

Improvement of range of motion (ROM) during locomotion and strength after training in community living elderly

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Purpose

Falls are well-known cause of hip fracture leading to hospitalization and bedridden among older people. Intervention programs for prevention of falls in elderly may have considerable benefits in reducing disability and health care costs. Various types of interventions targeting both community dwelling and institutionalized elderly have been reported: home modification, exercise programs, and medical and behavioral interventions individualized according to the person's risk factors.

The major factors on fall in the older people it was considered the decrease in balance, muscular strength, range of motion (ROM) in joint and walking ability. As for the characteristics of the elder walking, the slow speed, small steps, prolonged the double stance phase and the narrow range of the arm swing were proposed.

In this study for the fall prevention in elder and the improving the capability of locomotion, we proposed and executed the exercise program according to their physical fitness level in three months. The effects were examined in the physical status and the joint angle in the lower extremities during gait by using the technique of motion analysis.

Key words: Prevent of fall, older people, Exercise, Gait Analysis, Joint angle

Methods

- (1) **Subject:** 19 general elderly volunteers over 60 years old (age=63.9±3.84yr old; 1-male & 18-female) were collected to participate in a fall prevention program in Health Promoting Center. Among all of them, there were 5 with hypertension, 2 with hyperlipoidemia, 1 with diabetes, 1 with gastric ulcer and, 1with breast cancer. And 15 of them had waist pain and knee pain. During the last year, 6 subjects experienced falls and, 4 of them fell more than 2 times.
- (2) **Period:** This program was carried out from 13:30 to 15:30 each time and once per week for a total period of 12 weeks.

- (3) **Methods:** This program was designed to follow the physical fitness of those subjects before exercise. These subjects affirmed their health diagnoses, anamnesis, and so on. Furthermore, a survey was performed on fall, life style, smoking, eating and drinking, stress and related activities. The fall prevention program consisted of attitude control, muscle tension training and walk training. In details, it included stretch, balance ball, step, zigzag footwork, walk in pool, bicycle, muscle training by machine.

- (4) **Items:**
 - i. Physical characteristics: height, weight, BMI, %Fat, length of lower extremity,

- waist/hip ratio, and thigh circumference
- ii. Function: blood pressure, heart rate, bone density
- iii. Lower extremity muscle strength test: The frequency of chair stand during 30 seconds (CS-30).
- iv. Sports ability: 10m maximal walk, step on the 40cm-height box, a stride, grip, sit and reach, stand with one foot and open eyes, total body reaction time

- v. Walking analysis in left side view of subjects: free walk, maximal walk, and obstacle walk, using a high-speed video system (125f/s; software is Win-analysis). The angles of hip, knee and ankle at the moment of heel contact, toe off and mid swing were measured.

Results

During the period of 3 months, the average

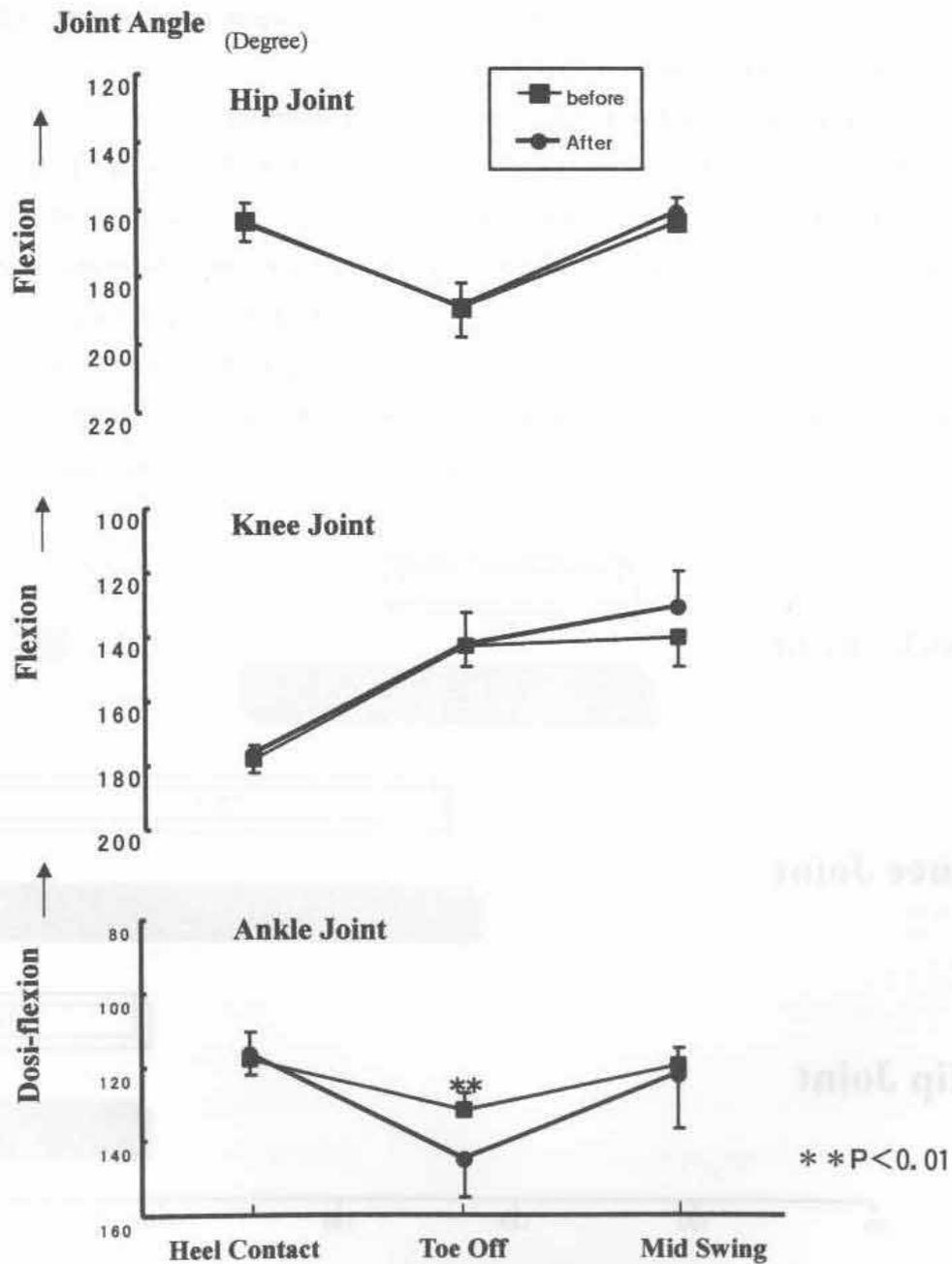


Fig.1 Phase of Gait pattern (Free-walking)

exercise frequency was 26.4 times (8~53times).

The results of form measure showed that the value of weight, BMI, waist (1.3cm declined) and %Fat (0.7% declined) decreased after exercise. But there were no significant difference between pre-exercise and post-exercise. However, the bone density decrease was significantly different between pre-exercise and post-exercise.

The results of sports ability indicated that the time of 10m maximal walk and obstacle walk were increased after exercise. The time of standing with one foot and open eyes was reduced, but it showed a greater variations. The total body reaction time was decreased. It suggested that the function of neural system has improved.

It was found that the frequency of CS-30 test was 2.4 times increased after exercise, and showed the gain in muscle strength.

Fig.1 showed that the hip and knee joint angle of post-exercise at the phase of heel contact, toe-off and mid-swing were no improvement than pre-

exercise (n=8, M±SD). However, planter flexion angle of ankle at toe-off phase was increased significantly (p<. 01). At the phase of mid swing in left foot, the mean value of knee angular changed toward the flexion. This means the foot position in swing phase elevated than pre- exercise, because of no changes in angle of hip flexion was observed.

Fig.2 showed that the range of motion of ankle, knee and hip changed between pre- exercise and post-exercise. The mean of ROM in ankle joint was significantly (p<.001). increased from 26.5 to 44.8 degree after 3 months exercise.

Discussion

For these adults living in community, the results of gait, 10m maximal walk, one step distance, obstacle walk, physical health status, BMI, body fat and body balance, which may have not an effect statistically after short-term (3 months) exercise. However hip flexibility and the range of foot joint during a free and maximal

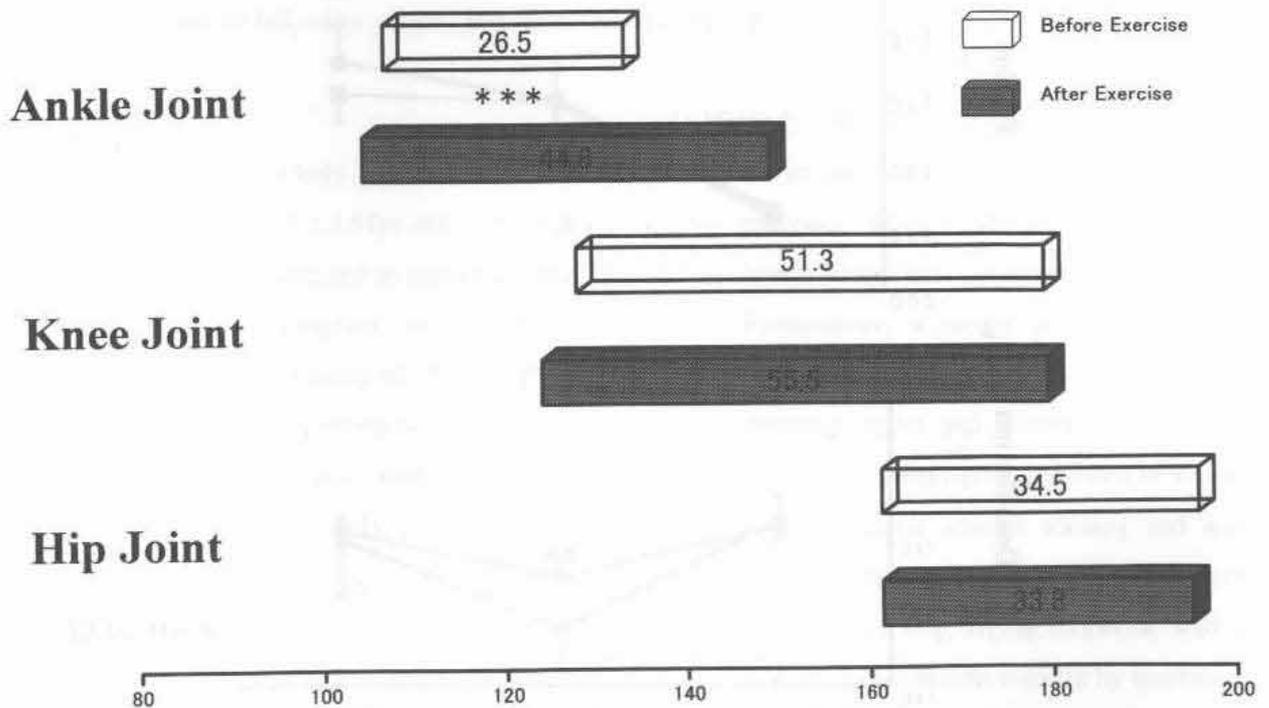


Fig.2 Range of Motion of 3 Joints before and after Exercise in Free-walking (degree)

***P<0.001

walking were improved statistically. And the mean foot angle was enlarged at toe-off in stance phase, and also the mean knee angle at mid swing phase was decreased statistically. Those seemed stronger propulsive force during the last stage of stance phase. The increasing tendency of mean lower extremity muscle strength was supported the improvement walking. It was showed recently that a 30-second (CS-30) test was a useful method for evaluating the total muscle strength of lower extremity in Japanese older people in a field setting (Nakatani et al., 2002).

These findings suggested that 3 months of a synthesis training with muscular strength, balance and walking adopted in this study may improve the movement ability with knee and ankle flexion with increasing lower limb muscle strength and range of motion in ankle joint during stance phase.

Further study was needed for the evaluation and the promotion on a gait ability preventing falls in older people.

References

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