特殊評価（１）

空気圧を利用したトレッドミル歩行の評価

DEVELOPMENT AND CLINICAL USE OF A FLOAT WALKING ASSIST SYSTEM USING AIR PRESSURE

（科学研究費　萌芽 2005年度，
萌芽 2007年度，シーズ試験研究 2007年度）

In the field of physical therapy, walking assist systems that comfortably reduce body weight are needed for patients with joint pain or muscle weakness of lower limbs. Although suspension devices or underwater walking systems reduce the weight, those do not resemble to normal walking pattern.

Therefore, we developed a float walking assist system using LBPP[4,5]. Today, the 2nd generation system has been developed.

The first generation system

4) Morinaga T (2002) *the 8th ACPT 2002, Bangkok*

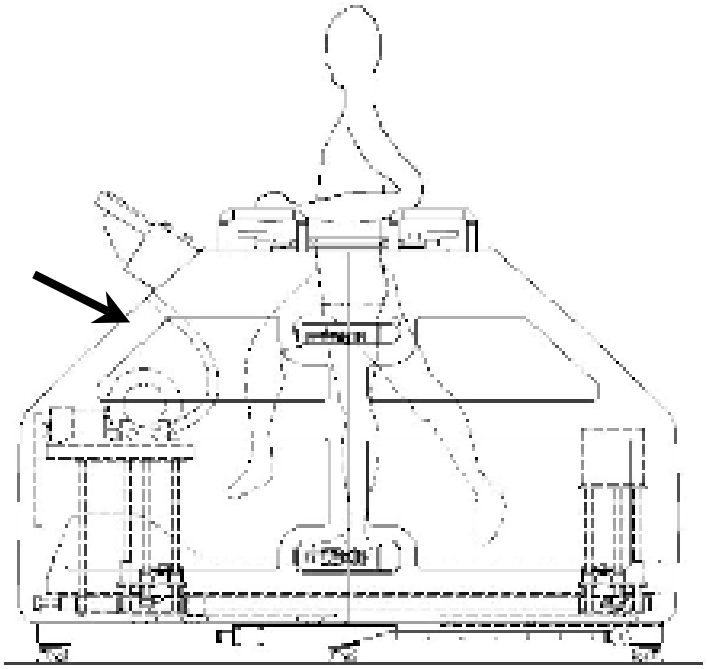
5) Kuroki H (2003) *the 14th WCPT 2003, Barcelona*

A float walking assist system using air pressure (The second generation system)

Side view

The LBPP chamber containing a treadmill, which encloses the subjects lower body in an inflatable chamber at the waist by a flexible seal, has been used.

Posterior view

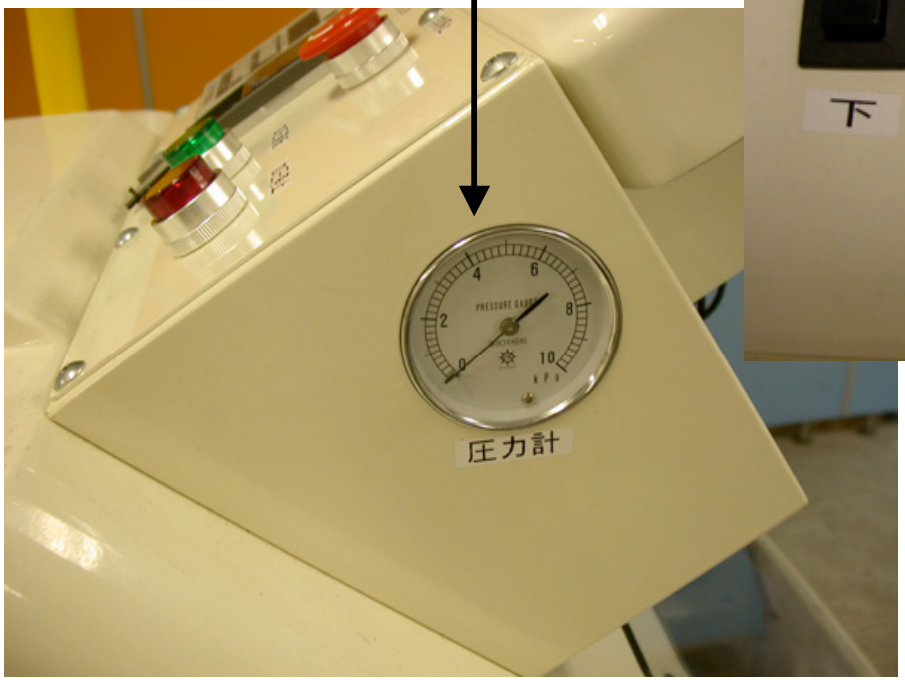


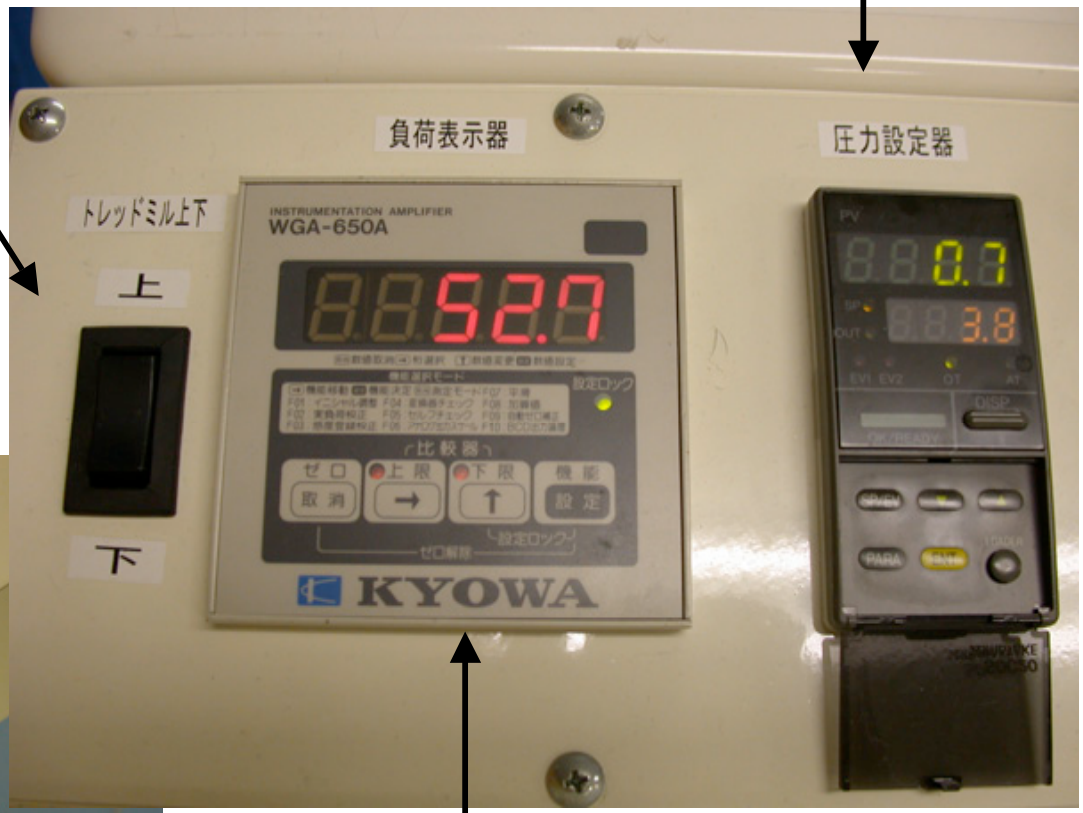
Drafting picture

A controller to elevate treadmill

An air pressure controller

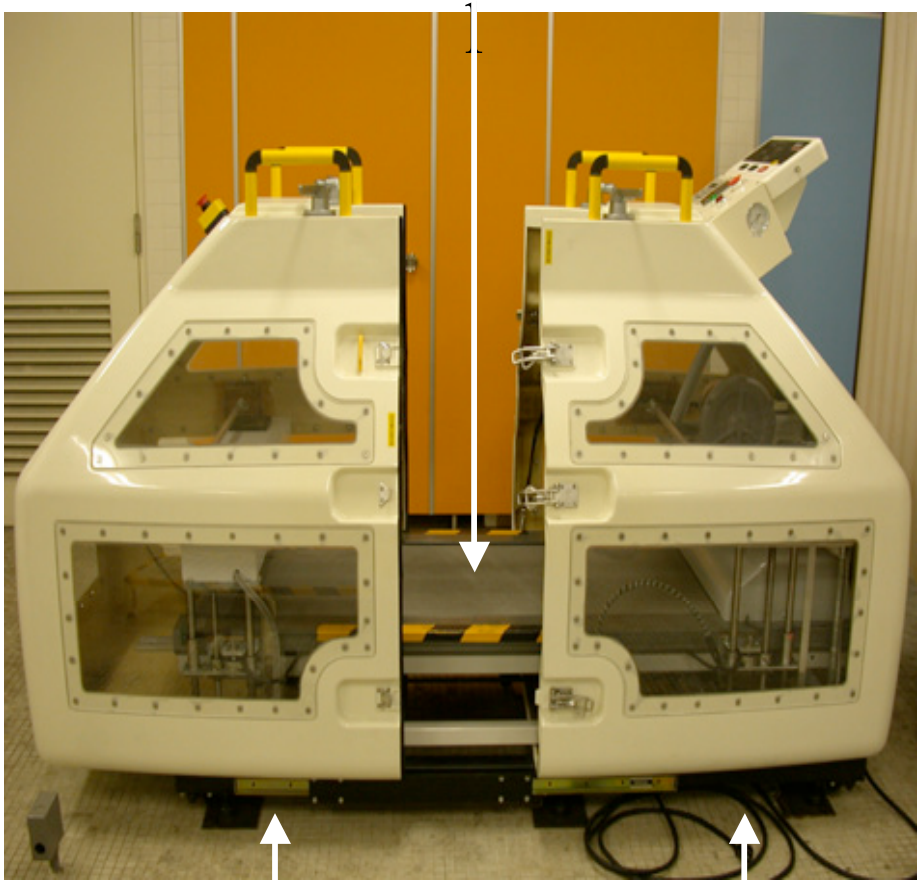
A pressure gauge



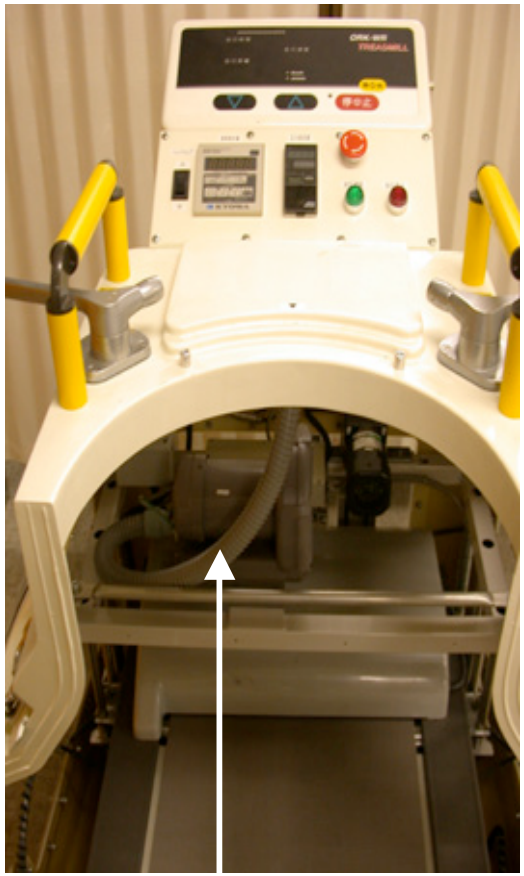


A load indicator

Treadmil



Four load cells are mounted under the treadmill



An air pressurizatio n device

A flexible seal at the waist

Subjects:	Thirteen females with hip osteoarthritis, including eight subjects who underwent total hip arthroplasty
Age (mean ± SD):	55.6 ± 7.7 years
Body height (mean ± SD) :	151.9 ± 13.2 cm
Body weight (mean ± SD) :	55.6 ± 11.8 kg
Length around the hip (level of ASIS):	90.0 ± 11.6 cm

Walking:

1) Before walking, written informed consent was obtained.
2) Target air pressure for 2/3 and 1/2 partial weight bearing was measured at standing position.
3) Each subject randomly walked at a full-weight, 2/3- and 1/2-weight bearing setting, at a speed of 1.5 km/hour.

Four measuring parameters:

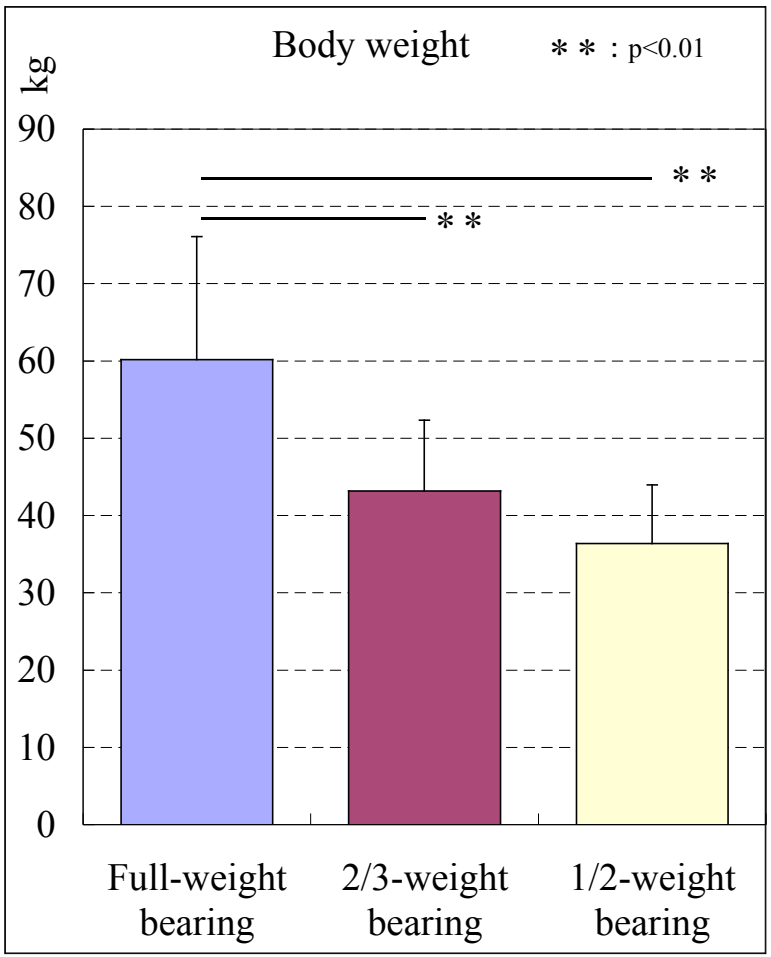
1) Maximum pressure on a foot
2) Mean pressure on a foot during the stance
3) VO_2
4) Heart rate

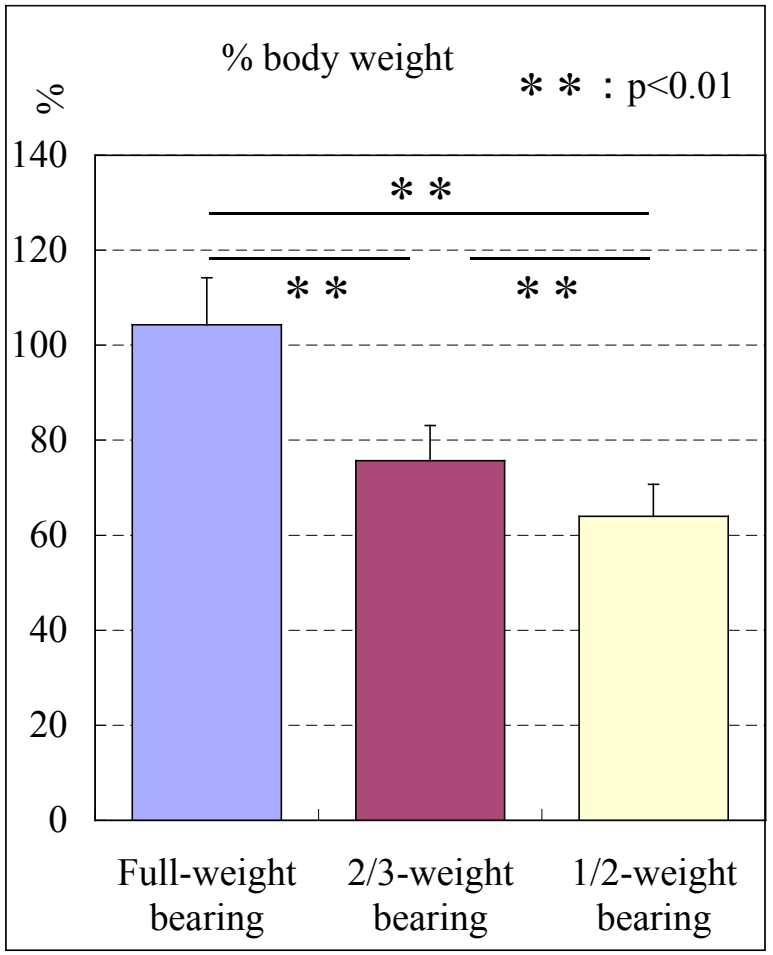
Statistical analysis: Repeated measure ANOVA and Post-hoc Sheffe's test

Pressure measuring system on a foot（MP-100, Anima Ltd., Japan）

Respiratory gas analyzer（AE-280, Minato Ltd., Japan）

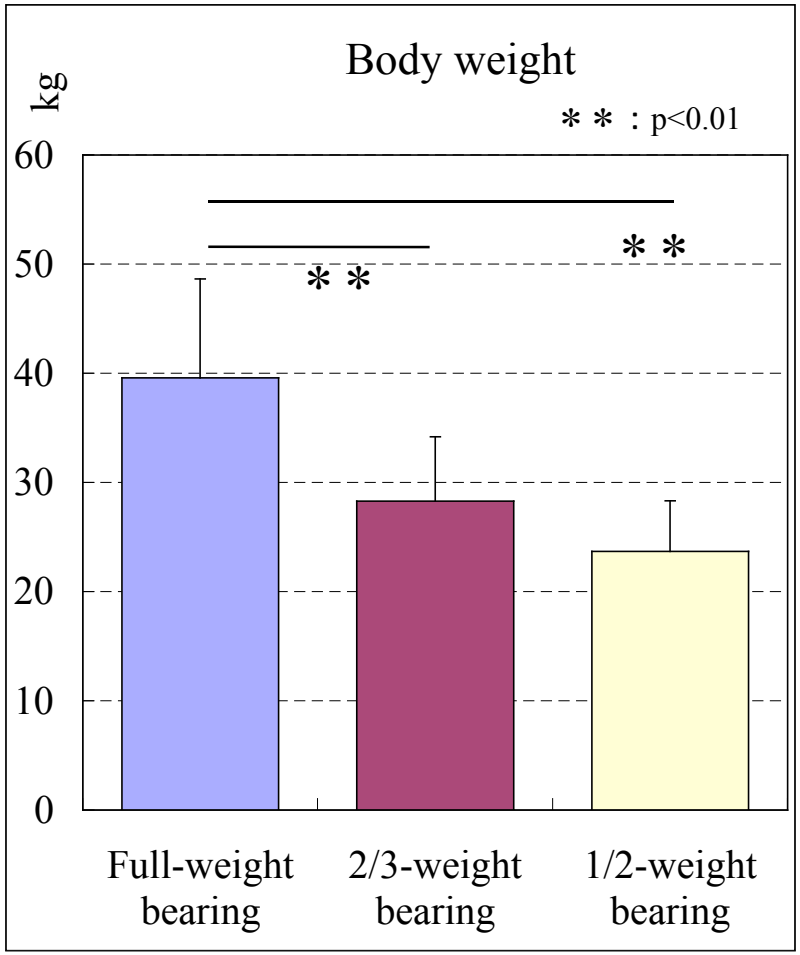
Heart rate measuring system（EBP-300, Minato Ltd., Japan）

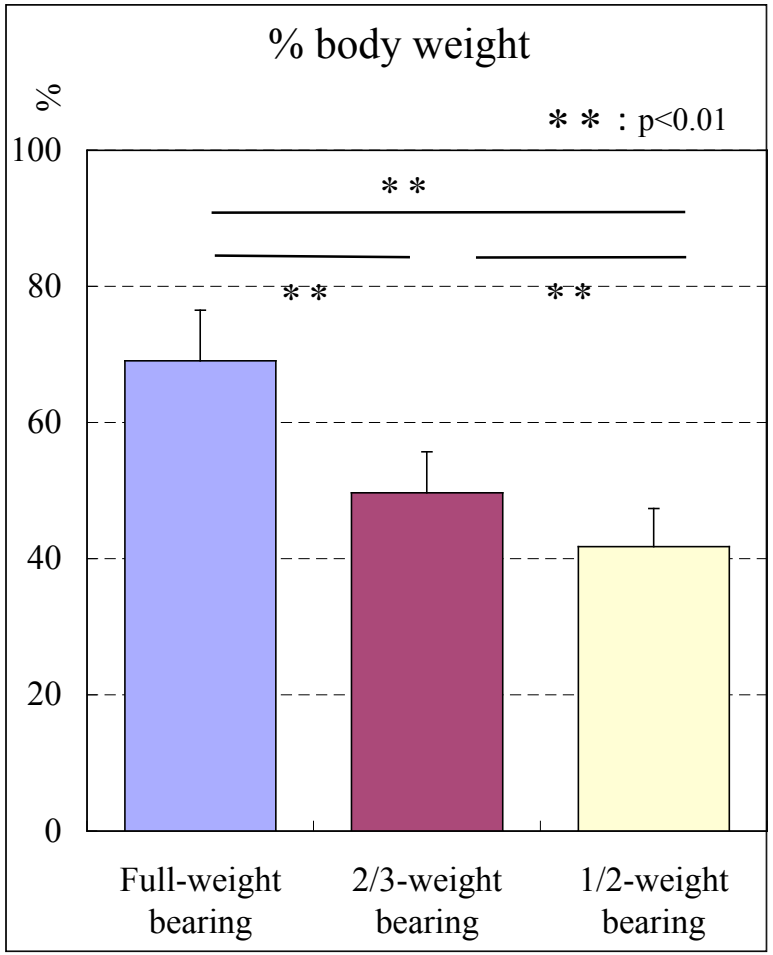




Maximum pressure on a foot

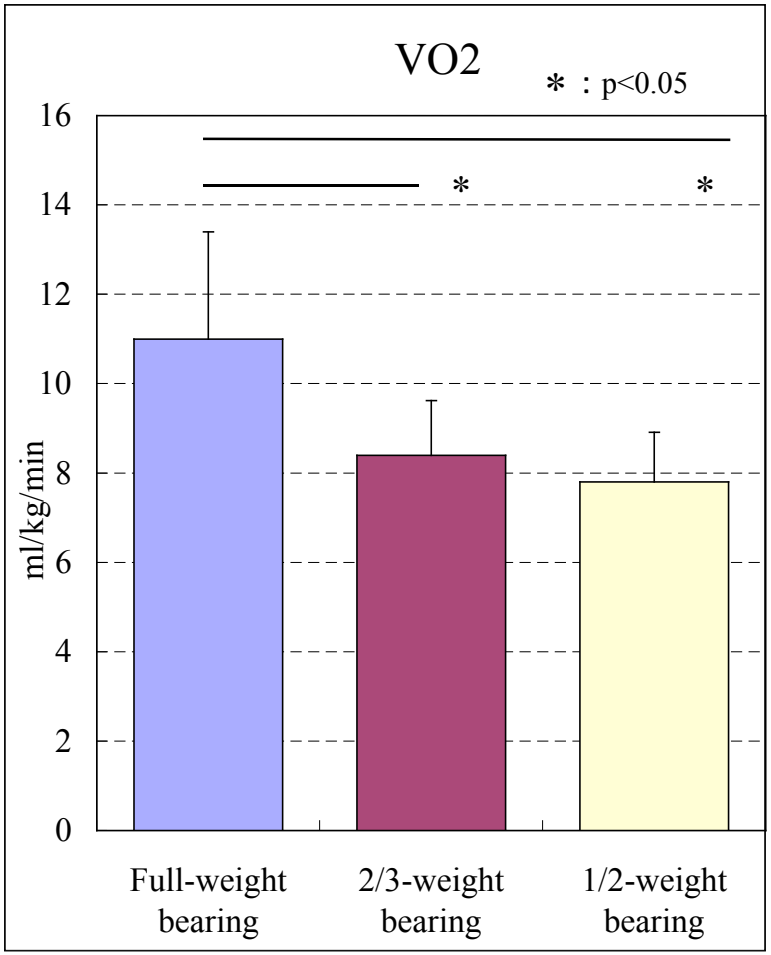
Average pressure was 2.3 kPa for 2/3- weight bearing setting and 3.2 kPa for 1/2-weight bearing setting, respectively. Maximum load on the foot at full-, 2/3- and 1/2- weight bearing settings was 104.3 %, 75.7 % and 64.0 %, respectively.

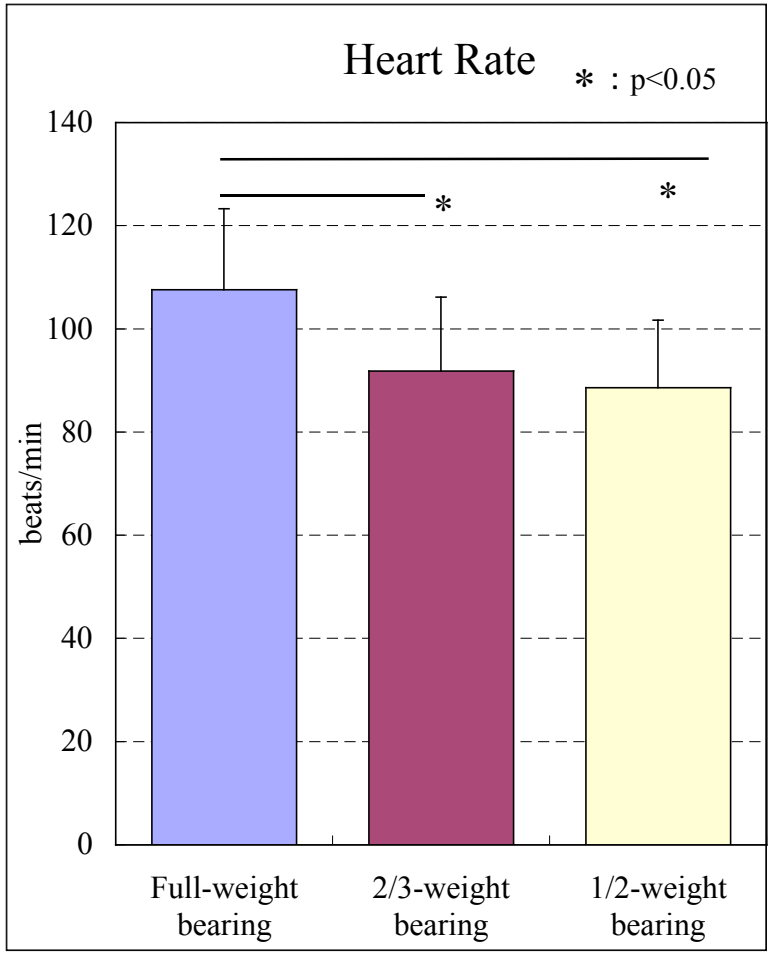




Mean pressure on a foot during stance phase

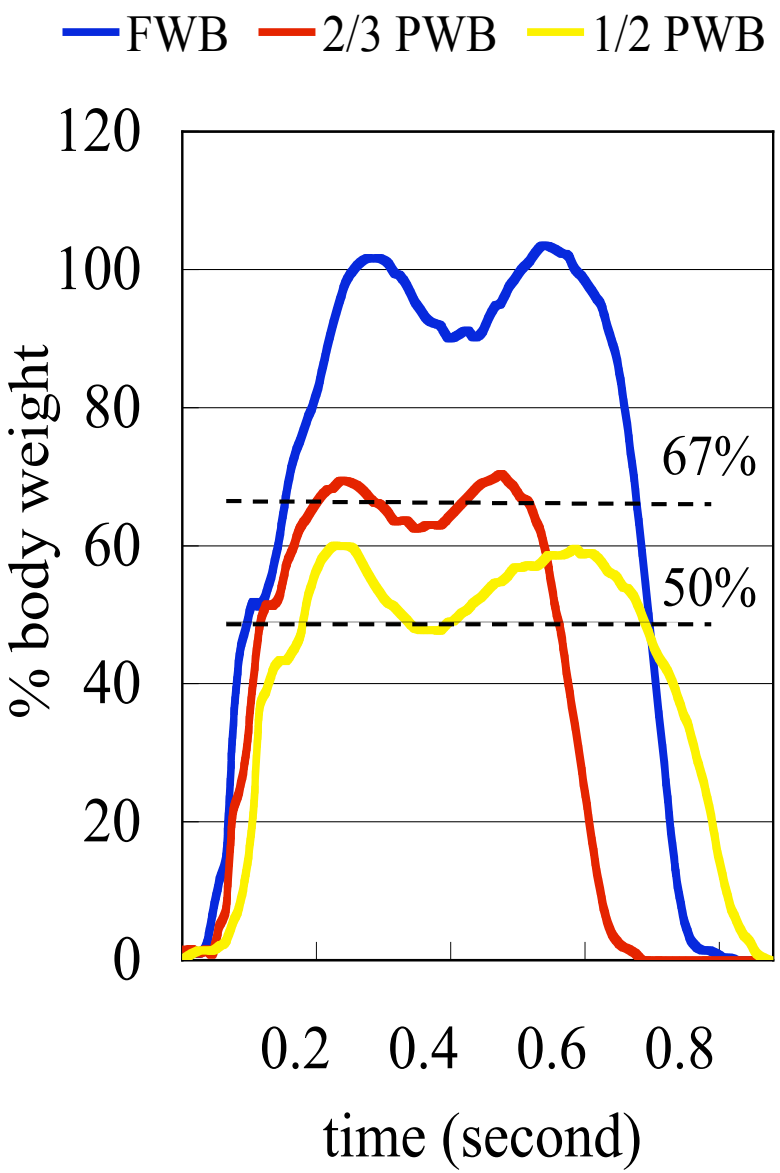
The mean pressure on a foot was 69.1 %, 49.7 % and 41.8 %, respectively.





VO_2 and Heart Rate

VO2 was 11.0, 8.4 and 7.8 mlO2/kg/min, respectively. Heart rate was 107.6, 91.8 and 88.6 beats/min, respectively.



Pressure on a foot significantly decreased at partial weight bearing settings.

The pressure pattern was two peaks that seemed to natural walking pattern.

At the 2/3-weight bearing setting, the body weight was reduced accurately.

At the 1/2-weight bearing setting with air pressure of 3.2 kPa, peak pressure was a little bit higher than the setting.

This means the air pressure was not enough to reduce the body weight.

↓

It may be controlled by additional air pressure before or during walking.

文献

黒木裕士，森永敏博，池添冬芽，大畑光司，家城弘，濱　弘道：空気圧を利用した部分荷重トレッドミル歩行が消費エネルギーに及ぼす影響　- 人工股関節置換術後患者での測定．理学療法学 2004; 31(5):319-324.

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