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The Effects of Corrective Hip Joint Exercises and Foot Orthotics on RCSP, Ankle Dorsi/Plantar Flexion, Pelvic Motion, Core Muscle Strength, and Foot Pressure for Middle School Students with Pes Planus

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ABSTRACT

1. PURPOSE

The purpose of this study was to evaluate the effects of hip joint exercises and orthotics on RCSP, Ankle Dorsi/Plantar Flexion, Pelvic Motion, Core Muscle Strength, and Foot Pressure for Middle School Students with Pes Planus from Goyang City.

2. METHODS

Out of an original pool of 200 students, 60 students with pes planus (RCSP < -2) were selected for the study. These students were equally divided up into four groups with dependent variables measured at the beginning and end of the test period. However, several students did not complete the study. The first group was a combined orthotics and exercise group (12 students), the second was the orthotics-only group (9 students), the third was the exercise-only group (8 students), and the last was the control group (10 students). Exercise groups worked out twice a week for 60 minutes per session over 8 weeks. 1
Independent variables were corrective hip joint exercises and orthotics. Corrective hip joint exercises focused on increasing flexibility, muscular strength and endurance through elastic band exercises. Custom-made, rigid orthotics was used.
Dependent variables consisted of kinematic and kinetic variables. Kinematic variables were RCSP, ankle dorsi / plantar flexion, pelvic angle (medial, lateral, transverse, anterior, posterior), and Trendelenberg angle. Kinetic variables were core muscle strength, hip joint adduction / abduction muscle force, and plantar pressure (for each

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toe, rear, mid, forefoot, medial, lateral). Statistical analysis was performed via SPSS 18.0 with ANOVA, MANCOVA, and regression analysis.

3. RESULTS

A. RCSP

For all groups, the left foot was more responsive to treatment than the right foot. MANCOVA showed that RCSP improved significantly in the left foot for only the exercise group. However, regression analysis revealed that RCSP in the left foot improved significantly for all test groups, in the following order: the combined exercise and orthotics group, the exercise group, and the orthotics group. These results indicate that corrective hip joint exercise has the greatest influence on RCSP angle. By the end of the test period, all groups eliminated pes planus in the left foot.

B. Pelvic movement(pelvic medial lateral height, pelvic rotation, pelvic anterior posterior angle)

By the end of the test period, the orthotic group only significantly improved their Trendelenberg angle.

C. Muscle Strength

At the end of the test period, only the combined exercise and orthotics group significantly improved their hip flexion, abduction, and adduction muscle strength

D. Plantar Pressure

By the end of the test period, the combined exercise and orthotics group significantly increased their plantar pressure at their toes. At the end of the test period, the combined group had the greatest increase in lateral and midfoot forefoot pressure. Orthotic use resulted in the greatest increase in rearfoot pressure.

4. CONCLUSION AND SUGGESTION

These results demonstrate the different ways the distal and proximal segments are interconnected. First, these results show that corrective hip joint exercise can help correct pes planus in the subtalar joint. Conversely these results also show that the use of orthotics can effect pelvic motion, specifically Trendelenberg angle. This demonstrates the recipricol relationship between the distal and proximal leg. Although some pathologies (such as pes planus or Trendelenberg gait) may manifest at the hip or subtalar joint, the origin of these problems may lie at the opposite end of the limb. Secondly, these results show different mechanisms for engaging different regions of the foot. Corrective hip exercises had the most pronounced effect on pressure distribution in the mid / lateral forefoot and toes, while orthotics demonstrated the most pronounced effect on pressure distribution in the entire medial foot. This reflects the imbalanced muscle development exhibited by subjects with pes planus. Specifically, individuals with pes planus tend to have facilitated medial leg muscle development and inhibited lateral hip and leg muscle development. Thus, stretching and strengthening the lateral hip and leg helps correct subtalar joint misalignment. Conversely, orthotics limits excessive medial movement, increasing medial foot pressure.

In conclusion, the human body has a complex and interconnected linkage. It is critical to understand the relationships between different joint segments in order to properly address problems throughout the lower body. This study highlights the interconnected nature of both subtalar and hip joint as well as the orthotics and pelvic movement. Future studies should expand on these results to examine the relationship between the ankle, hip, and shoulder.

table 1. MANCOVA & Paired t test Result

		Left foot orthoticsot		Right foot orthoticsot	
	dependant variables	MANCOVA	paired t-test	MANCOVA	paired t-test
Kinetic Variables	RCSP	exercise	3>1>2		1>2>3
	Pelvic Elevation(Left-Right)				
	Pelvic Rotation(clockwised)				
	Pelvic Tilting				
	Trendelenburg Test_Lt				
	Trendelenburg Test_Rt	foot orthotics			
	Ankle dorsiflexion	foot orthotics			3
	Ankle Plantarflexion		3>2>1		3
Kinematic Variables	Sit up		3(-)		
	Hip Joint flexer muscles	foot orthotics		foot orthotics	
	Hip Joint adducuter muscles				1>3
	Hip Joint abducuter muscles		2>1>3	exercise *foot orthotics	1
	foot ot pressure_Hallux	exercise *foot orthotics	1		
	foot ot pressure_2nd toe	exercise *foot orthotics	1	exercise *foot orthotics	1
	foot ot pressure_3nd toe	exercise *foot orthotics	1, 4(-)	exercise *foot orthotics	1
	foot ot pressure_4nd toe	exercise *foot orthotics	1	exercise *foot orthotics	1.4(-)
	foot ot pressure_5nd toe	foot orthotics	1	exercise >exercise *foot orthotics	1. 4(-)
	foot ot pressure- foot refoot ot medial	exercise >exercise *foot orthotics>foot orthotics	1	foot orthotics>exercise *foot orthotics	
	foot ot pressure- foot refoot ot central	exercise *foot orthotics>foot orthotics>exercise	1.3(-)	exercise *foot orthotics>foot orthotics>exercise	
	foot ot pressure- foot refoot ot lateral	exercise *foot orthotics>foot orthotics>exercise	1	exercise *foot orthotics>exercise >foot orthotics	1. 3(-)
	foot ot pressure- midfoot ot medial				
	foot ot pressure- midfoot ot lateral	exercise *foot orthotics>foot orthotics	1	exercise *foot orthotics>foot orthotics>exercise	
	foot ot pressure- rearfoot ot medial	exercise *foot orthotics>foot orthotics	1	exercise *foot orthotics>exercise	1. 4(-)
	foot ot pressure- rearfoot ot central	exercise *foot orthotics>foot orthotics	1. 3(-)	exercise *foot orthotics>exercise >foot orthotics	1
	foot ot pressure- rearfoot ot lateral	exercise *foot orthotics>foot orthotics	1	exercise *foot orthotics>>foot orthotics>exercise	1

(1: exercise * FO combined), 2:FO, 3: exercise, 4: control. (-):foot pressure ↓)

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