SciMedCentral

JSM Foot and Ankle

Editorial

Effect of Longitudinal Arch Drop on Surface Pressure of Plantar Artery in Flatfoot

Junchao Guo[1], Yubo Fan[1,2], and Lizhen Wang[1,2]*

[1]*Beijing Key Laboratory of Rehabilitation Technical Aids for Old-Age Disability, National Research Center for Rehabilitation Technical Aids, PR China*

[2]*Key Laboratory for Biomechanics and Mechanobiology of Ministry of Education, Beihang University, PR China*

***Corresponding author**

Lizhen Wang, School of Biological Science and Medical Engineering, Beihang University, No.37 Xueyuan Road, Haidian District, Beijing, PR China, Tel: 86-10-82339861; Email: lizhenwang@buaa.edu.cn

Submitted: 27 March 2018

Accepted: 29 March 2018

Published: 31 March 2018

ISSN: 2475-9112

EDITORIAL

Flatfoot deformity is characterized by the medial longitudinal arch drop, heel valgus, and protrusion of talus [1]. The incidence in children and adolescents is up to 35.9-47.8% [2]. Complications of deformity with the excessive rotation of the tarsus and the instability of joints will oppress the vascular and nerve of plantar foot [3]. This cans cause the new problems of plantar fasciitis, chronic achilles tendinitis and tenosynovitis [4]. However, the relationship of these complications and vascular changes has not been illuminated by the biomechanical mechanism.

In terms of topographic foot anatomy, the foot vessels can be subdivided into two parts: a dorsalis pedis artery are the direct continuation of the anterior tibial artery and represents the main vascular supply for the toes; plantar arteries origin from the posterior tibial artery includes the large lateral and the small medial plantar artery. The lateral plantar artery ends at the base of the first metatarsal bone, where it joins the deep plantar branch of the dorsalis pedis artery to form the plantar arterial arch [5]. The rich foot vessels can provide the adequate nutritive supply with tissue [6]. However, the medial longitudinal arch drop of flatfoot oppresses the foot arch vessels to result in functional dysfunction of soft tissue [3,7]. The disorder of the internal tissues often causes some complications of hallux valgus, plantar fasciitis, Achilles tendinitis, and bone hyperplasia [8]. In addition, the anterior tibial-dorsalis pedis and posterior tibial-plantar artery are common recipient artery options in foot microsurgery. This is also favorable for clinical application to evaluate the feasibility and safety of foot surgery [3]. Therefore, investigation of the interaction mechanism between flatfoot vessels and internal tissues can well explain pathogenesis of deformity and avoid the occurrence of complications.

Except for the surgery at present, physical orthopedics for the children and adolescents flatfoot is used the most common method. Many orthopaedic methods have been used to intervene the blood circulation of flatfoot, such as custom-made insole [1], shockwave therapy [4], ultra-sound therapy and external fixator. With the help of ultrasound, imaging and plantar pressure equipments, deformity of the flatfoot arch drop can be corrected to improve the medial and lateral longitudinal arches stiffness of foot. Also, bearing ratio of flatfoot (hind foot, midfoot and forefoot) during the stance phase is changed from 1.86:0.53:1 to 1.88:0.25:1 [9]. However, it is not involved in quantitative effect of blood circulation on corrective flatfoot.

Recent studies have shown that blood circulation disorders in flatfoot deformity can cause inflammation of the internal tissues. But it is only a speculative report [7-8]. Some researchers have shown similar studies to investigate the biomechanical mechanism [10-12]. Scott found that the chronic Achilles tendinitis was due to the excessive tension of itself to weaken nutrition supply of tissue [10]. Using the technique of wave stimulation in vitro, De Sanctis illustrated that the mechanism could promote the growth of vascular endothelial cell, form the new blood vessel, increase the regional blood supply, alleviate the Achilles tendinitis and heel pain [11]. Eri used a linear regression model to compare the systolic and diastolic blood pressure of subjects. It was shown that the reasonable stimulus could ameliorate the blood pressure of ankle and improve blood circulation of foot [12]. Therefore, it is great significance for children and adolescents to illuminate the biomechanical mechanism of flatfoot complications (navicular bone pain, heel pain, Achilles tendinitis, and so on) [2].

In further work, a novel method of flatfoot study based on foot finite element model of fluid-solid coupling and experimental measurement will be used to investigate the effect of custom-made insoleon blood circulation of plantar artery in flatfoot. The more reliable and validated outcome can be provided to evaluate the results of flatfoot correction.

ACKNOWLEDGEMENTS

This project was supported by the grants from National Natural Science Foundation of China (Nos. 11572029, 11120101001, 11421202 and 11702068) and the Ministry of Science and Technology of China (2016YFB1101101).

REFERENCES

1. Chen JP, Chung MJ, Wang MJ. Flatfoot prevalence and foot dimensions of 5- to 13-year-old children in Taiwan. Foot Ankle Int. 2009; 30: 326-332.

2. Abaraogu UO, Onyeka C, Ucheagwu C, Ozioko M. Association between flatfoot and age is mediated by sex: A cross-sectional study. Polish Annals Med. 2016; 23: 141-146.

3. Toullec E. Adult flatfoot. Orthop Traumatol Surg Res. 2015; 101: 11-17.

4. Wang CJ. Extracorporeal shockwave therapy in musculoskeletal disorders. J Orthop Surg Res. 2012; 7: 11.

5. Aragão JA, Neves OMG, Miranda FGG, Leão WB, Aragão FMS, Aragão ICS. True Aneurysm of the Dorsal Artery of the Foot: Case Report and Review of the Literature. Ann Vasc Surg. 2017; 44: 414.

6. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG, et al. Inter-Society Consensusfor the Management of Peripheral Arterial Disease (TASC II). J Vasc Surg. 2007; 45: 5-67.

7. Scheinberg P, Dennis EW. The relation between arterial pressure and blood flow in the foot. Am Heart J. 1948; 35: 409-420.

8. Giannini BS, Ceccarelli F, Benedetti MG, Catani F, Faldini C. Surgical treatment of flexible flatfoot in children a four-year follow-up study. J Bone Joint Surg Am. 2001; 83: 73-79.

9. Cavanagh PR, Rodgers MM, Iiboshi A. Pressure distribution under symptom-free feet during barefoot standing. Foot Ankle. 1987; 7: 262-276.

10. Scott A, Huisman E, Khan K. Conservative treatment of chronic Achilles tendinopathy. CMAJ. 2011; 183: 1159-1165.

11. De Sanctis MT, Belcaro G, Nicolaides AN, Cesarone MR, Incandela L, Marlinghaus E, et al. Effects of shock waves on the microcirculation in critical limb ischemia (CLI) (8-week study). Angiology. 2000; 51: 69-78.

12. Eri E, Narumi F, Kiyohide T, Tetsuya O, Keiki O, Takeshi T. The Effects of Aroma Foot Massage on Blood Pressure and Anxiety in Japanese Community-Dwelling Men and Women: A Crossover Randomized Controlled Trial. PLoS One. 2016; 11: 1-13.

Cite this article

Guo J, Fan Y, Wang L (2018) Effect of Longitudinal Arch Drop on Surface Pressure of Plantar Artery in Flatfoot. JSM Foot Ankle 3(1): 1047.