

## **The effects of multisensory exercise on foot pressure sensitivity, balance for the elderly**

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### **ABSTRACT**

The purpose of this study is to investigate the effects of multisensory exercise on foot plantar pressure sensitivity and balance. 17 women from an elderly residence program in Seoul served as subjects for this study. 11 women served as the exercise treatment group, 6 women were the control group, and they did not exercise at all. Independent variable was multisensory exercise with multidirectional exercise equipment. Multisensory exercise program developed include proprioceptive, vision, and vestibular system. Dependent variables were Plantar Pressure Sensitivity (The sub-Metatarsal Pad Elasticity Acquisition Instrument, MPEAI) and balance test (MFT S3 Balance Test). Pre and post test results for the 12 week period were compared using the independent, paired t-test with repeated measures via PASW 18.0. There appears to be a correlation between plantar pressure sensitivity and balance. Multisensory exercise can help prevent falls while increasing the capability for daily life activity amongst the elderly.

### **1. PURPOSE**

The purpose of this study is to investigate the effects of multisensory exercise on foot plantar pressure sensitivity, balance.

### **2. METHODS**

#### *2.1. Subjects*

17 women from an elderly residence program in Seoul served as subjects for this study. 11 women served as the exercise treatment group, 6 women were the control group, and they did not exercise at all.

Table 1. Subjects

		1. Ages(yr)	2. Weights(kg)
Exercise	Mean	82.91	49.88
(n=11)	±SD	±4.09	±4.64

Control	Mean	83.33	54.17
(n=6)	±SD	±6.38	±11.97

## 2.2. Variables

Table 2. variables

variable	item	contents
Independent variable	Multisensory exercise program	1. Proprioceptive 2. Visual 3. Vestibular
Dependent variables	Plantar pressure sensitivity <b>(Soft Tissue)</b> (Chen et al., 2011),	Foot positioned on the MPEAI system 1. Hallux: 0° 2.(2 <sup>nd</sup> MTH): 0°,20°,40° 3.Heel: 0°
	Balance test	MFT Balance test V1.7 1. Back and Forth, 2. Right and Left

## 2.3. Multisensory exercise program

### 2.3.1. Proprioceptive system

- A. Upper body (water bag and ball)
- B. Lower body (surfaces, and ball)
- C. Tung exercise

### 2.3.2. Vestibular system

- A. Lower body (Surfaces)
- B. Change direction
- C. Change head
- D. Closed eyes on ky boulder
- E. Contents and principles of a multisensory balance exercise program

### 2.3.3. Visual system

- A. Close & open eye
- B. Eye tracking

### 2.3.4. Steps for Multisensory exercise (Yi,2010)

This study used variations of three different exercises to stimulate the somatosensory, visual, and vestibular systems. The first exercise involved walking and moving with a 500 ml water-filled weight. The second exercise involved seated self-massage with a knobbed, air-filled ball. The last exercise was visual tracking from a variety of positions.

### 2.3.5. Developing exercise program

-From easy to moderate & advanced gradually-

- A. Body segments
  - From one to more.

- B. Center of gravity
  - from lower to higher
  - from proximal to distal
- C. Base of support
  - from wider to narrower
- D. Direction
  - from sideward to upward, backward, and etc.
- E. Velocity
  - from slower to faster
- F. Blindfold
  - from eyes open to eyes closed
- G. Load
  - from light to heavy

### 3. RESULTS

Table 3. Paired t-test analysis for plantar pressure sensitivity for control group

	Mean	±SD	t	df	P
Hallux_0 -12weeks	82.03	±264.96	.76	5	.482
Heel_0-12weeks	-209.56	±463.78	-.78	2	.516
2 <sup>nd</sup> MTH 0°-12weeks	21.11	±34.59	1.06	2	.401
2 <sup>nd</sup> MTH 20°_0 -12weeks	61.83	±87.45	1.00	1	.500
2 <sup>nd</sup> MTH 40°_0 - 12weeks	-123.67	±187.81	-1.32	3	.279
Hallux_0 - 6weeks	5.83	±101.77	.15	6	.885
Heel_0-6weeks	-69.47	±139.35	-.86	2	.479
2 <sup>nd</sup> MTH 0°_0 - 6weeks	-20.20	±22.22	-1.82	3	.167
2 <sup>nd</sup> MTH 20°_0 - 6weeks	-84.65	±233.11	-.73	3	.520
2 <sup>nd</sup> MTH 40°_0-6weeks	-41.91	±220.66	-.38	3	.729

\*p<.05, \*\*p<.01

Table 4. Paired t-test analysis for plantar pressure sensitivity for exercise group

	Mean	±SD	t	df	P
Hallux_0 -12weeks	176.00	±157.89	3.15	7	<b>.016*</b>
Heel_0-12weeks	226.24	±186.40	2.71	4	.053
2 <sup>nd</sup> MTH 0°-12weeks	16.59	±230.88	.14	3	.895
2 <sup>nd</sup> MTH 20°_0 -12weeks	180.94	±249.04	1.62	4	.180

2 <sup>nd</sup> MTH 40°_0 - 12weeks	-100.00	±575.00	-.35	3	.751
Hallux_0 - 6weeks	124.71	±137.23	2.87	9	<b>.018*</b>
Heel_0-6weeks	186.84	±92.56	5.71	7	<b>.001**</b>
2 <sup>nd</sup> MTH 0°_0 - 6weeks	66.07	±74.11	2.36	6	.056
2 <sup>nd</sup> MTH 20°_0 - 6weeks	161.85	±254.87	1.80	7	.116
2 <sup>nd</sup> MTH 40°_0-6weeks	204.64	±159.13	3.15	5	<b>.025*</b>

\*p<.05,\*\*p<.01

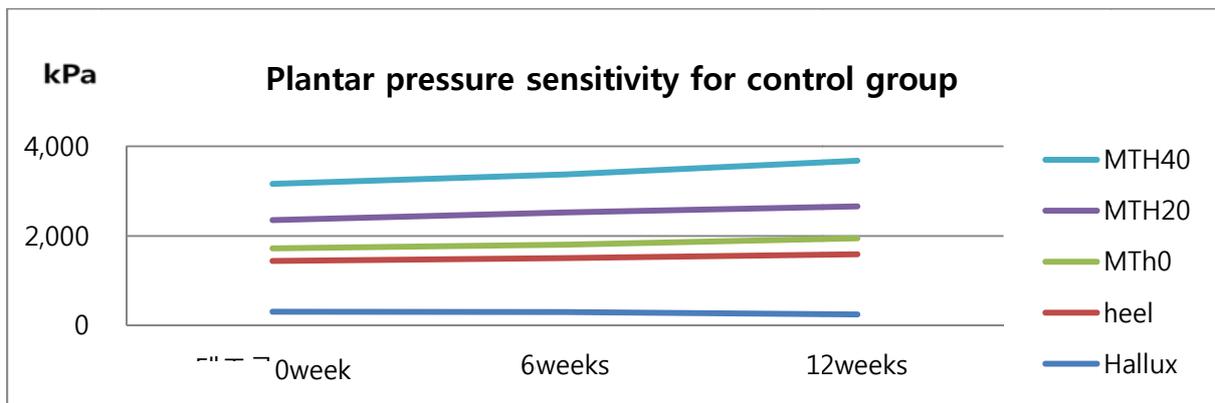


Fig 1. Plantar pressure sensitivity for control group

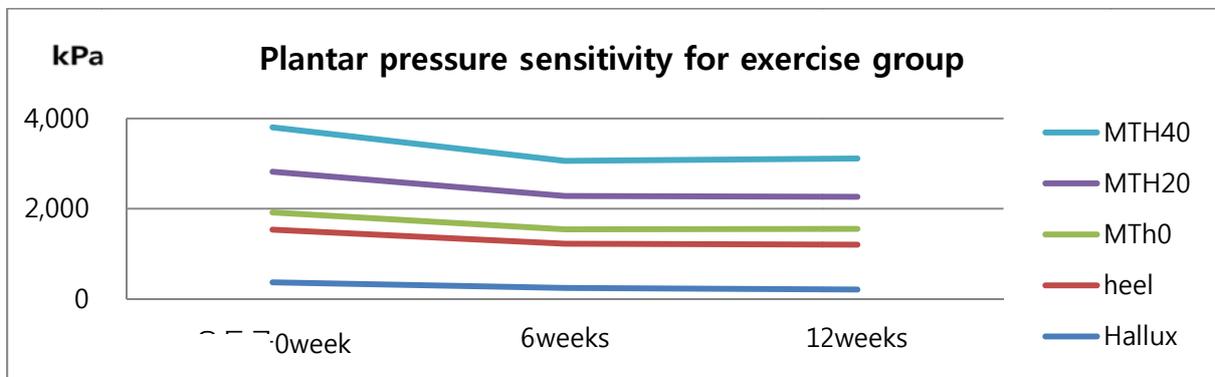


Fig 2. Plantar pressure sensitivity for exercise group

Table 5. Paired t-test analysis for MFT Balance test for control group

	Mean	±SD	t	df	P
Balance RL pre - post	.16667	±.57155	.714	5	.507
Balance FB pre - post	-.83333	±.85946	-2.375	5	.064

\*p<.05,\*\*p<.01

Table 6. Paired t-test analysis for MFT Balance test for exercise group

	Mean	±SD	t	df	P
Balance RL pre - post	.32727	±.68715	1.580	10	.145
Balance FB pre - post	.00909	±.63789	.047	10	.963

\*p<.05,\*\*p<.01



Fig 3. MFT Balance test of Right and Left

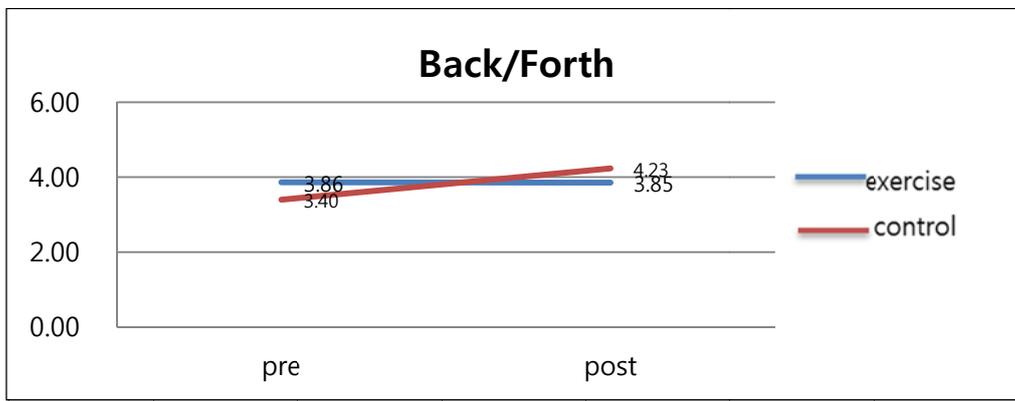


Fig 4. MFT Balance test of Back and Forth

#### 4. CONCLUSIONS

There appears to be a correlation between plantar pressure sensitivity and balance. Multisensory exercise can help prevent falls while increasing the capability for daily life activity amongst the elderly.

#### REFERENCES

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