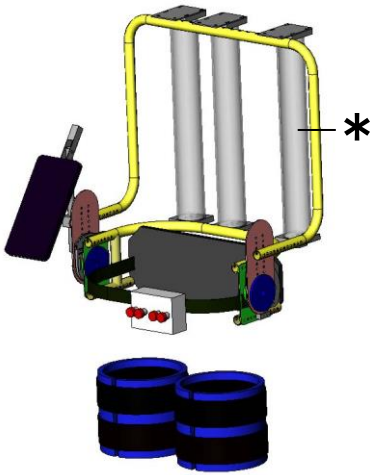
History for lower back assitance



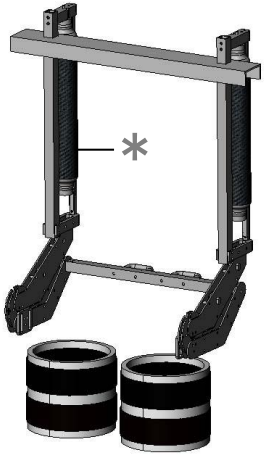
2006.11



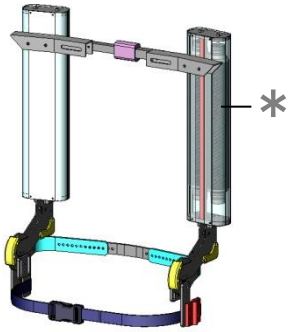
2007.1



2007.5



2008.12



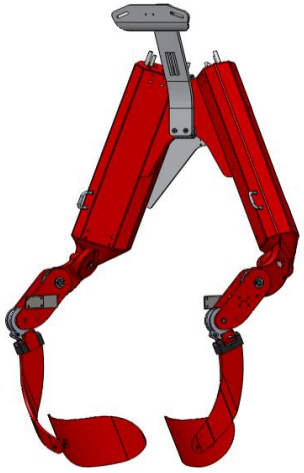
2009.2

2010.3

2010.7

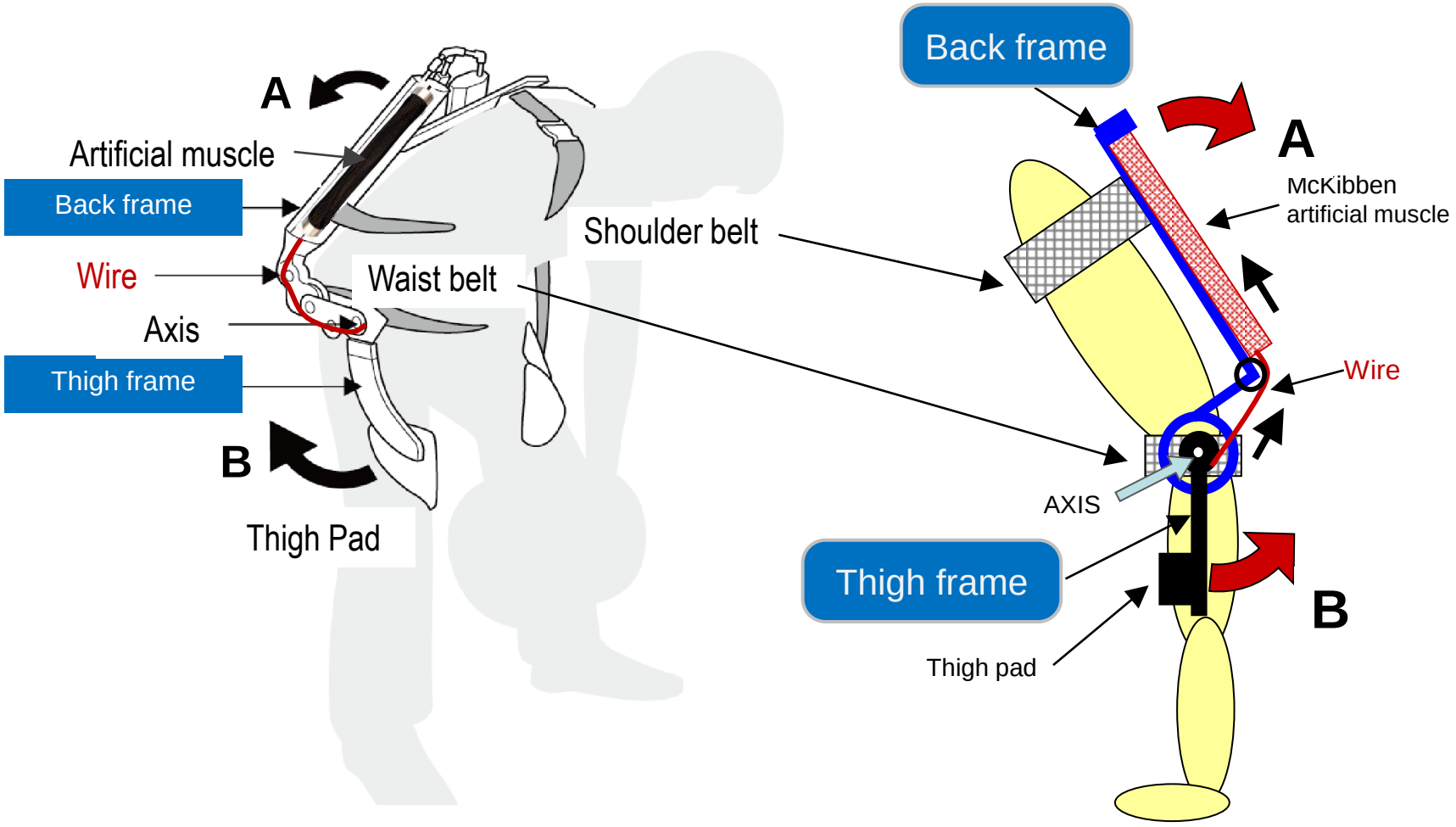
2011.1

2012.1

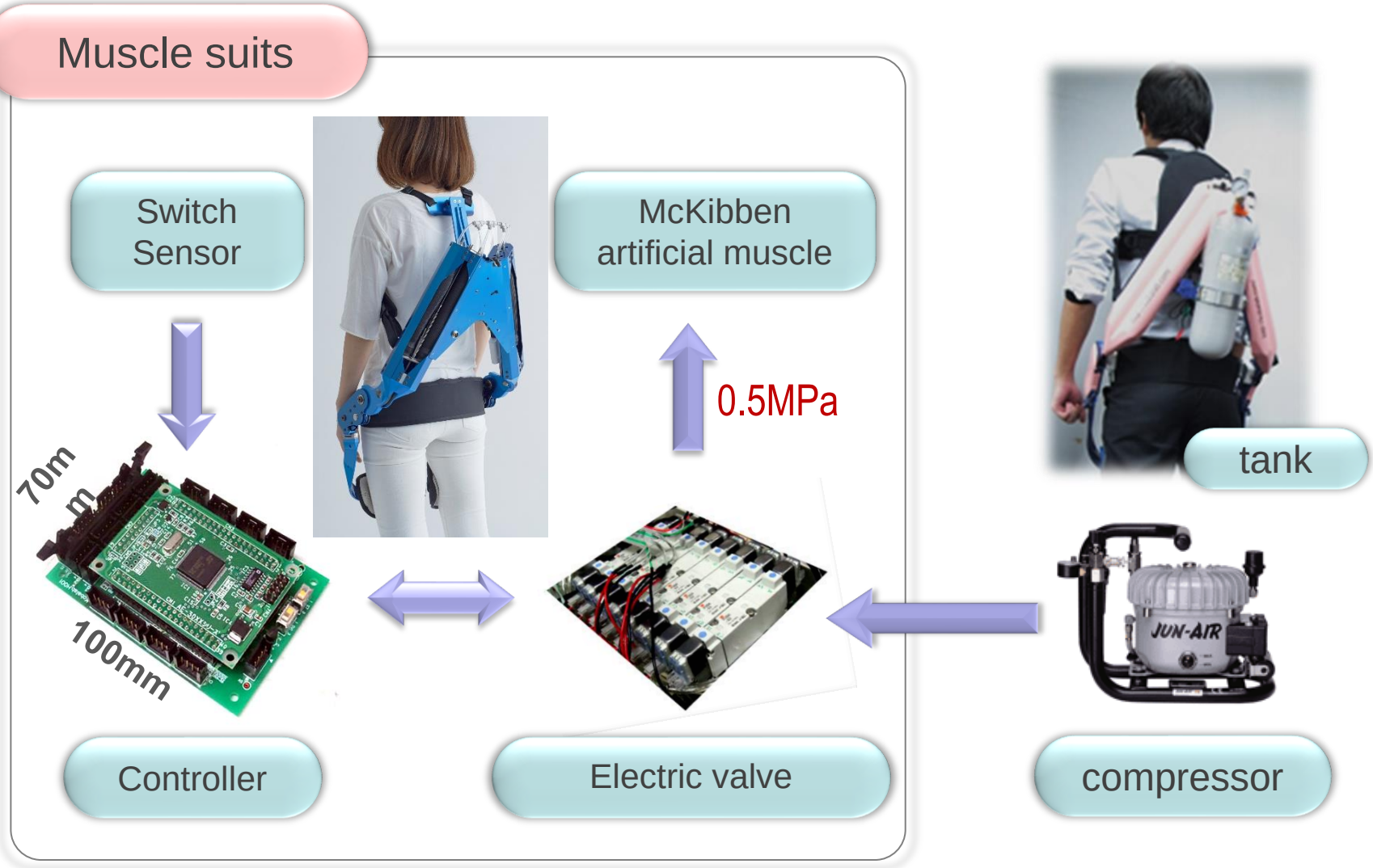


2013.1

Principle for back assistance

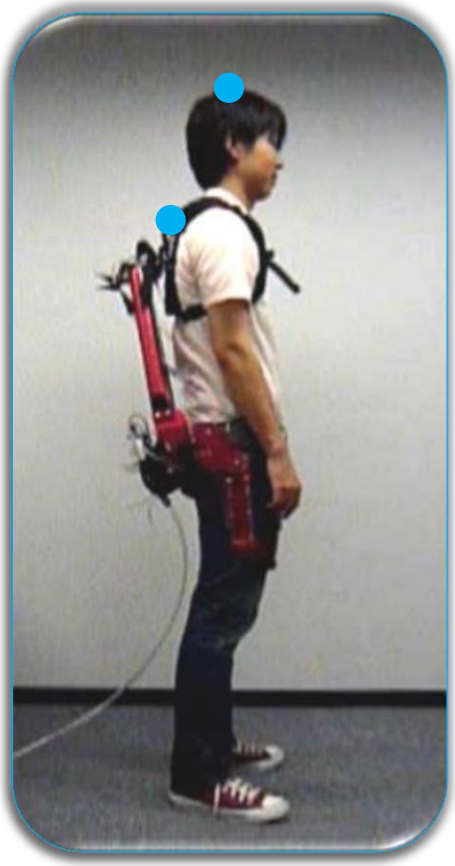


System configuration



Interface

Expiratory switch



Acceleration switch

Touch switch

Wearing : 10sec.

0. Loosen the belt

1. Carry on back

2. Fasten the waist belt

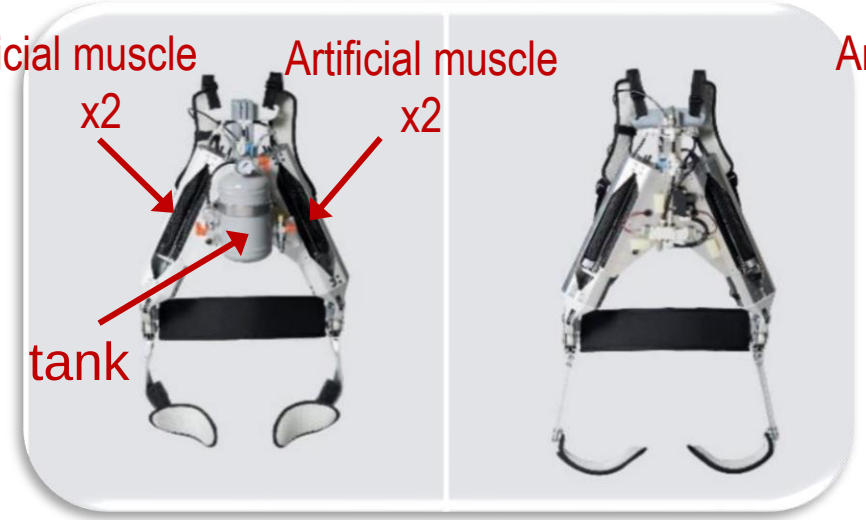
must be loose

3. Fit the thigh pad

1st and 2nd model: Active type

2014

Artificial muscle x4

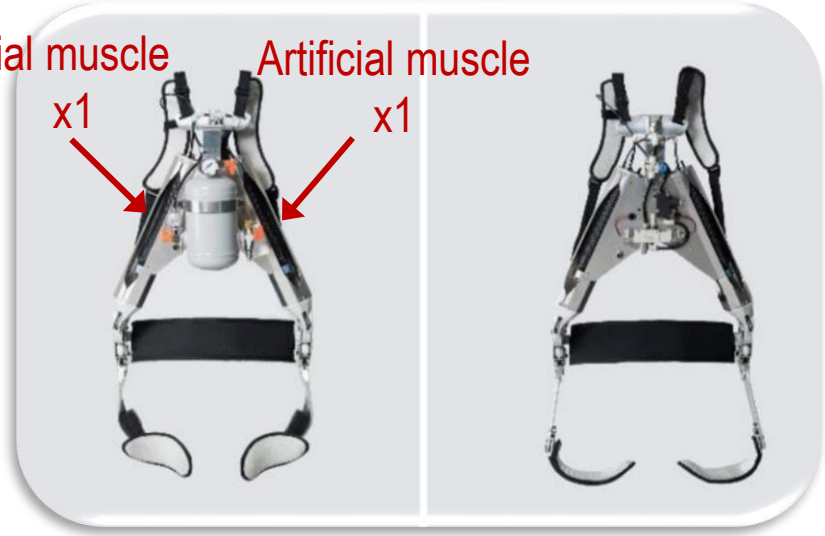


8.1kg 6.6kg

power assistance
140Nm(35.7kgf)
\600,000
$45,000

2015

Artificial muscle x2



6.7kg 5.2kg

power assistance
100Nm(25.5kgf)
\600,000
$45,000

Application: Visiting care for bath

Application: Visiting care for bath

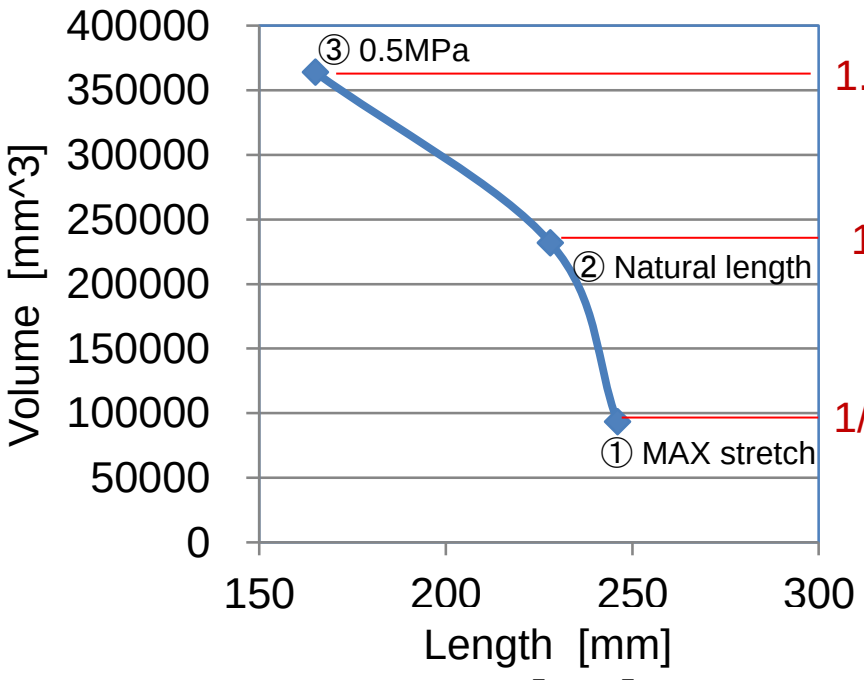
Feedback from User

- Dislike Compressor & Tube

- Dislike using Interface

- Heavy

Length & Volume for artificial muscle



1.6

1

0.2MPa

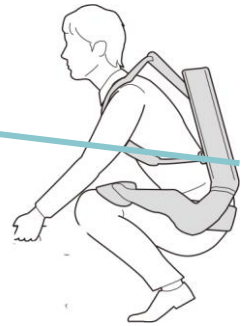
1/2.5

0.5MPa

③ 0.5MPa

② Natural length

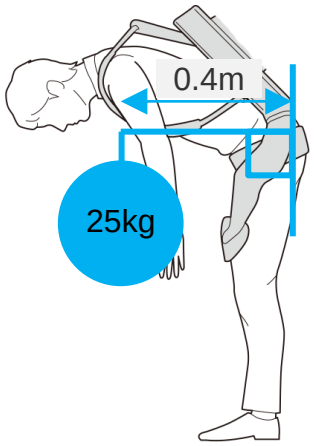
① MAX stretch

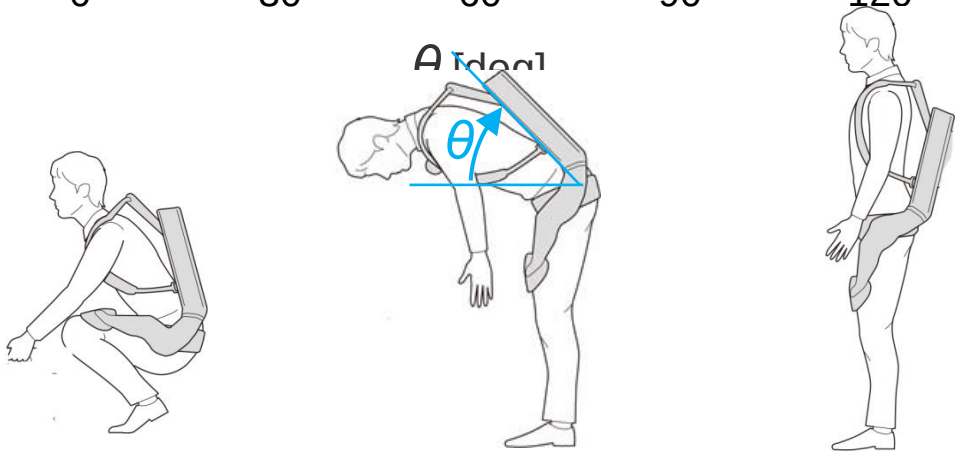


PV = Const.

Assistance torque

100Nm = 25kgf x 0.4m





Passive type

Hand pump

- No Compressor
- No Electricity
- No Interface
- 100Nm is realized.

Lineup of passive type

power assistance
100Nm(25.5kgf)

2017	2018	2019.11
	EDGE 	EVERY 
5.2kg	4.3kg	3.8kg
\700,000-800,000	\498,000	\136,000
$6,000	$4,000	$1,000
	4150 ←	20,000 ←
		2021.4

Muscle suit

Active type

Compressor

Passive type

Hand pump

Industry / global expansion passive type

ASIA
Taiwan
Hong Kong
China, Macau
Malaysia
Thailand

EUROPE
Spain
Italy
France
Germany
Poland
Sweden
Denmark
Estonia
Latvia
Lithuania

Latin America
Mexico

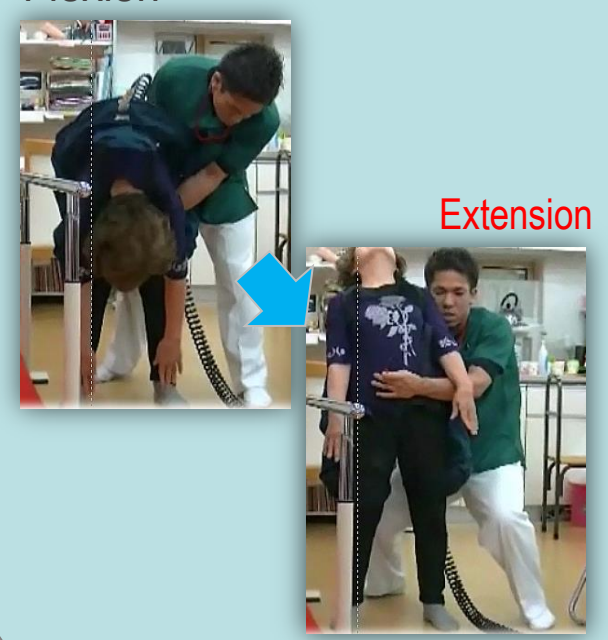
Effects of Active type

Posture correction

Muscle suit for Rehabilitation (Function training)

Standard: Extension Assist

Flexion



Squating

Flexion Assist

Flexion Assist model: ex.1

- Age: 100 years old
- 15min. training/week x 3 weeks

Flexion Assist model: ex.2

- Age: 74 years old
- Brain infarction (7 years ago)
- Left hemiplegia

- Just after 15min. Training > possible to raise left leg
- After 3 months > Walk smoothly

Flexion Assist model: ex.3

- Age: 80 years old
- Impossible to sitting straight
- Just after 15min. Training > possible
- After 3 months > Walk smoothly

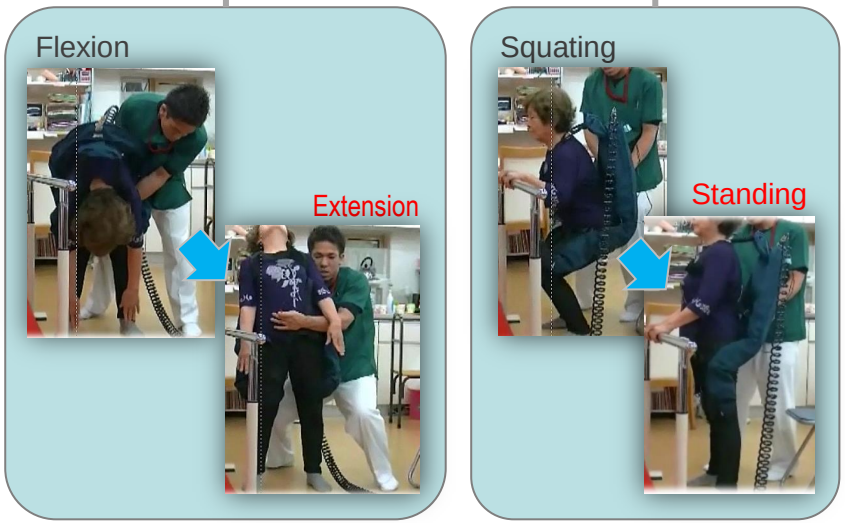
Ex.5

- Age 80, stroke at 40 years old

Muscle suit for Rehabilitation (Function training)

Standard: Extension Assist

Flexion Assist

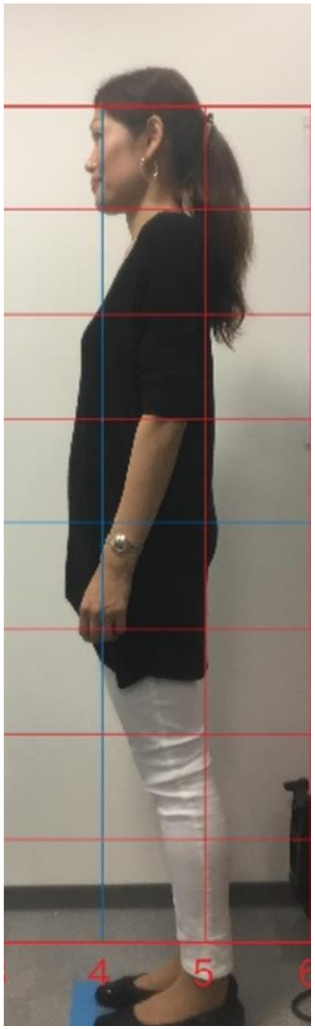


◆Hip joint position reset

◆Pelvic tilt correction

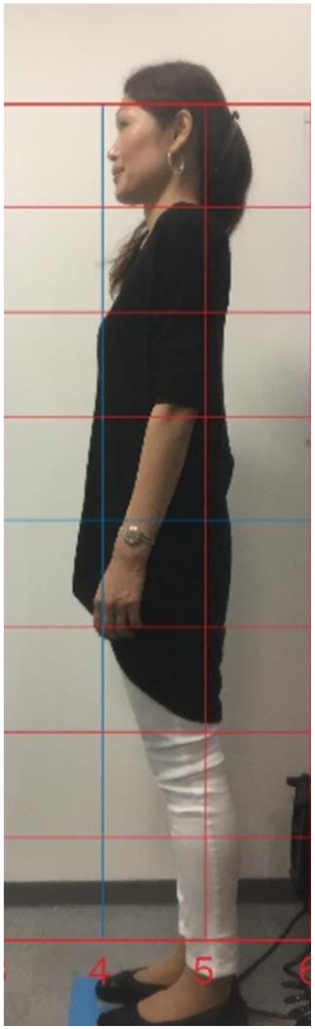
Posture correction of healthy people

Posture correction



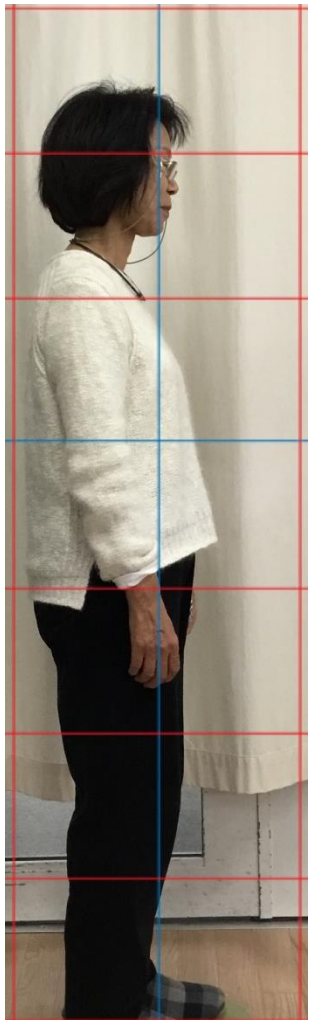
Before

Posture correction



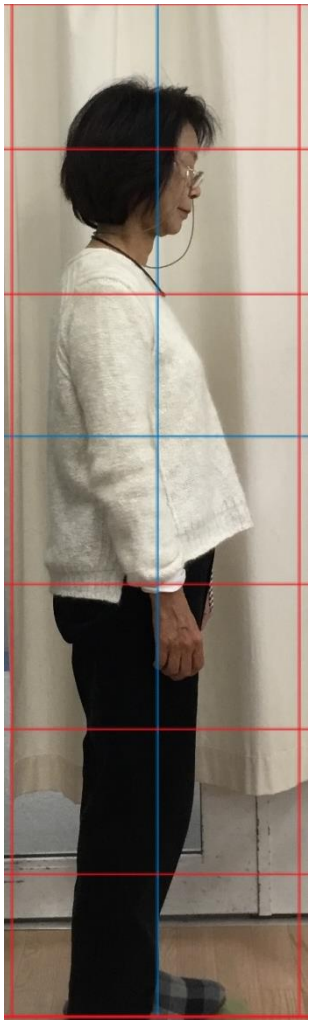
After

Posture correction



Before

Posture correction

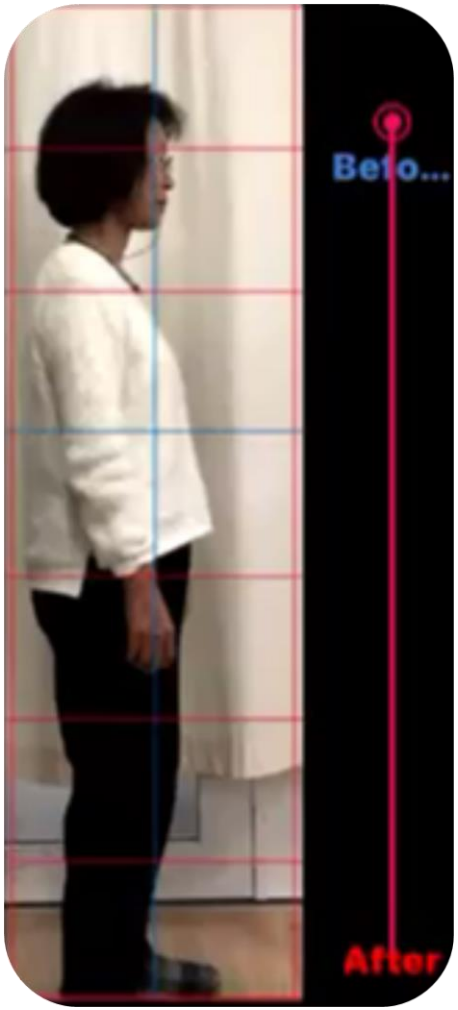


After

Posture correction

Movie

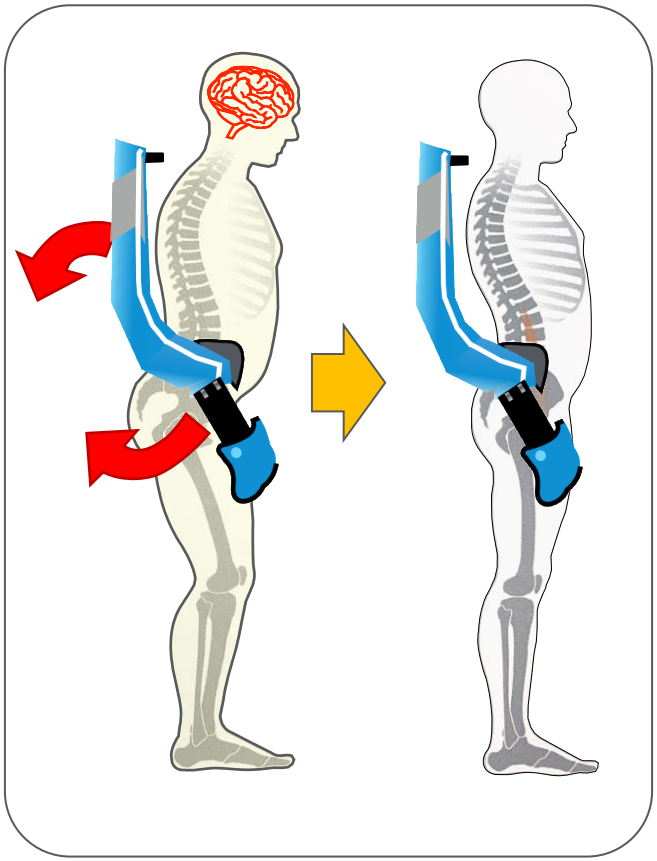
Movie

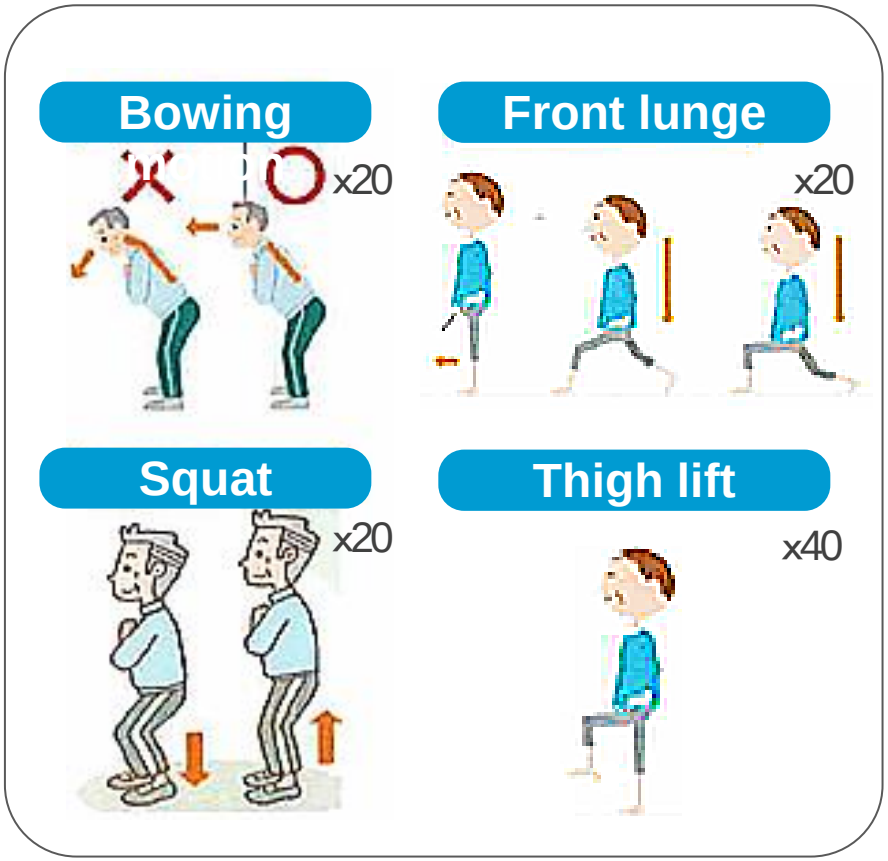


Effects of Passive type

Inner Muscle Strengthening

Passive training motion





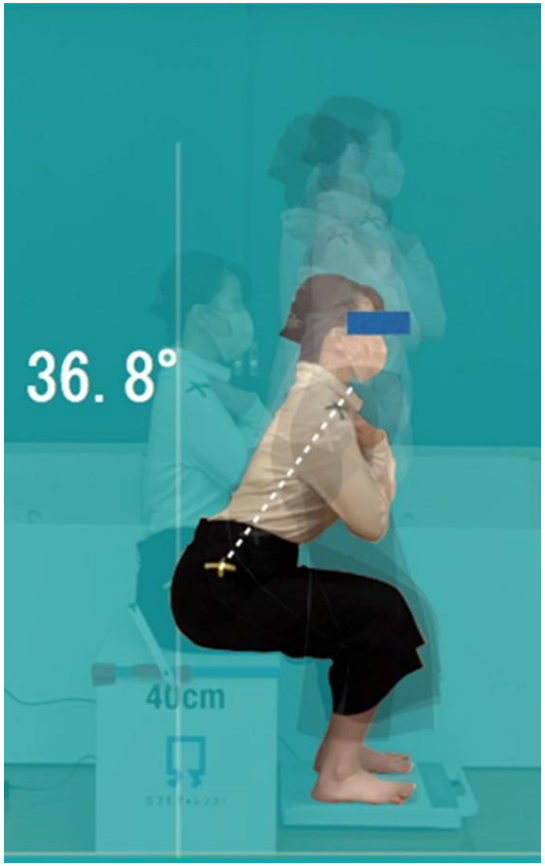
Passive training motion

Bowing

Standing up and sitting

Passive training: Effect

Before

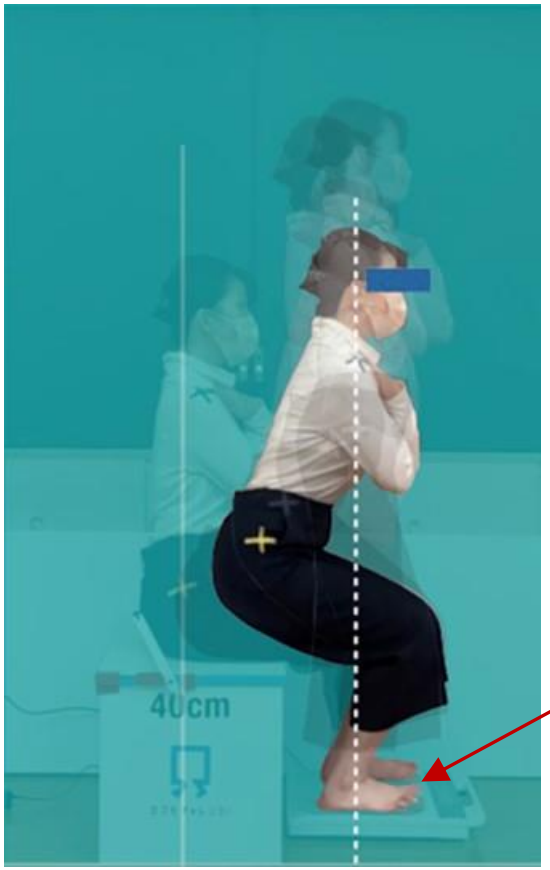


Ideal: 30°

After: 2 weeks

Passive training: Effect

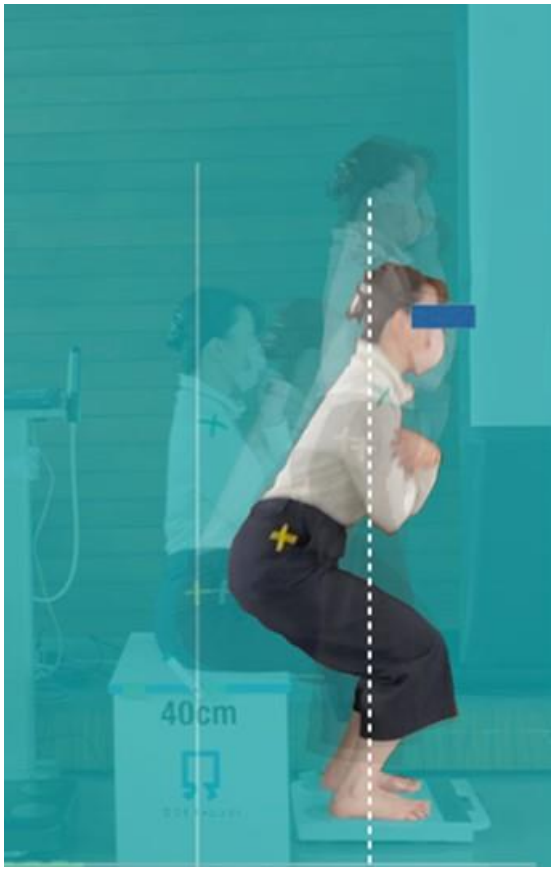
Before



Float toes

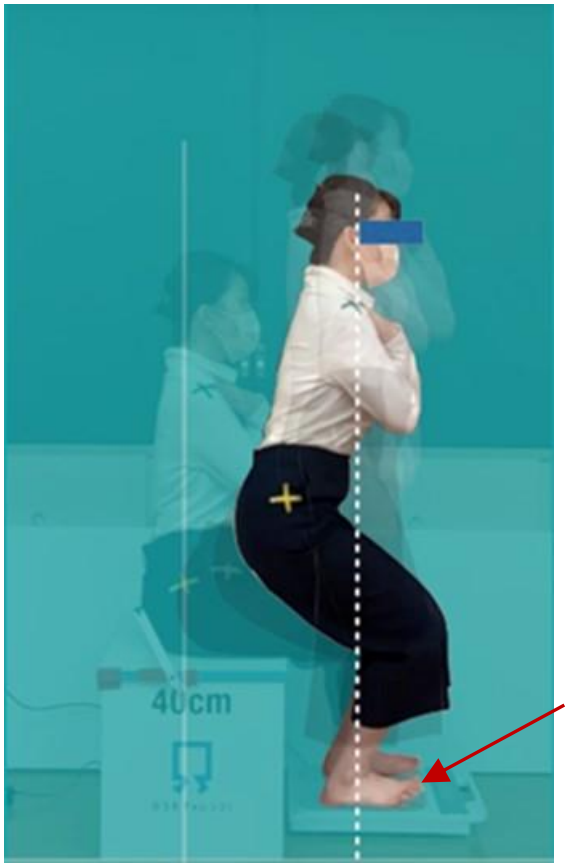
Center of gravity: Behind

After: 2 weeks



Passive training: Effect

Before



Float toes

Center of gravity: Behind

After: 2 weeks

Passive training: Effect

Before

Float toes

Center of gravity: Behind

After: 2 weeks

Passive training: Effect

Before

Change angle

After: 2 weeks

Muscle Suit

- Motion assistance
- Function training / Posture correction

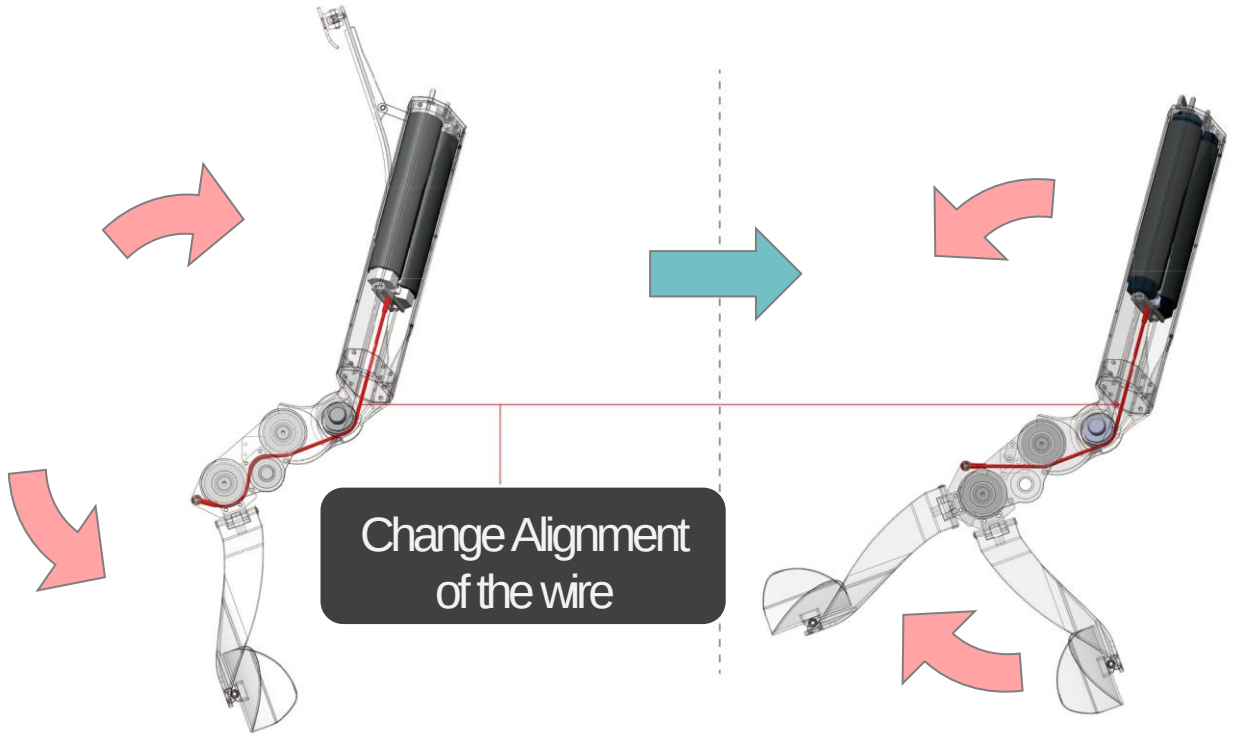
,,,,,,,, Thank you

Active walker for Adult: Panplegia (全麻痺) 2015

+ Consciousness disorder

Active walker for Adult: Panplegia (全麻痺) 2018

Flexion Assist model



Standard: Extension Assist

Flexion Assist