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by Agus Nugroho

THE EFFECT OF USING MEDIAL ARCH SUPPORT ON DYNAMIC BALANCE ON PES PLANUS MI NURUL KARIM COLOMADU STUDENTS

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Background: Balance is the ability to maintain the body in the center of mass against the base of support to fight gravity (center of gravity) is influenced by sensory processes or the nervous, motor or musculoskeletal system, and external effects (Bacolinni, 2013) . The low balance ability in children can result in children prone to falling and experiencing obstacles when walking. One of the factors that can cause balance disorders in children is musculoskeletal disorders in the form of foot deformities. The shape of the soles of the human foot is divided into three types, namely normal foot, pes planus and cavus foot according to the structure of the arcus pedis or the arch of the foot. This curve also serves to increase speed and agility during walking and provides stabilization and flexibility (Franco, 1987). Pes planus is a clinical orthopedic condition in which the medial longitudinal arch is not visible from birth and the area is covered with fatty tissue. The arch normally forms from the first 5 years with an age range of 2-6 years. The critical period for arch formation is 6 years of age (Campbell, 2012). In the early school years, 28% - 35% of children have pes planus deformities, 80% of whom are categorized as "moderate" (Notary, MA, 1988).
Methods and Subject: This research is a true experimental type with a type of pre and post test design which aims to determine the effect of using med arch support on the dynamic balance of pes planus students of MI Nurul Karim Colomadu.The subjects used were grade 1-5 students with the condition of pes planus at MI Nurul Karim Colomadu, who had determined the inclusion and exclusion criteria. The number of subjects was 40 people with male and female sex from a total population of 92 people.
Result : Using the Wolcoxon Correlation Test, it is known that the value of p = 0.000 (P <0.05) shows that there is an effect of the use of medial arc support on dynamic balance in flat foot patients.

Keywords: *Pes Planus, Dynamic Balance, Medial Arch Support*

INTRODUCTION

The balance ability of children at developmental age is very important to review, both in terms of balance sitting, standing, and when walking. Balance is one of the most important parts or things in activities where everyone needs balance in maintaining their body position in moving or doing activities. Balance is the ability to maintain the body in the body's center of mass (center of mass) against the base of support to fight gravity (center of gravity) influenced by sensory processes or the nervous, motor or musculoskeletal system, and external effects (Bacolinni, 2013) .

One of the factors that can cause balance disorders in children is musculoskeletal disorders in the form of foot deformities. The shape of the human foot is divided into three types, namely normal foot, pes planus and cavus foot according to the structure of the arcus pedis or the arch of the sole of the foot. This arch also serves to increase speed and agility during walking and provides stabilization and flexibility.

Early childhood is children who are aged 0-8 years according to the National association for the education of young children (Takdirotun Musfiroh, 2008). Early childhood is an important period or often called the golden age because this period only comes once and cannot be repeated. This period is a period of great potential to train and develop various aspects of children's development. Early childhood has enormous potential to optimize all aspects of development, including the development of motor skills. According to Toho Cholik Mutohir (2004), a person's motor abilities consist of several mutually supportive elements, such as strength, coordination, speed, balance, agility.

During the child's growth and development, most of the soles of the child's feet experience thickening of the soft tissue on the inner side (medial), this situation will decrease along with the growth period. One of the disorders / disorders that can cause walking difficulties is pes planus. This condition is caused by a weakness in the structures that support the longitudinal arch of the pedis, namely (1) the short muscles of the foot, (2) the plantar ligament, (3) the anterior and posterior tibial tendons.

Pes planus is a clinical orthopedic condition in which the medial longitudinal arch is not visible from birth and the area is covered with fatty tissue. Normally the arch is formed from the first 5 years with an age range of 2-6 years. The critical period for the formation of the arch is the age of 6 years (Campbell, 2012). During early school age, 28%-35% of children experience pes planus deformity, 80% of them are categorized as "moderate". After birth, 80% of flat arches or first-degree pes planus gradually change to normal curves. Arcus pes planus third degree, the frequency remains in each age strata 0-18 years. Arcus pes planus second degree, the frequency decreased partially. This applies to both men and women. Thus, it can be concluded that about 20% of the population, the arcus pedis has not yet reached its normal shape and 0.6-1.2% has overgrowth or cavus foot (Idris, 2010).

From research conducted by Roohi et. al (2013) and Dabholkar et. al (2012) that there are significant differences in static and dynamic balance and agility in children with pes planus and normal feet. In a study conducted by Ali and Mohamed (2011) there were differences in the dynamic balance between the pes planus group and the normal foot group. It can occur at any age and can occur in one or both legs. A survey of 297 schoolchildren in Allahabad, India revealed that 40.32% of children under 5 years, 22.15% of children between 5 to 10 years, and 15.48% of children over 10 years had bilateral pes planus. (Sharma et al., 2005).

According to Benedetti et.al (2011) as many as 75.3% of children with pes planus are unable to stand on one leg for a long time due to instability of the subtalar joint and the eversion position of the subtalar joint which hinders balance while standing on one leg.

From previous research that has been conducted on students of MI Nurul Karim Colomadu, it shows that there is a significant relationship between pes planus and dynamic balance with moderate correlation strength. By looking at the above phenomenon, it makes researchers interested in conducting further research from previous research by providing interventions in the form of med arch support and then examining the effect of using medial arch support on dynamic balance in pes planus students of MI Nurul Karim Colomadu.

RESEARCH RESULT

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Table 1 Distribution of Research Subjects by Gender

Gender	Frequency	Persentage (%)
Male	10	34,5
Female	19	65,5
Total	**29**	**100**

Source: Primary data, 2019

Based on table 1, the number of male subjects is less than female subjects, where the number of male subjects is 10 people (34.5%) and women are 29 people (65.5%).

Table 2 Results of dynamic balance measurements

Bakance result	N	Min	Maks	Mean	Std. deviation
Without *medial arch support*	29	2	4	3.10	0.976
With *medial arch support*	29	2	5	3.79	0.902

Source : Primary data, 2019

Based on table 2, the results of dynamic balance measurements obtained without using medial arch support are smaller than those using medial arch support. These data were obtained from the results of dynamic balance measurements which were carried out alternately on each research subject using the balance beam test.

Table 3 Data normality test

Treatment	Sig. *Shapiro-Wilk*	Description
Without *medial arch support*	0,000	abnormal
With *medial arch, support*	0,002	abnormal

**= Normality test Shapiro - wilk*
Source :Primary data, 2019

Based on table 3 above, the normality test of the dynamic balance test results using Shapiro-Wilk in the first treatment without using medial arch support showed $P = 0.000$ where the P value <0.05 so that the data was not normally distributed. While the normality test of the dynamic balance test results in the second treatment using the medial arch support, the results were $P = 0.002$ where the P value <0.05 so that the data was not normally distributed. So it can be concluded that the two data are not normally distributed. Based on the results of the normality test of the data, to determine the effect of using medial arch support on dynamic balance, a parametric test is carried out, namely the Wilcoxon test because it is paired data with a ratio measurement scale and the data is not normally distributed.

Table 4 Hipotesis test with Wilcoxon

	N	Mean
Total	29	-0.25533
Score Z	-3.503	
Asymp. Sig. (2-tailed)	0,000	

**= Hipotesis test wilcoxon*
Source : Primary data, 2019

Based on table 4 above, the results of statistical analysis with the Wilcoxon test that have been carried out have a value 1 P = 0.000 (P <0.05), so this can answer the effect of using medial arch support on dynamic balance in flat foot patients. Ho is rejected and Ha is accepted.

DISCUSSION

The research subject criteria data is primary data obtained from the results of direct measurements on the research subject. The research subjects were students of MI Nurul Karim Colomadu, with an age range of 8 to 12 years. This is in line with the theory presented by Pudjiastuti (2012) where the age of 7 to 9 years is included in late childhood which has enormous potential to optimize all aspects of development, including the development of motor skills. At the age of 7 to 12 years, children's motor skills reach the stage of specialized skills, where children master their motor skills and achieve optimal motor development. In addition, this theory is also in line with the theory presented by Permana (2013) which states that motor skills are very 2 fluential on children's development. If there is a delay in motor skills, there will be delays in the development and growth of children which will have an impact on functional abilities, especially mobility abilities such as decreased balance, increased risk of falling, and decreased walking speed (Indardi 2015). During the child's growth and development, most of the soles of the child's feet experience thickening of the soft tissue on the inner side (medial), this situation will decrease along with the growth period. One of the disorders/disorders that can cause walking barriers is flat foot (Siswiyanti et all, 2013).

A study using gait measurements by Lyn (2001), found that children with flat feet performed worse on physical tasks or were unskilled and walked more slowly than normal children. This is also in accordance with the theory presented by Idris (2010) where the flat shape of the foot without an arch is less able to function as a rigid lever system to lift the body when the foot will leave the footing in the walking process (push off phase). Whereas the normal foot has a sufficient arch so that it can be a good lever when walking. In addition, in the condition of the foot with a flat arch (flat foot) hyperpronation occurs in the medial longitudinal area, this situation causes the foot to require a large force to push the body weight forward during the take off phase so that the hyperpronated foot condition takes time to perform resupination movements and produces spring. (spring force). When compared with a normal foot shape, the time needed by someone with a flat foot arch will be longer because they have to enter a longer take-off phase and the resulting spring force is smaller so that the force when walking is smaller. Then the road speed (speed) will also be lower (Sabita, 2017).

In this study, subjects with flat foot were measured for dynamic balance without using medial arch support, then intervention was given and dynamic balance was measured using medial arch support. This intervention was given because according to what was conveyed by Sarafian SK (1983) the use of medial arch support can improve the physiology of the foot so that leverage when standing and walking will increase and cause a more even distribution of body weight. In addition, according to the assumption conveyed by Siswiyanti et all (2013) that the provision of medial arch support causes the longitudinal arch of the pedis to become more stable so that the walking function of patients with flat foot becomes better.

The dynamic balance data obtained are primary data obtained from observations using the Balance beam or horizontal balance beam. The balance beam is used to measure the balance of the research subject. According to Suyanto (2008) balance beams can be made simply from a beam placed in two places higher than the ground with a size of 15 x 120 x 20 cm, so that it can be moved around.

Based on the results of the Wilcoxon test tha 10 s been carried out with N = 29, the value of P = 0.000 (P <0.05) is statistically stated that there is a significant effect on the use of medial arch support on dynamic balance. The dynamic balance of flat foot sufferers is better when using medial arch support than without using medial arch support. If an assessment is made of the gait analysis of the research subject while walking, the use of the medial arch support is more flexible and able to adjust the movement of the foot so that the walking phase from heel strike to heel strike again can be passed well and the toe off phase can be passed without any obstacles, especially in the metatarsophalangeal section. joints. This is in accordance with what was conveyed by Siswiyanti 16 al (2013) that the selection of the use of medial arch support with flexible materials can be used to support the arch remains intact. Also presented by Willion and Barbara (2002) medial arch support from a soft material functions as a shock absorber. The heel pad will dampen or reduce the pressure on the heel. Plantar foot pressure will be distributed on the arch support, metatarsal shaft, heel, to the forefoot. Biomechanically, the medial wedge will hold the weight of the foot, especially the mid-foot (middle of the foot) so as to prevent foot pronation which disrupts balance.

If flat foot is found in children aged 8 to 12 years, intervention in the form of medial arch support can be chosen so that the dynamic balance of flat foot sufferers is faster and comfort when walking can be achieved. This is in accordance with the statement conveyed by the subject of his subordinate research, all subjects feel comfortable when walking using medial arch support. In addition, it is also in accordance with the theory presented by Dutton (2001) that soft materials can provide comfort by providing limited joint control when used.

CONCLUTION

This research was conducted at MI Nurul Karim Colomadu. In this study, 29 research subjects were male and female with a degree of flatfoot 2-3.

In this study, research subjects were selected using a purposive sampling technique and then a comparison of dynamic balance was performed without using medial arch support and dynamic balance using medial arch support.

Normality test was carried out using Shapiro-Wilk. From the results of the normality test, the data obtained are normally distributed, so the test used is the Wilcoxon test.

SUGGESTION

In this study, the researcher proposed the following suggestions: (1) The use of the two medial arch supports was carried out for a long time so that the subject was really used to it and the subject felt comfortable in using the two medial arch supports, (2) Conducted a study under the same conditions. more controlled so that the subject can concentrate fully in the research process, (3) In the future if a patient with a flat foot deformity is found, intervention can be given in the form of the use of medial arch support with the aim of providing support so that the patient's dynamic balance is not hampered and can be passed well.

REFERENCES

Abrahamova, D., & Hlavačka, F. (2008). Age-related changes of human balance during quiet stance. *Physiological research*, *57*(6).

Ali, M. M. I., & Mohamed, M. S. E. (2011). Dynamic postural balance in subjects with and without flat foot. *Bulletin of Faculty of Physical Therapy*, *16*(1).

Anzai, E., Nakajima, K., Iwakami, Y., Sato, M., Ino, S., Ifukube, T., ... & Ohta, Y. (2014). Effects of foot arch structure on postural stability. *Clinical Research on Foot & Ankle*, 1-5.

Boccolini, G., Brazzit, A., Bonfanti, L., & Alberti, G. (2013). Using balance training to improve the performance of youth basketball players. *Sport sciences for health*, *9*(2), 37-42.

Bachtiar, F. (2012). Gambaran Arkus Pedis pada Mahasiswa Ortotik prostetik. *Skripsi*. *Makassar: Prodi S1 Ortotik prostetik, Fakultas Kedokteran, Universitas Hasanuddin*.

Benedetti, M. G., Ceccarelli, F., Berti, L., Luciani, D., Catani, F., Boschi, M., & Giannini, S. (2011). Diagnosis of flexible flatfoot in children: a systematic clinical approach. *Orthopedics*, *34*(2).

Brown, S. P., Miller, W. C., & Eason, J. M. (2006). Neuroanatomy and neuromuscular control of movement. *Exercise physiology: Basis of human movement in health and disease. Philadephia: Lippincott Williams & Wilkins*, 217-246.

Campbell, S. K. (2012). The Child's Development of Functional Movement dalam Campbell, SK (ed); Physical Theories for Children.

Chang, Y. W. (2009). Postural Responses in Various Bases of Support and Visual United Stated.

Shumway-Cook, A., & Woollacott, M. H. (2007). *Motor control: translating research into clinical practice*. Lippincott Williams & Wilkins.

Dabholkar, A., Shah, A., & Yardi, S. (2012). Comparison of dynamic balance between flat feet and normal individuals using star excursion balance test. *Indian Journal of Physiotherapy and Occupational Therapy*, *6*(3), 33-37.

Dahlan, M. S. (2011). *Statistik untuk kedokteran dan kesehatan*. Penerbit Salemba.

Delitto, A. (2003). The Link Between Balance Confidence and Falling. *Physical Therapy Research That Benefits You*.

Franco, A. H. (1987). Pes cavus and pes planus: analyses and treatment. *Physical therapy*, *67*(5), 688-694.

DiGiovanni, C. W., & Greisberg, J. (2007). *Foot and ankle: core knowledge in orthopaedics*. Elsevier Health Sciences.

Harris, E. J., Vanore, J. V., Thomas, J. L., Kravitz, S. R., Mendelson, S. A., Mendicino, R. W., ... & Gassen, S. C. (2004). Diagnosis and treatment of pediatric flatfoot. *The Journal of foot and ankle surgery*, *43*(6), 341-373.

Gail, H. Flat Feet, Your Health Encyclopedia.

Horak, F. B. (2006). Postural orientation and equilibrium: what do we need to know about neural control of balance to prevent falls?. *Age and ageing*, *35*(suppl_2), ii7-ii11.

Huxham, F. E., Goldie, P. A., & Patla, A. E. (2001). Theoretical considerations in balance assessment. *Australian Journal of Physiotherapy*, *47*(2), 89-100.

Idris, F. H. (2010). Filogeni dan Ontogeni Lengkung Kaki Manusia. *Dalam Majalah Kedokteran Indonesia, Departemen Kedokteran Fisik dan Rehabilitasi Medik, Fakultas*

Kedokteran Universitas Indonesia/Rumah Sakit Dr. Cipto Mangunkusumo, Jakarta, *60*(2), 74-80.

Kitaoka, H. B., Luo, Z. P., Kura, H., & An, K. N. (2002). Effect of foot orthoses on 3-dimensional kinematics of flatfoot: a cadaveric study. *Archives of physical medicine and rehabilitation*, *83*(6), 876-879.

Knudson, D. V. (2007). *Fundamentals of biomechanics* (Vol. 183). New York, NY: Springer.

Lutfie, S. H. (2007). Hubungan antara Derajat Lengkung Kaki dengan Tingkat Kemampuan Endurans pada Calon Jemaah Haji. *Jakarta: Fakultas KedokterandanIlmu Kesehatan UIN Syarif Hidayatullah*.

Miller, C. (2010). What type of shoes do you wear.

Mineo, M. (2004). Flexible Flatfoot.

Permana, D. F. W. (2013). Perkembangan Keseimbangan pada Anak Usia 7 s/d 12 Tahun Ditinjau dari Jenis Kelamin. *Media Ilmu Keolahragaan Indonesia*, *3*(1).

Pohl, M. B., & Farr, L. (2010). A comparison of foot arch measurement reliability using both digital photography and calliper methods. *Journal of foot and ankle research*, *3*(1), 1-6.

Riemann, B. L., & Lephart, S. M. (2002). The sensorimotor system, part II: the role of proprioception in motor control and functional joint stability. *Journal of athletic training*, *37*(1), 80.

Santoso, D. (2011). Perawatan Tepat Bagi Anda yang Memiliki Telapak Kaki Datar (Flat Feet). *Sport Injuries & Rehabilitation*.

Sharma, K. N. (2005). Flat Feet: A Study of 297 School Children. *Tamanna Institute of Allied Health Scince*.

Shier, D., Butler, J., & Lewis, R. (2004). Somatic and Special Senses. Hole's Human Anatomy and physiology.

Sujiono, B., Sumantri, M. S., & Chandrawati, T. (2014). Hakikat Perkembangan Motorik Anak. *Modul Metode Pengembangan Fisik*.

Ikeda, T., & Aoyagi, O. (2008). Relationships between test characteristics and movement patterns, physical fitness, and measurement characteristics: Suggestions for developing new test items for 2-to 6-year-old children. *Human Performance Measurement*, *5*, 9-22.

Musfiroh, T. (2008). Memilih, menyusun, dan menyajikan cerita untuk anak usia dini. *Yogyakarta: Tiara Wacana*.

Watson, M. A., & Owen, B. (2008). The Human Balance System, A Complex Coordination of Central and Peripheral Systems By The Vestibular Disorders Association. Retrieved from December 12, 2017.

Wilson, M. J. (2008). Synopsis of causation pes planus. *UK: Ministry of Defence*.

Watson, M. A., Black, F. O., & Crowson, M. (2008). The human balance system: A complex coordination of central and peripheral systems. *Portland, OR: Vestibular Disorders Association*.

Wilson, M. J. (2008). Pes Planus. A synopsis of causation. *Ministry of Defense Journal*, 2-11.

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