

Three major issues in current geriatrics and gerontology

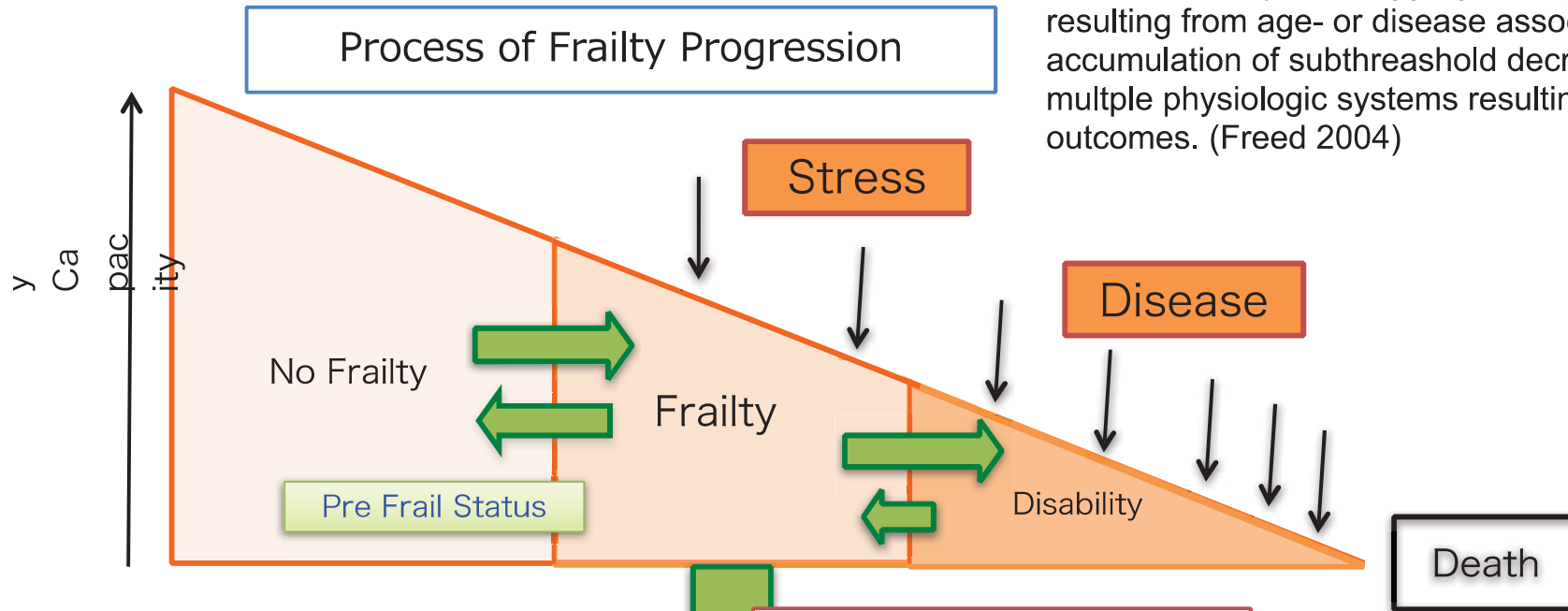
Frailty

Sarcopenia

Malnutrition

Geriatric Syndrome of Frailty

Frailty is a state of increased vulnerability to stressors that results from decreased physiological reserves and multi-system dysregulation, limited capacity to maintain in homeostasis and to respond to internal and external stresses. Frailty is an aggregate expression of risk resulting from age- or disease associated physiologic accumulation of subthreshold decrements affecting multiple physiologic systems resulting in adverse health outcomes. (Freed 2004)



This frailty phenotype was independently predictive (over 3 years) of (Fried 2001)

Several reports suggested that exercise brought improvement from frail status.

Sequels of Frailty

- High Mortality
- Number of Diseases
- Hospitalization
- Incident Fall
- Worsening of mobility or ADL

転倒はフレイルの帰結として重視されている、それはなぜか？

Aggravating factors of Frailty

- Sarcopenia
- Malnutrition
- Osteoporosis
- **Balance disorder with unknown reason assumed to be caused by aging**
- General deconditioning

Poor Standing Balance



Fall



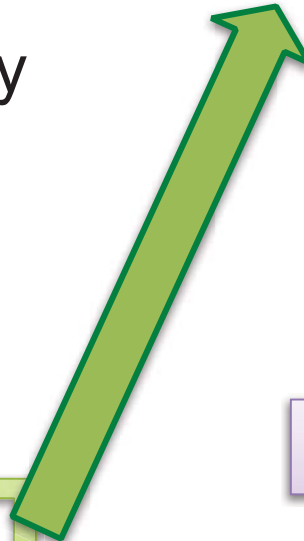
Fear for Fall



Low Activity



Muscle Weakness
Sarcopenia



高齢者特有のバランス障害は、転倒を引き起こす
転倒は転倒恐怖を通じて、活動低下、筋量の減少を起こし
さらにフレイルを悪化させる

Postural Strategy Training



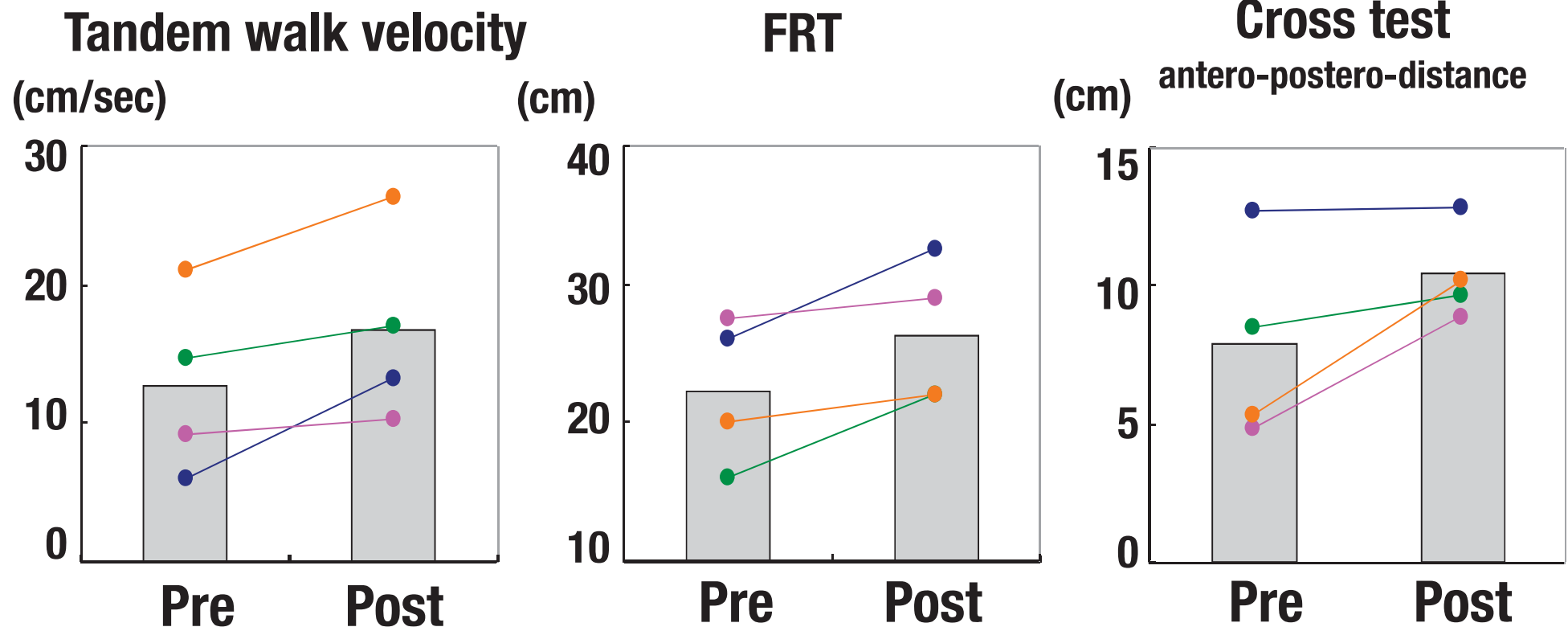
Ankle Strategy Ex



Hip Strategy Ex

These are the essence of kitchen sink training.

Change of Balance Function in Preliminary Study



Balance Exercise Assistant Robot (BEAR)

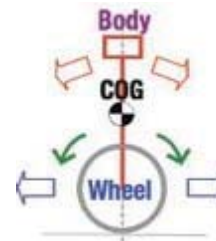
Personal Transport Assistant Robot (Toyota©) was the origin of BEAR

Philosophy of BEAR

- Inverted-pendulum control
- Facilitation of COG movement
- Changeable difficulty level

Excellent effectiveness was proved for patients with neurological diseases (Ozaki, 2013)

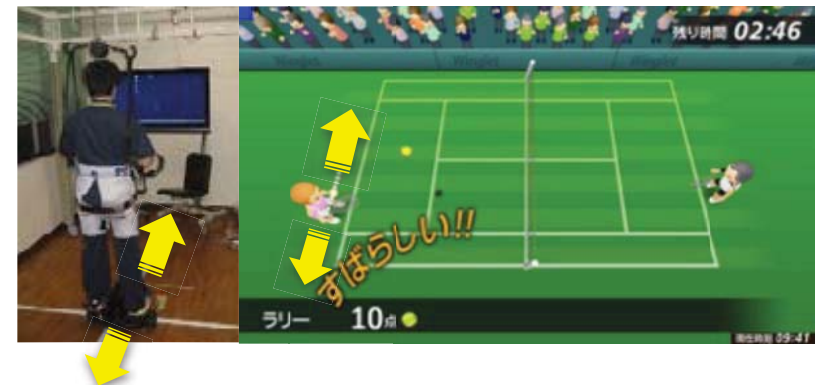
Objective: To determine the difference of efficacy to postural strategy training using a balance exercise assist robot (BEAR) between elderlies with frail.



Ankle Strategy



Hip Strategy



Participants

26 subjects with Frailty or Pre-frail

(mean age: 74 ± 6 y.o., male / female = 7 / 19)

Frailty Defining Criteria in this study

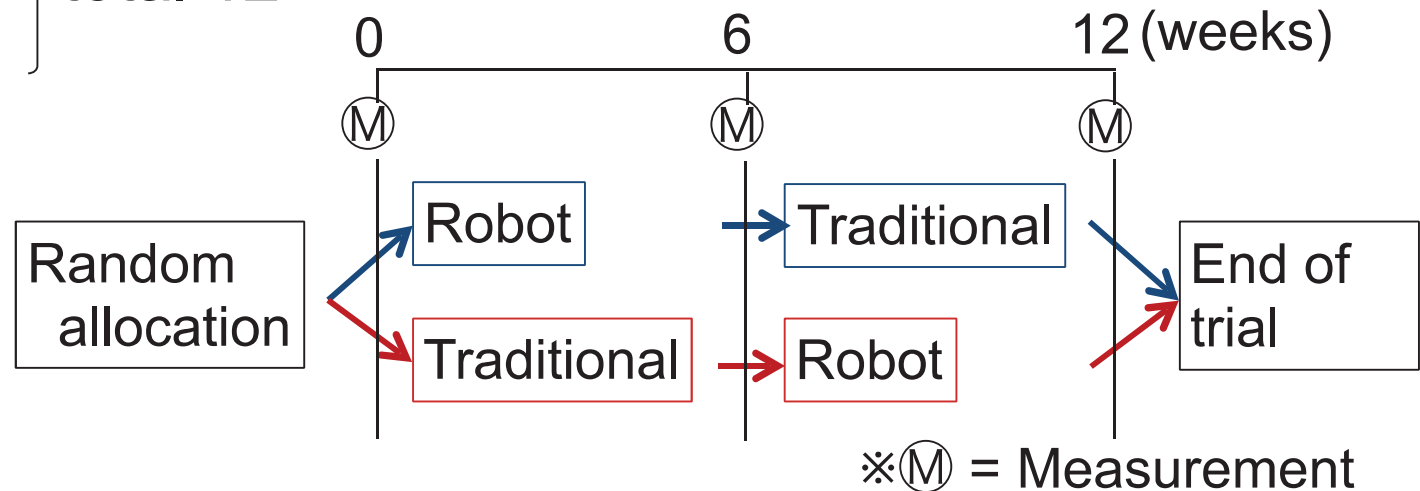
(Cardiovascular Health Study (CHS) criteria by Fried et al were modified)

Characteristic	Definition
Weight loss	Lost > 10 pounds unintentionally in last year
Exhaustion	Any of: Felt unusually tired in last 2 weeks Felt unusually fatigue in last 2 weeks
Low activity	The lowest quartile in the modified Baecke questionnaire
Weakness	Grip strength of the dominant hand: 30kg > grip strength in Male 20kg > grip strength in Female
Slowness	Walking speed in: ≤ 0.8 m/s

Frailty: ≥ 3 Items
Pre-frail: 1 or 2 Items
Robust: 0 Item

Procedures

- 20 min/session
 - twice a week
 - 6 weeks
- } total 12



◆ Evaluation tools (before and after each exercise)

- Functional Reach Test (FRT)
- Timed Up & Go test (TUG)
- Center of pressure (COP, eyes open, quiet standing, 30 sec)
 - Total path length
- Muscle strength of lower extremities (by hand-held dynamometer)
 - hip abduction, knee extension, plantar flexion

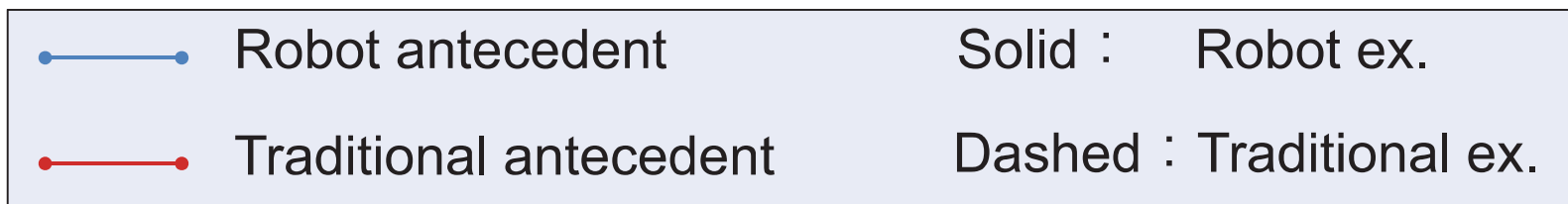
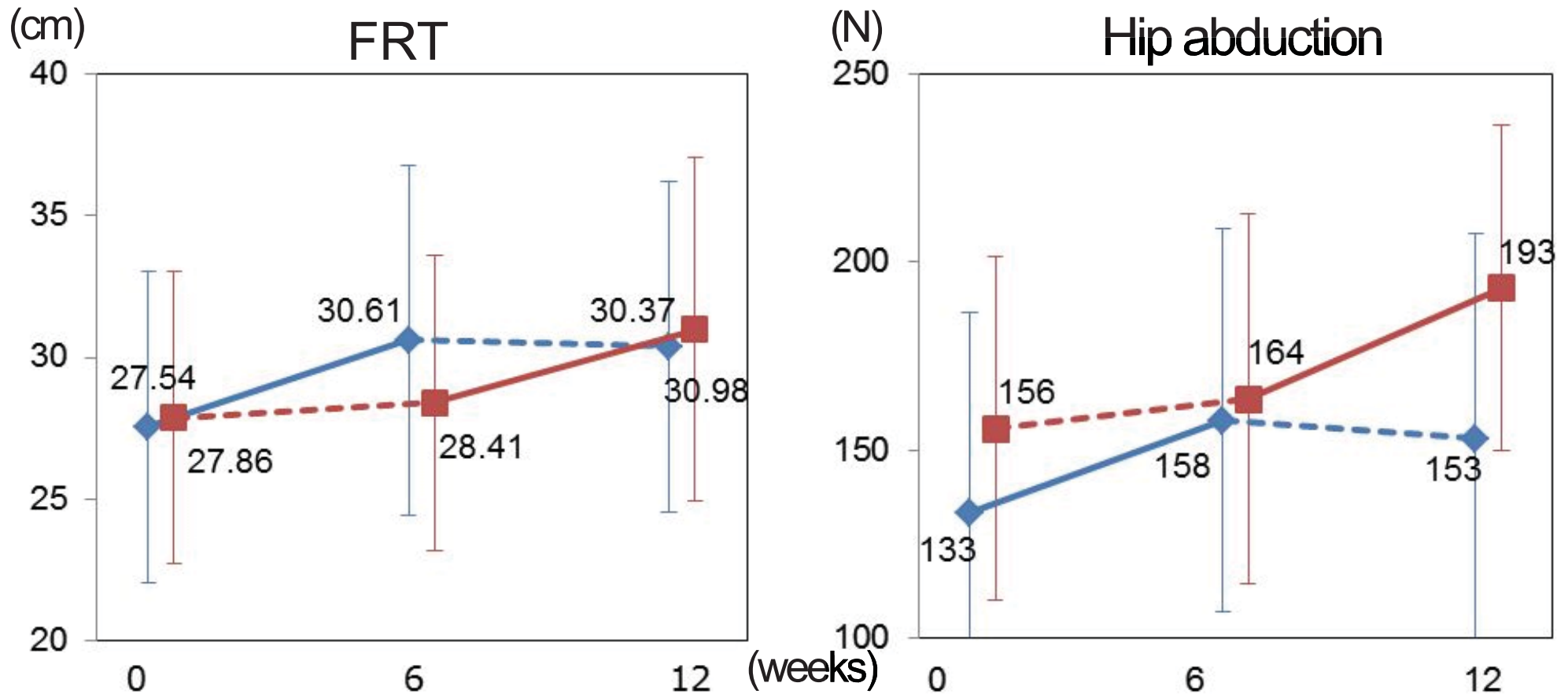
Results

Change in indexes during each exercises

	Robot ex.		Traditional ex.		p
	Ave.	SD	Ave.	SD	
Dynamic balance					
FRT (cm)	2.5	2.0	0.2	2.6	.003
TUG (sec)	-0.7	1.1	-0.3	0.9	.005
Static balance					
COP total path length (cm)	1.6	10.4	-0.3	7.2	ns
Muscle strength (all, N)					
Hip abduction	25.3	23.6	1.2	23.8	.006
Knee extension	25.2	29.9	9.9	30.2	ns
Plantar flexion	62.8	36.4	23.1	51.8	.001

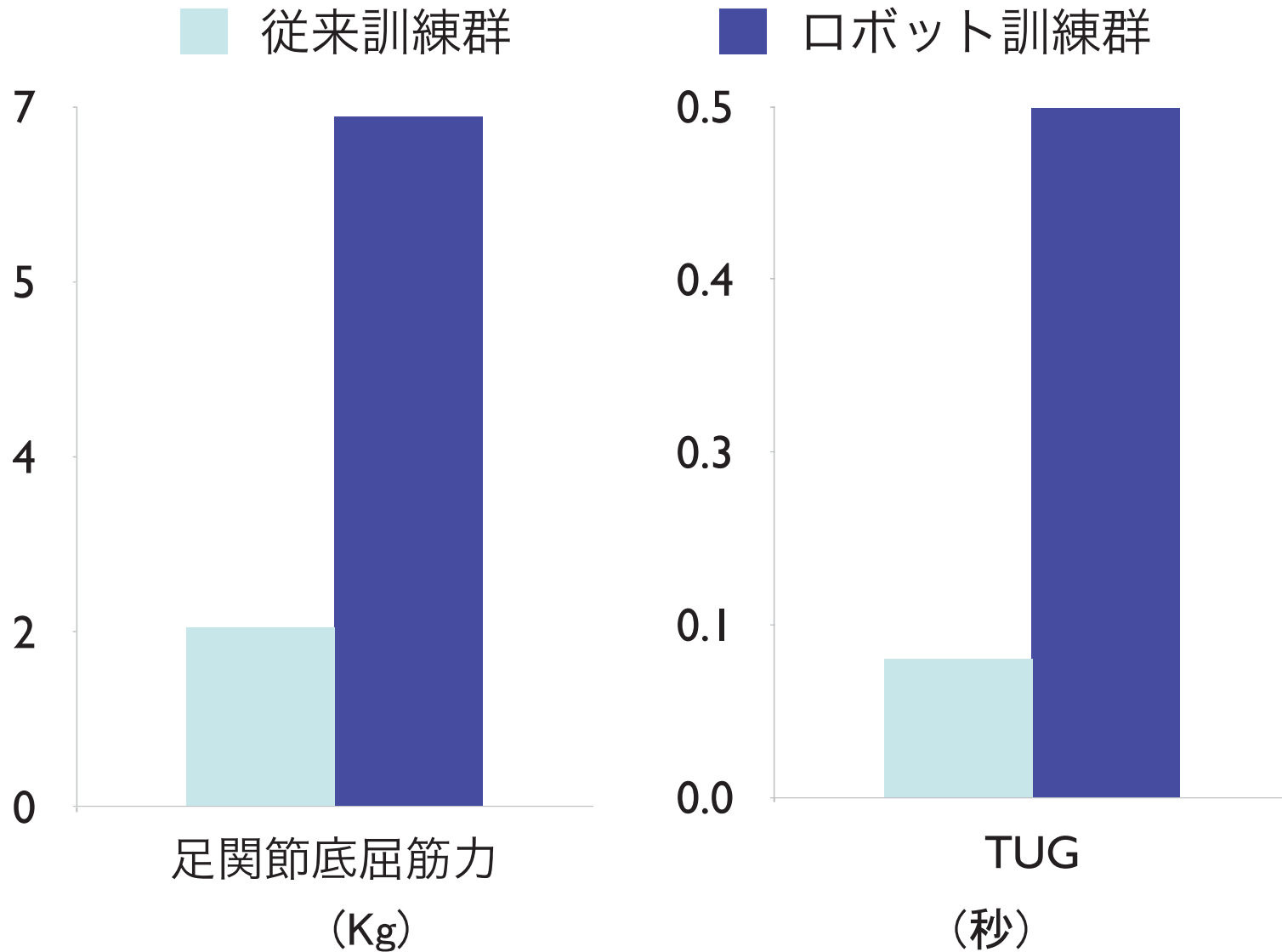
Results

Change in indexes of each Groups



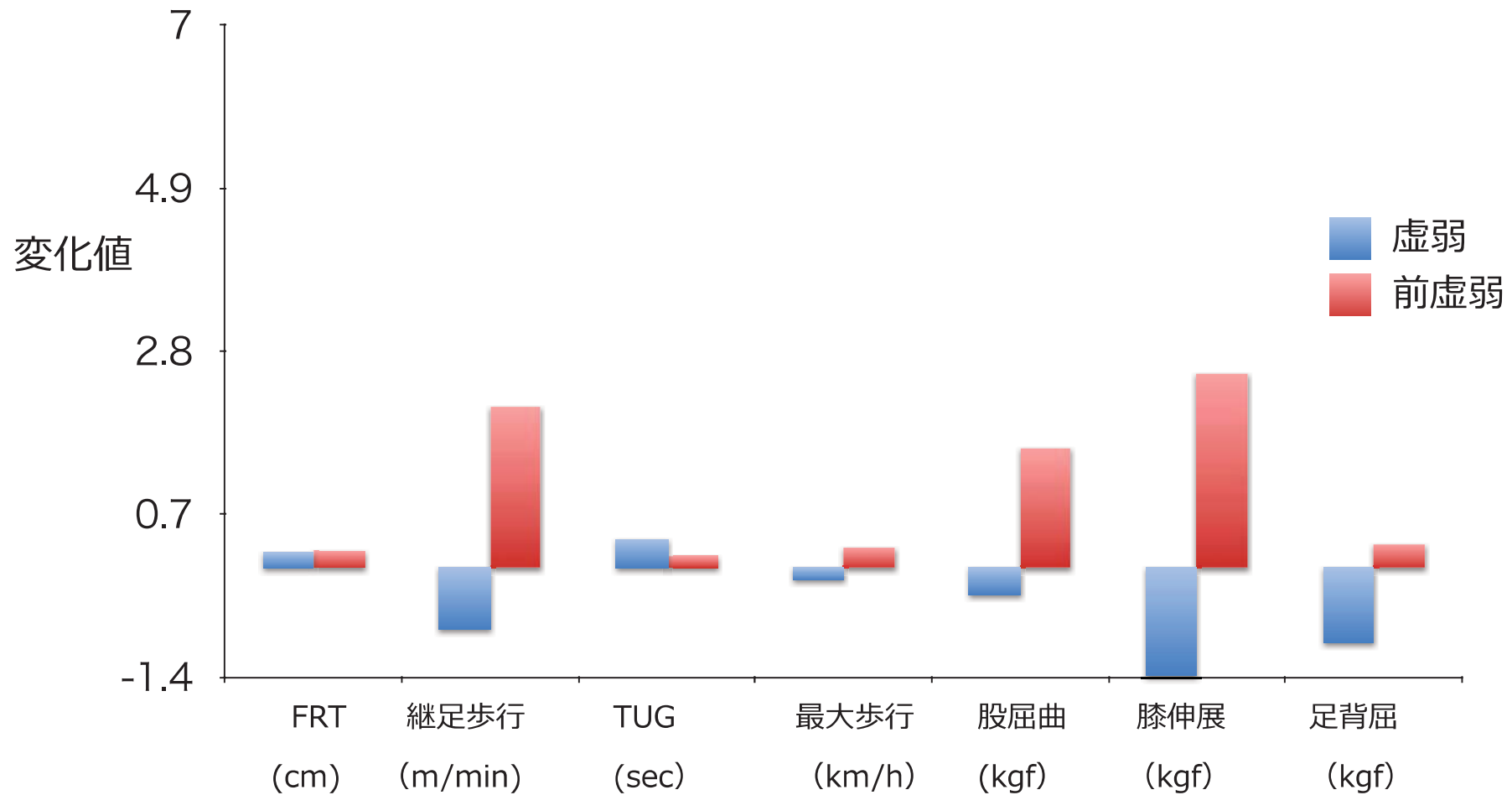
結果(n=16)

—訓練前後の改善量を比較—



結果 3

虚弱・前虚弱群における練習効果の比較 —従来練習—

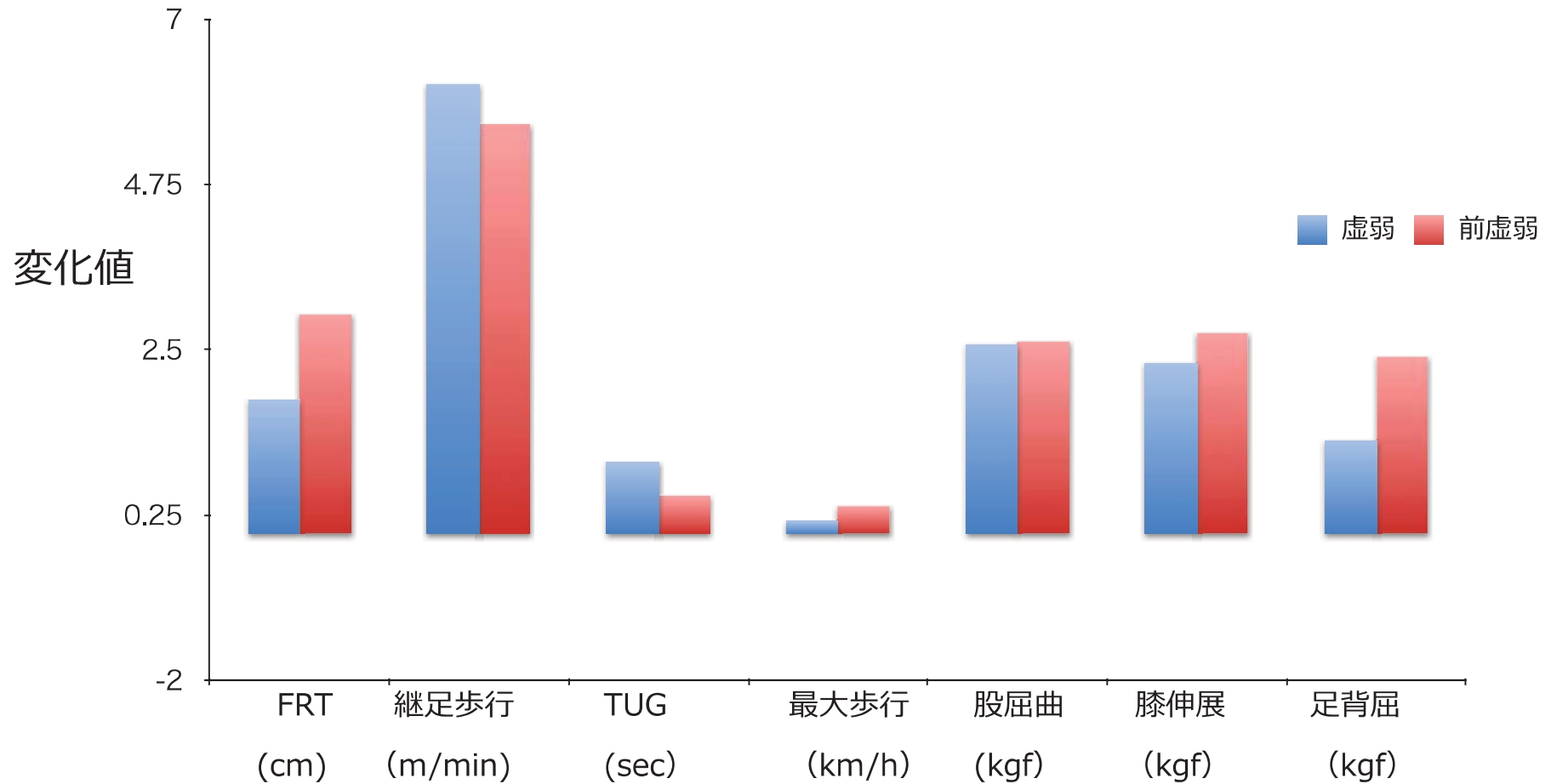


※TUGは符号を反転させて表示

結果 3

虚弱・前虚弱群における練習効果の比較

—ロボット練習—



※TUGは符号を反転させて表示