Points to remember and safety issues when conducting KAATSU Training
What is the difference between KAATSU belts and a blood pressure cuff?
Questions regarding belt pressure during KAATSU Training

1. Is it OK to put a higher pressure than your blood pressure?

2. Why does the optimal pressure increase as your training period continues?
<table>
<thead>
<tr>
<th>Elasticity</th>
<th>Belt width</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAATTSU Training belt</td>
<td>Yes</td>
</tr>
<tr>
<td>Blood pressure cuff</td>
<td>No</td>
</tr>
</tbody>
</table>
Fig. 1 Cylindrical model for Alexander’s arm

図1 Alexander の腕の円柱モデル
Fig 2  Stress relations between cuff’s width and center axis

図 2 カフ幅と中心軸上の応力の関係
Fig. 3 Cylindrical model for upper arm
Fig. 5 Cuff pressure transmission region
Large-cuff effect

- Cuff
- Artery
- Arterial pressure
- Pressure drop
- Flow
- Width $W < \square \times D$
Small-cuff effect

- External pressure
- Segment
- Artery
- Arterial pressure

by Alexander (1977)

\[ W > 1.2D \]
The Elasticity of Belts
Blood pressure cuff

KAATSU Belt
Outer pressure

low

high
Question regarding pressure during KAATSU Training

1. Is it OK to apply higher pressure than your blood pressure?

2. Why does the optimal pressure increase as training period continues?
KAATSU Belt is very safe to use because the width of the belt is narrow which makes it hard to pressurize at the core.

It is easy to apply pressure to frail arms (legs).
Elasticity of the Belt

When the outer pressure is low, the pressure spreads outwards.

If you want a higher pressure, it is necessary to set the outer pressure high.
Digital A.

\[ R = \frac{r}{r_o} \]
Question regarding pressure during KAATSU Training

1. Is it OK to apply a higher pressure than your blood pressure?

2. Why does the optimal pressure increase when the training period continue?
P (Pressure)

R (Vascular Resistance)

Q (Blood Flow)
Pressure (P) = Blood flow (Q) x Peripheral resistance (R)
\[ Q = \frac{Pa - Pv}{Ra + Rv} \]
\[ Q = \frac{Pa-Pv}{Ra+Rv} \times k \]

K is a fixed number
Those veins that are close to the surface are easy to occlude even with low pressure. That is why the blood flow of deeper veins increases.
Question regarding pressure during KAATSU Training

1. Is it OK to apply a higher pressure than your blood pressure?

2. Why does the optimal pressure increases as the training period continues?
If you continue KAATSU Training,

Frail arteries and veins in the deep sections [of your arms and legs] start expanding.

Vascular resistance is reduced and blood flow is increased.
Note:

This theory contains unverified parts, so please consider it as a hypothesis at this point.
Issues arise when you push yourself too hard.

I will exert myself to do the maximum repetitions for the greatest effects!
Vagovagal reflex

Stimulations caused by stress, strong pain, excretion and abdominal internal organs disease and such.

- Drop in heart rate
- Vasodilation
- Drop in blood pressure
- Unpleasant feeling,
Low blood pressure

2.4 When the exercise intensity increases, utilization of sugar increases
Necessary cautions when feeling nauseous
Things to do when feeling bad

- Lie horizontally and elevate your feet
- Check your blood pressure
- Check your pulse
- Hydrate with water
- Intake of sugar
- Electrocardiogram if available
It is important to apply pressure gradually especially for older individuals and those with disease.
Do not worry about the number of repetitions so much. Frequently look at their face (countenance) and act appropriately.
Important points for exercise remedies and how to deal with elderly users
Check the following before KAATSU Training:

- Presence of subjective symptom
- Blood pressure
- Irregular pulse
It is improper to ignore when you feel subjective symptoms.
Blood pressure

Green = men  Yellow = women

% of Japanese by gender and age who have high blood pressure
One-third of Japanese elderly people have high blood pressure. % of Japanese by gender and age who have high blood pressure.
It is important to check blood pressure before and after exercise.
Impulse conduction system of the heart

Sinus node

Atrioventricular node

Right ventricle
Left ventricle
It is common for elderly people to have no subjective symptoms.

Normal

extrasystole

Atrial fibrillation
Stroke caused by atrial fibrillation

Stroke
Because the heart operates irregularly in atrial fibrillation, stagnancy of the blood (character of the vein clot) is created.
心臓リハビリテーションの絶対的禁忌

- 急性心筋梗塞
- 不安定狭心症
- 心室頻拍あるいは重症不整脈
- 重症心不全 (NYHA class IV)
- 高度の大動脈弁狭窄症
- 急性肺塞栓あるいは肺梗塞
- 急性心筋炎あるいは心膜炎
- 急性大動脈解離

Prohibited for heart rehabilitation patients

- Acute myocardial infarction
- Unstable angina
- Ventricular tachycardia or severe arrhythmia
- Serious case of cardiac insufficiency (NYHA class IV)
- Serious aortic stenosis
- Acute pulmonary embolism or lung infarction
- Acute myocarditis or pericarditis
- Acute vena cava dissociation
Intensity of normal training

Load

負荷

回数・時間

Number of repetitions and duration
Intensity of KAATSU Training

KAATSU pressure

Load

Number of repetitions and duration
When you exercise, reactive oxygen species will be generated due to aerobic metabolism.

- Reactive oxygen originated from mitochondria increases due to aerobic metabolism
- Catecholamine in blood will be increased and Hb is autoxidated during exercise and it promotes active oxygen generation.
- Ichemia due to exercise – reactive oxygen species production from return current or inflammation reaction.

Increase of active oxygen generation during exercise is inevitable.

⇒ 運動による活性酸素産生の増加は不可避である
Oxidation stress state
smoking
Inflammation
Old age

Normal state

Active oxygen generation system

Antioxidant
Active oxygen scavenging enzyme

Active oxygen scavenging system
However, if balance is not maintained...
d-ROM (determinable reactive oxygen metabolites)⇒活性酸素代謝物測定

We do not directly measure active oxygen and free radical in vivo. Instead we comprehensively evaluate the degree of oxidation stress by measuring pyrrolidino? peroxide (oxidation stress degree marker) density with coloring reaction.

BAP（Biological Antioxidant Potential）⇒抗酸化力測定

This will measure the power to prevent the chain reaction of oxidation caused by active oxygen and free radical.
Twice a week for 40 minutes on an ergometer below your AT level
Start of heart rehabilitation
After 3 months
After 6 months

n=9
Relationships between dROM and lactic acid, white blood cell count, noradrenalin density for healthy individuals during exercise
The relationship between BAP and lactic acid, white blood cell count, noradrenalin density in healthy individuals during exercise

BAP in healthy individuals had a significant association with lactic acid, white blood cell count and noradrenalin (exercise intensity). On the other hand, no association with dROM was admitted.
The relationship between dROM and lactic acid, white blood cell count, and noradrenalin density among patients doing exercise and undergoing heart rehabilitation.
The relationship between BAP and lactic acid, white blood cell count, and noradrenalin density in patients doing exercise and undergoing heart rehabilitation.

Significant relationship between dROM and lactic acid, white blood cell count, and noradrenalin was admitted in Cardiovascular disease patients. Relationship between BAP and lactic acid was admitted too.
For healthy individuals, antioxidative activity is activated to prevent upswing in oxidation stress depending on the exercise intensity. On the other hand, for cardiovascular disease patients (elderly individuals), it is considered that oxidation stress is exacerbated depending on the exercise intensity.

It is necessary to pay extra attention to the exercise intensity for elderly patients.

The same can be said in KAATSU Training.
Young healthy individuals
Red = active oxygen species Blue = antioxidant substance

Elderly individuals and patients with cardiovascular disease

When the same load as healthy individuals is applied to the elderly individuals, it will be too stressful.
Young healthy individuals
Red = active oxygen species  Blue = antioxidant substance

Get used to it gradually

Elderly individuals and patients with cardiovascular disease

High-age, cardiovascular disease patients

Exercise intensity

Production quantity

若年健康人（運動強度曲線右に）

高齢者、心血管疾患患者（運動強度曲線左に）
If we think about the moderation of blood flow as a unique characteristic of KAATSU, it is better to gradually increase the pressure instead of increasing the load.
It is important to gradually increase the load when dealing with everyone’s physical strength and age.