Effect of foot bathing in carbonated or warm water on foot grip strength

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ABSTRACT

Some training methods are used in rehabilitation to strengthen the foot grip force. But these methods are boring and the training does not continued by people. So we tried new training methods of exercise of grasping with a toe during foot bathing. The purpose of this study is to clarify the effect of the new training methods on the foot grip strength.

Participants are ten males aged 21 to 65. They performed an exercise of gripping with toe of a foot in carbonated or warm water and another foot did same action in the air as a control. After the gripping exercise, the foot grip strength was measured again. The experiment was conducted on three conditions; (1) in 1000ppm carbonated water of 25 degree centigrade, (2) in 38 degree centigrade warm water, (3) in the air (control).

At first, participants measured foot grip strength, then they took a foot bath for 5 minutes.

The results showed that the foot grip strength tended to increase after bathing in carbonated but not changed in warm water and control. Carbonated water bathing is known to dilate peripheral blood vessels and increases blood flow. Warm bathing also expands peripheral blood flow and increases blood flow. It is not clear whether exercise training with increased blood flow increase muscle strength but it is considered that the increase of foot grip strength after the exercise in the carbonated water is due to the increased blood flow of a foot. Foot bathing is popular in Japan and if people move their foot fingers in a bath, a risk of fall in aged people will decrease through the increase of foot grip strength.

Keywords: Foot grip strength, Training, Foot bath, Carbonated water

1. Introduction

Foot grip strength can be related to the tolerance against falling in aged people. So, it is important to strengthen the foot grip strength for preventing fall of aged people. We have developed a device that measures foot grip force (Horiuchi et.al, 2008) and now we are developing the training methods to strengthen the foot grip force.

Some training methods are used in rehabilitation to strengthen the foot grip force. Gripping and moving balls by foot fingers or gripping and dragging a towel by foot fingers are the examples. But these methods are boring and the training does not continued by people. So we tried new training methods of exercise of grasping with a toe during foot bathing. The purpose of this study is to clarify the effect of the new training methods on the foot grip strength.

2. Method

Foot grip force was measured by push type measuring device which was developed by us (Fig. 1).

The experiment was conducted on three conditions; (1) in 1000ppm carbonated water of 25 degree centigrade, (2) in 38 degree centigrade warm water, (3) in the air. The carbonated water was made by Carbothera (Mitsubishi Rayon Cleansui Co. Ltd.) which can make about 1000ppm carbonated water.

Participants are ten males aged 21 to 65. At first, participants measured foot grip strength, then they took a foot bath for 5 minutes. They performed the action of gripping with toe of a foot in carbonated or warm water and another foot did the same action in the air as a control (Fig. 2).

After the gripping exercise, the foot grip strength was measured again. Then the participant performed same action with exchanged feet and measured the foot grip strength.
patients living alone would have difficulties in operating with residential patients. An issue identified by both tended to fall off. The pharmacists pointed out that if BP with thin arms, pharmacists,

3.1 Usability test

from the interviews were analyzed using a qualitative operability

2.2 Usability test

issues identified after using the system

Issues identified by pharmacist

HVN: It should be possible to manage data of multiple smartphones

Issues in the present study

It should be possible to freely set monitoring

Pairing is difficult

(VHN)

Ph)

Ph)

should be somebody to contact in case of a problem

(VHN)

P

to figure out

(VHN)

Ph)

(VHN)

Ph)

Some training methods are used in rehabilitation to

strengthen the foot grip force. Gripping and moving balls by

foot fingers or gripping and dragging a towel by foot fingers

now we are developing the training methods to strengthen the foot

strength.

Foot grip force was measured by push type measuring

grip force.

Foot grip strength after the exercise in the carbonated water is due to the

grip strength after the exercise in carbonated water but not changed in warm

water or in the air (control). Carbonated water is known to dilate

peripheral blood vessels and increases blood flow. It was thought

that the warm bathing also expands peripheral blood vessels and

increases blood flow but the magnitude of the influence is not so

large as the carbonated water bathing.

It is not clear whether exercise training with increased blood flow

increase muscle strength but it is considered that the increase of foot

grip strength after the exercise in the carbonated water is due to the

increased blood flow of a foot. Foot bathing is popular in Japan and

if people move their foot fingers in a bath, a risk of fall in aged

people will decrease through the increase of foot grip strength.

4. Discussion

The results showed that the foot grip strength tended to increase

after the exercise in carbonated water but not changed in warm

water or in the air (control). Carbonated water is known to dilate

peripheral blood vessels and increases blood flow. It was thought

that the warm bathing also expands peripheral blood vessels and

increases blood flow but the magnitude of the influence is not so

large as the carbonated water bathing.

Fig. 3 shows the result of experiment. The mean force of foot

grip tend to increase after the exercise in carbonated water

(p=0.06) but did not change after that in warm water and in the air

(control). The mean force of foot grip also tended to increase after

the exercise in the air after carbonated water or warm bathing

(p=0.06).

3. Results

Fig. 3 The mean force of foot grip before and after

exercise in footbath and in the air.

4. Discussion

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