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The Effects of 8 Weeks Corrective Exercise Program on the Navicular Height of Teens with Flat Feet

Mohammad Kolooli[1], Reza Mahdavi-Nezhad[2], and Rahim Mirnosuri[3]

[1]MA Student in Sport Pathology and Corrective Exercises in Islamic Azad University, Borujerd Branch,Borujerd.Iran
[2]Assistant Professor in Isfahan University,Isfahan.Iran
[3] Lorestan University,Iran

Abstract: Flat feet (pes planus) deformity refers to one of the most prevalent postural deformity of lower limb appearing in two types of structural and acquired. The appearance of flat feet may be as a result of a weakness in elevator muscles of navicular bone. This research is aimed at studying the effect of an 8 week corrective exercise program on the navicular height of teens with flat feet aged 12-16.

Thirty boy students with acquired flat feet deformity (with mean and standard deviation of age, length, and weight at 13.46 years, 152.46 centimeters and 46.13 kilograms respectively) participated in the study. The research is a semi-empirical study of pre and post test kind accompanied by a control group. Samples are first selected by a pedascope and then divided into two groups of control (without exercise) and corrective exercise groups. Navicular drop test was used to measure variables. The difference between two groups was studied by two sample t-test and the effect of corrective exercises on corrective exercises group and the effect of time on controlled group were examined by paired t-test.

Results showed that no significant difference was observed in pretest and posttest of control group. However, corrective exercise group had improved navicular height.

According to results, special corrective exercises were effective on the growth of navicular height. Thus, it seems that corrective exercises can effectively improve pes planus.

Keywords: Flat Feet, Special Corrective Exercises, Navicular Height

Introduction

Flat feet (pes planus) deformity refers to a postural deformity in which the arch of the foot collapses, with the entire sole of the foot coming into complete or near-complete contact with the ground. Foot flatness may be flexible or rigid. People with flat feet may suffer from biomechanically inefficient feet and ankle and walking abnormalities (Anbarian et al. 2009). Musculoskeletal weaknesses and abnormalities have been studied in sport sciences. Abnormalities are generally attributed to many reasons such as lack of movement, wrong movement, and unfavorable environmental conditions and gradually appear during childhood and developmental ages in particular (Daneshmandi et al. 2007). Comparing with other parts of body, foot goes through more structural changes. One of the most important and changeable structural properties is the height of internal longitudinal arch when enduring weight (Cavangh & Radgers, 1987). Flat feet may be the cause of biomechanical irregularities at the time of running and this may result in a pain in achilles tendon, a pain in crus and heel, hamstring strain, pain in knee and back and early fatigue (Lee et al. 2005). The best solution to heal the pain and fatigue resulting from flat feet is to carry out corrective exercises and finally endure pressures by reinforcing and stretching supporting muscles of this limb. Corrective exercises reinforce supporting and elevator muscles of longitudinal arch and may finally alleviate the side effects of flat feet and the accompanied chronic pains (Daneshmandi et al., 2007). Pfeiffer et al. (2006) estimated the prevalence of the deformity among three to four year old children at 70 percent and among five to eight year old children at 30 percent. In a study titled “biomechanical effects of framed bottom soles on people with acquired flat feet”, Arangio (2004) studied load changing and the direction of forces in people with normal feet and people with flat feet. He analyzed the reaction of a normal foot, a foot without sole and a flat foot with a kind of medical shoe sole to a 683 tone force. According to results, while using sole, a loading change from inside of feet toward outside and a reduction in the first metatarsal in about 6% of weight was observed. Moment of forces of talo-navicular joint at about 11.9 decreased to about 6 Newton. In a study on 100 people with flat feet, Wenger et al. (1989) studied the effect of three methods of treatment. Groups enjoying medical care services were given orthopedic shoes, medical shoe soles and special pads. No significant difference was observed following the examination of pressures on body. They concluded that these equipments have equal effect on feet. Regarding the high prevalence of this abnormality in societies and as foot surgeries are normally performed, people have to spend their money on surgeries and endure the side effects. Foot surgeries, however, should be performed when all corrective exercises have been done and they are not effective for abnormalities. Thus, more research is needed to achieve simple treatments without any side effects and with less cost to gain better results.

Research Methodology

Subjects

This is a field study using semi-empirical methods. The statistical population include boy students aged 12 to 16 years old in Dezful County. 964 were selected as a convenience sample by Cochran's formula for sample size calculation. Subjects were accurately examined to specify the type of feet deformity. Finally, 30 people (with mean and standard deviation of age, length, and weight at 13.46±420 years, 152.46 centimeters and 46.13 kilograms respectively) were randomly classified into two groups of control (15 people) and corrective exercises (15 people).

Data Collection Method

All people were studied on the method of performing tests and doing corrective exercises and the needed notes were explained for receiving orthopedist's confirmation forms and consent letters. According to orthopedist, deformity should be of a drop in navicular height and there should be no neuromuscular diseases, fracture and surgery in the patient's medical history. The navicular drop test was used to determine the flatness degree. Subjects sit on a chair and put their foot soles on the ground without undergoing any load. By touching the two sides of talus bone with thumb and pointing finger, orthopedist gently moves foot back and forth and the fingers are in aligned position (in neutral manner subtalar joint). In this manner, the excess of navicular bone is marked. Patient is then asked to stand up normally and undergo the weight. Navicular excess is marked again then the distance between arch and the ground level is measured. The data are recorded as a pre-test. The navicular drop test was used as a valid clinical method. ICC for left and right feet is 72% and 82% respectively.

Exercise Protocol

1. Bend your ankle up and down
2. Stretch your Achilles tendon (the tendons attaching the calf muscles to the heels) and plantar fascia (the thick connective tissue (fascia) which supports the arch on the bottom (plantar side) of the foot.) by a step
3. Stretch the Achilles tendon and Gastrocnemius muscle
4. Twist your ankle into the sole
5. Bend your ankle upward
6. Patient is asked to stand on her/his toe and take 10 to 15 steps. This strengthens sole muscles.
7. Gently hit your toes on chair
8. Move your toe backward under the resistance of rubber band
9. Collect the towel by toes

Statistical Method

To analyze descriptive data, mean and standard deviation were used and to determine the normality of data, the Kolmogorov–Smirnov test was used. Having determined the normality of data, the difference between two groups was specified by the two sample t-test and the effect of corrective exercises on corrective exercises group and passing time effect on control group were studied by paired t-test.

Research Findings

This study is aimed at studying the effect of special corrective exercises on navicular height. Table 1 compares age mean and anthropometric features of group in pre-test.

Table 1: Subjects' mean anthropometric features in control and corrective exercises groups

Group / Variable	Mean for Corrective Exercises Group	Mean for Control Group
Age (year)	13.46	13.3333
Length (centimeters)	153.6000	152.2000
Weight (kilogram)	48.5333	48.7333
BMI (kilogram per squared meter)	20.57	20.96

Table 2: Results of paired t-test to compare pre-test and post-test of navicular height in both groups

Group / Variable		Special Corrective Exercises	p-value	Control	p-value
Right Navicular Height	Before	1.35±0.29	0.004	1.38±0.30	0.334
	After	1.45±0.22		1.37±0.29	
Left Navicular Height	Before	1.43±0.27	0.008	1.38±0.22	0.082
	After	1.56±0.24		1.40±0.21	

According to a comparison between pre-test and post-test data, table 2 shows that an 8 week special corrective exercises program significantly increases the right and left navicular heights (p=0.004 and p=0.008 respectively) in corrective exercise group. And no significant difference was observed in navicular height of control group (p>0.05).

Table 3: t-test results to compare the difference of values for navicular height in both groups

Group / Variable	Special Corrective Exercises	Control	P-value
Right Navicular Height	+0.093±0.10	+0.007±0.3	0.002
Left Navicular Height	+0.127±0.16	+0.020±0.04	0.022

T-test results in table 3 reveal that there is a significant difference between values for right and left navicular heights (p=0.002 and p=0.022 respectively) in both groups.

Discussion

Results showed that there is a significant difference between longitudinal arch (right and left navicular heights) in corrective exercises group before and after the 8 week program. These results are in accord with research findings by Hasanvand et al. (2011) on 160 students with flat feet. To study the quality and observational effects of corrective exercises on flatness of feet, they used pedascope. However, in this research, navicular heights were compared to examine the effect of corrective exercises on improvement of longitudinal arch, which is the quantitative variable and variations are measurable. In a research titled “comparing the effect of a special corrective exercises program on improvement of flat feet”, Kuhi Achachluei et al. (2004) did not observed any significant correlation between a 18 session corrective exercises program and recovering the disorder. Their results did not match with results of present study. The reasons is thought to be the fewer exercise sessions (18 sessions), difference in selection of exercise protocol and most importantly the qualitative measuring method in above study. As stated in research findings, navicular heights in empirical group will increase. This means that changes in corrective exercises group are significant and shows that corrective exercises may significantly increase navicular heights in children with flat feet. And if the exercises continue, they can improve navicular heights better. However, in control group, no significant effect was observed. Thus, it can be concluded that passing time does not have any effect on longitudinal arch. Regarding the effect of corrective exercises, it can be anticipated that starting corrective exercises at lower ages and continuing them would increase the longitudinal arch and navicular heights and consequently children may recover their disorder. Corrective exercises group recover because the exercises strengthen the elevator muscles and pronator teres, decrease the external angle and increase navicular heights. To explain this subject, we can refer to a complicated process called adaptation. Body preparedness and daily activities can be effective as well. Factors such as muscular strength, flexibility and power to retain body posture contribute to the process of improvement. Wilmur et al. (2004) state that by short or long term physiologic responses, human body shows adaptation and tries to fight against pressures and recreate a suitable setting.

Conclusion

According to research results, it is concluded that corrective exercises can strengthen the elevator muscles and pronator teres and increase navicular heights in people with flat feet. Continuation of these exercises probably reduces the severity of effects and deformation of ankle and other abnormalities.

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References :

Achacheloei Kuhi., Kebreab E., Lopez S. and France J. 2004. A comparative evaluation of functions for describing the relationship between live-weight gain and metabolizable energy intake in turkeys. Journal of Agricultural Sciences, 142: 691-5.

Anbryan M., H. K. (2011). Comparison of static balance performance among adolescents with a different structure. *Research in Sports Medicine and Technology (MOVEMENT SCIENCE), Spring and Summer 2011*.

Arangio, George A, Reinert, Kristy L, & Salathe, Eric P. (2004). A biomechanical model of the effect of subtalar arthroereisis on the adult flexible flat foot. *Clinical Biomechanics, 19*(8), 847-852.

Cavanagh, Peter R, & Rodgers, Mary M. (1987). The arch index: a useful measure from footprints. *Journal of biomechanics, 20*(5), 547-551.

Daneshmandi, H., Aghabeigi, M., & Haghayegh, A. (2013). Prevalence of Musculoskeletal Symptoms among Employees of Iranian Petrochemical Industries: October 2009 to December 2012. *The international journal of occupational and environmental medicine, 4*(4 October).

Farhad, K. (2003). Comparison Of The Effects Of A Reform Movement On Flat Foot Deformity, Boys And Girls. *Ma, University Of Guilan*.

Hasanvand, b., bahrami, f., darvishi, a., karami, k., & chegeni, m. (2011). The effect of regular corrective exercise on musculoskeletal deformities in Khorramabad school girls. *Yafteh, 13*(1), 77-84.

Lee, Michael S, Vanore, John V, Thomas, James L, Catanzariti, Alan R, Kogler, Geza, Kravitz, Steven R, . . . Gassen, Susan Couture. (2005). Diagnosis and treatment of adult flatfoot. *The Journal of Foot and Ankle Surgery, 44*(2), 78-113.

Pfeiffer, Martin, Kotz, Rainer, Ledl, Thomas, Hauser, Gertrude, & Sluga, Maria. (2006). Prevalence of flat foot in preschool-aged children. *Pediatrics, 118*(2), 634-639.

Wenger, DENNIS R, Mauldin, D, Speck, G, Morgan, D, & Lieber, RICHARD L. (1989). Corrective shoes and inserts as treatment for flexible flatfoot in infants and children. *The Journal of bone and joint surgery. American volume, 71*(6), 800-810.

Wilmore, Jack H, Costill, David L, & Kenney, W Larry. (2004). *Physiology of sport and exercise* (Vol. 726): Human kinetics USA.

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