

FLAT FEET AND REHABILITATION

Patricia BAŇÁROVÁ*

Faculty of Healthcare, Alexander Dubček University of Trenčín, Študentská 2, 91150 Trenčín, Slovak Republic

* Corresponding author E-mail address: patricia.banarova@tnuni.sk

Abstract

The contribution deals with problem of flat foot and its consequence on the human body. We describe the risk factors that may lead to the flat foot. The emphasis is on the possibilities of rehabilitation as a Freeman's method, orthopaedic insoles and other forms of kinesiotherapy.

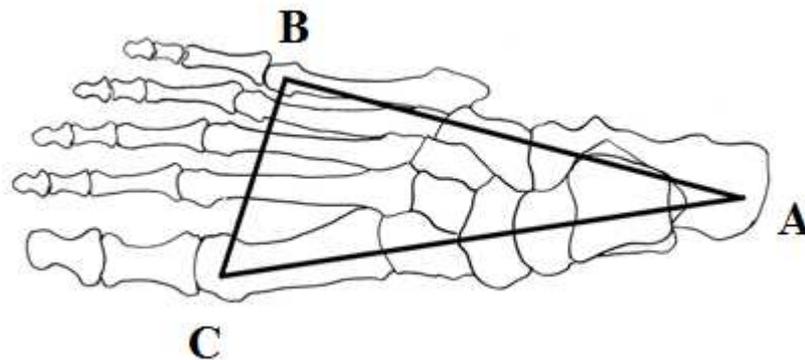
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1 Introduction

The human foot had been adapted to upright posture and bipedal locomotion during the evolution. To maintain its proper functioning is necessary a healthy foot [1], which foot means maintaining ideal shape - the right shape lateral and longitudinal arch of the foot. Such foot then provides a flexible walking and promotes healthy posture [2].

2 Foot arch

The body is stable if it is leaning on at least three points and the center of gravity is projected between them. The human foot is also not in contact with the ground by its entire surface. The weight of the body is transferred from the tibia to the talus and from the talus to the three focal points soles of the feet: head of the first and fifth metatarsal bone and protuberance calcaneus. Between these focal points are formed three arches of the foot - transversal, longitudinal medial and longitudinal lateral (fig. 1).



Legend: A – B lateral longitudinal arch; A – C medial longitudinal arch;
B – C transversal arch

Fig. 1 Arches of the foot (Modified by [3], online)

Transversal arch of the foot is located between the heads of the first and the fifth metatarsal bone. The longitudinal arch is divided into medial and lateral but the medial edge of the foot is more significant. Medial longitudinal arch is formed by talus, navicular bone, cuneiform bones, metatarsal bones Ist - IIIth and phalanges of first three fingers. The highlight of the arch is navicular bone. Lateral longitudinal arch is formed by calcaneus, cuboideum bone, metatarsal bones IVth and Vth and phalanges of 4th and 5th finger [1, 2].

The hip movements also have influence on the shape and function of the foot. If the femur is rotated inwards, patella is oriented to the thumb (medial) side and the rotation of the femur is forcing the foot into pronation. This reduces the medial longitudinal arch of the foot. If the femur is rotated outwards, patella is oriented to the little finger (lateral) side and foot tends to supination. This increases the medial longitudinal arch of the foot.

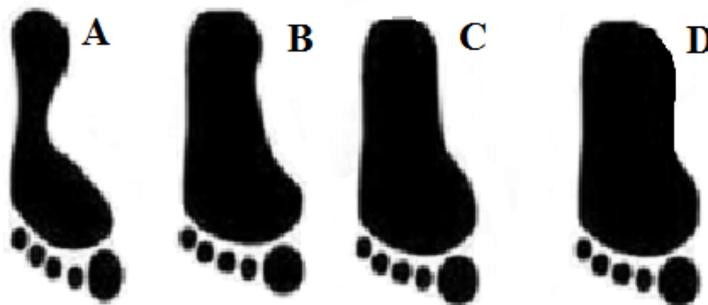
The shape of the foot arches is maintained passively through architectonics and shape of bones, joints and ligaments and also actively using the muscles of the foot and lower leg [1, 2]. The activity of long flexor hallucis muscle raises the longitudinal arch of the foot. Muscle is active during standing, unrolling feet in walking and standing on tiptoe. Therefore, it is the distance between the heel and thumb metatars shorter in standing position than lying down when the muscles supporting the arch of the foot are relaxed. The long peroneal muscle participates on maintain the shape of the transversal arch of the foot. Activity of quadratus plantaris muscle and plantar aponeurosis also stabilize the longitudinal arch [2, 4].

3 Flat foot

Saggy medial longitudinal arch is referred to as the most common pathology of the arch of the foot. Such status foot leads to valgus position of heel and frequent complication is hallux valgus [1, 2, 4, 5]. Flat foot can be congenital (e.g. steep talus congenital) or acquired (e.g. muscle weakness or part of other syndromes and diseases - e.g. Morbus Down, cerebral palsy, etc.) [6].

Flat foot is divided according to the severity of the finding on plantogram into three levels (fig. 2):

- at the first level is the longitudinal arch less cut out,
- at the second level the longitudinal arch in the load completely absent,
- at the third level is visible convex inner edge of foot on plantogram for the descended location head of talus [6, 7].



Legend: A- normal medial foot arch; B- less cut out medial foot arch, but still indicated; C- medial foot arch is completely absent; D- visible convex inner edge of foot

Fig. 2 Levels of the flat foot (Modified by [7], online)

4 Flat foot in childhood

Condition for the development of flat foot in childhood is increased weakness of ligaments. On flat foot formation can also participate obesity or malnutrition. If is so predisposed foot burdened, there is a plantar and medial decline of talus head. Calcaneus gets into valgus position and its front part rotates in the outside with the entire forefoot. Thus is center of gravity projected to the medial part of the foot, which is overburdened. Long-term exposure of the load with biomechanically inappropriate position leads to leg pain and also can lead gradually to limit movement and fixation of pathological bone position. It is important to note that the

longitudinal arch that is based at birth is filled of fat in infants and toddlers. Clinically distinct becomes the arch only after the second year of life. The pathology is the absence of medial longitudinal arch in children over three years of life [1, 4, 6].

Most pediatric flat feet shall be adjusted spontaneously. Only a small number of pediatric flat feet pass into adulthood, when they start to create the secondary structural changes of bones and fallen foot arches become rigid. Flat feet in young children are not recommended to be treated by kinesiotherapy methods. It is recommended to let the children go barefoot as often as possible in the natural terrain. Bare foot responds to the contact with terrain by dynamic contraction of muscles that control the movements of the foot and the joints [1, 6-8].

5 Flat foot in adulthood

Flat feet in adults are occurring when the load of feet exceeds the ability of feet load tolerated. Often, the cause may be also a lifestyle change. On its occurrence may thus participate static overloading feet at work, heavy lifting, or some power sports. An important factor is also wearing inappropriate footwear and overloading feet in obesity. The hormonal influences such as menopause or pregnancy also have the importance. Difficulties are first manifested by fatigue and pain in the subtalar joint, pain in the lower legs and cramps in the calf. Walking is not flexible. Influence of chain muscle activity can arise also pain in the higher parts of the body such as the hip joints and lumbosacral spine [1-4, 6, 9].

6 Consequence of flat feet on the human body

The shape of the arch of the foot significantly affects the position of the talocrural joint and thus the position of the legs, pelvis and spine. Flat foot forces valgus heel position which undermines the mechanics of walking. Not flexible walking leads to change of segments position and causes the pain in the upper parts of the body as in the joints of the knee, hip and often to the lumbosacral or cervical spine (fig. 3).

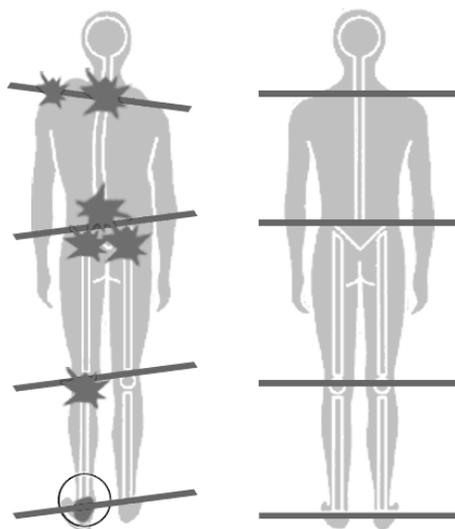


Fig. 3 Flat foot and changes in posture (Modified by [10], online)

In its capacity is the position of the foot soles closely associated with pelvic floor muscles, deep stabilization system of lumbar spine, abdominal wall muscles and upper thoracic aperture. Position of the foot greatly affects the function of pelvic floor muscles and conversely. It is also very important the connection between the hip stabilizers and feet. Therefore, we can say that foot overloading and improper ergonomics of environment or shoe are really manifested in the whole body [2, 11-13].

7 Rehabilitation

Within the framework of rehabilitation we choose exercises for short foot muscles (scrolling towel by feet, drawing by feet, taking off socks by foot, gather small items from the ground by feet, walking on the lateral side of the feet, walking on heels and tiptoe, Freeman's method - "Little Foot" - the activation of quadrat plantar muscle), also actively exercise ankle joints and toes feet (fig. 4). Suitable is barefoot walking on natural terrain (sand, cut lawn, thick carpet, not asphalt or flooring). In adults is the treatment supplemented with adequate mobilization techniques aimed at Chopart and Lisfranc joint, the talus and the mobilization of individual tarsal bones to each other. We can use elements of proprioceptive stimulation (walking on pebbles, facilitation ball and massage) [1, 8, 12].



Legend: A – taking of socks technique by flat feet; B – technique of mobilization; C – drawing by feet

Fig. 4 Flat foot and changes in posture ([14], p. 25)

Freeman's method is the most common elective procedure of physiotherapy in the treatment of flat foot. That the patient presses his toes into the ground picks up the longitudinal arch of the foot and activates muscles of foot and long peroneal muscle. So the foot gets in the correct position and create a so-called "Little Foot". Little foot is an original type of exercise that is aimed at increasing feet afferentation. This exercise activates the deep muscles of the foot and the foot is shortened and narrowed. It activates and irritates the proprioceptors in the short plantar muscles. Central nervous system receives increased number proprioceptive impulses. On this basis, then the brain will modify and choose appropriate motor programs [12, 14-16].

Shoes should be wide at the tip, comfortable, and must not hinder the movement of the toes. Orthopaedic insoles or orthopaedic shoes are ordained for patients with severe pathology. Selection of appropriate orthopaedic insoles and footwear is based on previous plantografic examination. Only then can hold the heel in the right position and prevent the valgus deflection. The rule is that inappropriately adjusted orthopedic insoles are worse than no insoles.

8 Conclusion

In this contribution we dealt with the problem of flat foot, its consequences on the postural - locomotor system and possibilities of conservative therapy - rehabilitation. The most important in children's flat foot therapy is prevention. Therefore, we do not support children to the early getting up and walking, while feet muscles are not strong enough to the child goes alone. It is important do not force little children walking and long standing (only to feeling of fatigue). If necessary, we recommend the body weight reduction. Flat foot correction by rehabilitation methods does not always lead to achieving the perfect arch shape. Rehabilitation will prevent deterioration in the status and alleviate pain in the locomotor system incurred as a consequence of flat foot.

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