

Flexible flatfoot in the childhood: negative influence of inappropriate footwear

Pie plano flexible en la infancia: influencia negativa del uso del calzado inapropiado

Juan de Dios García-Domínguez^{1*}  <https://orcid.org/0000-0003-3211-1445>

Mariela Díaz-Lima²  <https://orcid.org/0000-0002-4006-7010>

¹ Hospital Pediátrico Docente Provincial Eliseo Noel Caamaño. Matanzas, Cuba.

² Hospital Universitario Clínico Quirúrgico Comandante Faustino Pérez Hernández. Matanzas, Cuba.

* Author e-mail address: juandedios.mtz@infomed.sld.cu

ABSTRACT

An analysis was carried out in relation to the adverse effects produced by the use of inadequately made footwear in patients with flexible flat feet in pediatric ages; we carried out an anatomical-functional reminder of the foot as a basic structure for standing and walking. The functional adaptability of the feet was valued in those populations with the habit of walking barefoot, also making a description of the basic characteristics that a properly made footwear must have. We address the different therapeutic approaches and their behavior over time. We highlight the widespread use in our society of inappropriate footwear, mainly of the flip-flop type, and its negative influence on the feet of those children with flexible flat feet and valgus of the ankle.

Key words: flexible flatfoot; inappropriate footwear; children; foot deformities; gait; valgus ankle.



RESUMEN

Se llevó a cabo un análisis en relación a los efectos adversos producidos por el uso de calzados de confección inadecuada en los pacientes portadores de pies planos flexibles en edades pediátricas. Se realizó un recordatorio anatómico-funcional del pie como estructura básica para la bipedestación y la marcha. Se valoró la adaptabilidad funcional de los pies en aquellas poblaciones con hábito de andar descalzos, haciéndose, además, una descripción de las características básicas que debe reunir un calzado adecuadamente confeccionado. Se abordó los diferentes enfoques terapéuticos y su comportamiento en el tiempo, destacando el uso generalizado en la sociedad cubana de calzados inapropiados, principalmente del tipo chancletas, y su influencia negativa sobre los pies de aquellos niños con pies planos flexibles y tobillo valgo.

Palabras clave: pie plano flexible; calzado inapropiado; niño; deformidades podálicas; marcha; tobillo valgo.

Recibido: 01/07/2021.

Aceptado: 04/02/2023.

The foot as is logical to think, is an essential piece for the bipedal position and human gait, so that each of the anatomical elements which conform its structure undoubtedly plays an important role in achieving the functional harmony required both during standing and ambulation; hence it is conceptualized as the distal end of the lower limbs that serve for support and ambulation^(1,2).

Anatomically the feet consist of 107 ligaments, 19 intrinsic muscles and 26 bones, perfectly meshed, all of which make possible the necessary resistance for standing, and weight bearing, and at the same time make it flexible enough in order to perform different movements necessary for walking, jumping, running, turning, etc.⁽³⁾.

The gait is conditioned by the incidence of numerous highly complex factors that, coordinated with each other, make ambulation possible, all in direct relation to the psychomotor development achieved by the child⁽¹⁾.

It is known than the sensitive–sensorial development of the feet in infant anticipates the development of the hands by several months which provide tactile and proprioceptive information to the baby about his environment, allowing him to walk and jump around the crib, and conditioning the development of equilibrium.

In children's orthopedic consultations, one of the most frequent reason for consultation is constituted by children who are brought by their parents showing concern about the way their children walk, alluding that the child walks different from other children and fall frequently, also pointing out at times that the shape of their feet is not normal. A very high percent of adults have podalic deformities,



which reinforce the concern about their children's feet, arguing that their foot problems are a consequence of the lack of treatment during childhood^(1,4-7).

Among the higher incidence of podalic deformities is the flexible flatfoot, which principal clinical characteristic is the decrease or absence of the internal longitudinal arch of the foot, but this is not the only one deformity; in all its magnitude it is a flat-valgus-abduct and pronated foot, where these deformities appear in a variable way, constituting the valgus deformity of the ankle one of the most important and disabling^(4,8).

There are many elements to take into account when evaluating a flat foot, but in general it is important to know the patient's age, weight, family inheritance, neurological disease, etc.; sometimes young children are asymptomatic and parents show concern about their child's "ugly" feet, while in older and overweight children they can become painful from overuse during standing. A careful assessment is very important. If not, the patient could be mistreated because it can be other kind of flatfoot as congenital, neurological, etc., and not the real flexible flat foot^(4-7,9).

Regarding treatment, it has been suggested over time not to carry out any therapeutic action until after two or three years of age, since the absence of the internal longitudinal arch of the foot until then was considered physiological, especially due to the persistence of the adipose pad present in the plantar region at this stage of life; however, despite the fact that the lowering of the arch in flat feet is attributed to ligamentous laxity and not to muscular action, we are of the opinion that once the child begins ambulation, and is sufficiently cooperative, it is important to give guidance to the family members about how to strengthen the intrinsic muscles of the foot, which is not the main cause of the fall of the longitudinal arch, but plays a role in the configuration of the arch; so that it is indicated in addition to make exercises and manipulations, walking on soft surfaces such as grass, sand, wrinkling a cloth with toes, etc.

For years, the use of orthopedic footwear remained a primary guideline in the conservative treatment of flexible flat feet. Hence the initiation of some type of action aimed at promoting better development of the longitudinal arch was somewhat confused with the ideal moment for the use of orthopedic footwear. There was talk of starting treatment after two years of age, since it is at this time when there is adequate myelination of the nerve roots, the child has a better relationship with the polygon of support; there is better awareness of gait, and foot size is adequate for the use of corrective footwear. However, treatment with orthopedic shoes over time was becoming obsolete; the use of orthopedic removable insoles began to gain popularity in the orthopedic community worldwide, pointing out a series of advantages such as: it adapts so conveniently to the footwear and to the foot; it avoids making corrections to the footwear; they are easily changed and have a useful life of approximately 14 months. However, at the present time insoles have suffered the same fate as orthopedic footwear, since most authors highlight their doubtful usefulness in the treatment of flexible flat feet^(3,7,10,11).



The most widespread current consensus is that flaccid flatfoot do not need any special treatment, just try to improve the gait and support, recommending careful scrutiny of the foot worn by the child, bearing in mind the indispensable characteristic of any shoes to be protectors enough of the flatfoot in order to avoid the worsening of the deformities, mainly the pronation of the foot and the valgus of the ankle which can become very painful with the time. Therefore it is not necessary to prescribe orthopedic shoes with its uncomfortable corrections⁽⁸⁾.

The foot structurally does not exist with the purpose of being protected wearing shoes. If we observe the feet of the inhabitants of many African towns where they walk barefoot throughout their lives, a marked plantar hyperkeratosis is appreciated, protective of the tactile sensitivity of the sole of the foot, as well as from the action of external agents to which they are exposed when walking on uneven surfaces where they are exposed to all kinds of aggression. This hyperkeratosis constitutes the natural sole of their bare feet^(2,6,12).

Transposing this natural behavior of the development of the human foot from these African cultures to other cultures like ours, where the use of footwear is inescapably essential for our feet, it is vital that this footwear respond to the anatomical-physiological demands of the foot in a way that respect its anatomy, to be able to respond to the high functional requirement to which the feet are subjected; always respecting the principle of making the shoe adapt to the foot and not the foot to the footwear, beyond traditions and fashions to which we see ourselves submitted⁽¹⁰⁾.

From the very first moments in which infants are exposed to external action, their feet demand immediate protection from external aggression such as cold. When starting the march, it is necessary to wear shoes with specific conditions that protect them from inadequate plantar support and from the incoordination of movements typical of this stage of life, allowing them to be victorious in their struggle to maintain that upright balance that makes possible the start of walking; this footwear must allow the mobility of several joints that must remain free for a good execution of the ambulation⁽⁴⁾.

The foot inside the shoes must have an adequate range of mobility; the limitation within the footwear due to improper use of it, would cause weakness of the muscles, consequently delaying the learning process of walking. The shoes' toe and the buttress of the heel must be powerful in children's footwear, to which is added the need for the shoes' toe to be high and wide enough to allow a certain range of mobility of the toes, which prevents compression of these for aesthetic purposes. The reinforced buttress has the important function of protecting the heel from the natural displacement that it suffers during childhood which accentuates the valgus of the ankle. Although its tendency is to spontaneous correction over time, it is of great importance to prevent its development beyond what is physiological correct because due to intensity of the deformity and its painful symptoms it may require future surgical treatment. This can be avoided by means of a buttress that, in addition to being firm, sufficiently covers the lateral parts of the shoe, without the concept of firm and protective being misinterpreted and not being taken into account that these functions must be fulfilled respecting the adequate padding that protects the child's foot from injuries caused by poorly made footwear. Another



important feature of footwear is the flexibility of the sole, especially at the metatarsophalangeal level, which is where the main flexion of the foot occurs. The upper closure of the footwear can be with laces, Velcro or buckles, but always respecting the anatomy of the foot and avoiding excessive pressure^(13,14).

Once the anatomical configuration of the foot and its functional requirements have been exposed in a general way, as well as the conceptualization that the feet are structurally not shaped to be worn, the more general concepts in relation to the flexible flat foot and the basic requirements for the footwear fulfill with its protector function of the foot, we are in a position to carry out a summary analysis of the influence that footwear exerts on children's feet and even more so on those children who present flexible flat feet.

First of all, although in more than one study the concept is raised that the feet have not been created to wear shoes, and that they develop a protective keratosis in the plantar region that allows us to dispense with the use of footwear, we do not find in the literature reviewed studies related to the incidence and behavior of podalic deformities in those cultures where the population mostly walks barefoot; no study has investigated whether people who grew up habitually barefoot or wearing minimal shoes have stronger foot muscles than those who grow up wearing conventional modern shoes⁽¹²⁾. Thus, the relationship between foot muscle strength, footwear use, and longitudinal arch stiffness needs to be tested, but even though there are studies that indicate the absence of foot disorders in these countries, walking barefoot would not be the solution to the problems that may be generated with the use of footwear. The development of humanity has led us to dress, groom ourselves, etc., habits to which we cannot renounce; in the same way although the human being was conceived to eat raw meat, the fact that perhaps some communities maintain these eating habits does not mean that eating raw meat would be the solution to digestive problems caused by inadequate food preparation due to seasoning meats: the solution would be an adequate preparation of these. In an analogous way we can say that although the incorrect use of footwear can cause a great variety of podalic alterations, the solution to this problem would not be to give up wearing shoes, but to use correct shoes, respecting by the manufacturers the basic requirements that demand a well-made footwear that accomplish with the anatomical-physiological demands of the feet, and raising awareness on the part of everyone that to wear for a long time and continuously shoes that only respond to a fashion causes serious damage to our feet.⁽¹³⁾

In our society we observe the widespread use of inappropriate footwear, both in children and in adults; even the activities that most demand protective footwear due to the possibility of injury, are performed in flip-flops or similar footwear that not only leave the feet unprotected, but also can cause in the long term a greater damage than the one that can occur in bare feet, due to the wear that occurs in the back of the sole that favors the existing valgus position. This wear causes a greater stiffness of the ankle valgus, which constitutes one of the most important and disabling deformities that make up the flexible flat foot, a deformity that, when it becomes very pronounced or presents marked painful symptoms, often requires surgical treatment in pediatric ages.



In our view, beyond social customs, fashions, canons of beauty and even climatic requirements, anatomy and functionality of the foot must be respected by wearing shoes that meet the essential requirements of a shoe well made, especially in those children featuring flexible flat feet. The concept of lightweight footwear should not be misinterpreted with that of footwear or flip flops that have been made in order to be worn for short periods of time during the day and in specific circumstances. The permanent use and for long periods of time of flip flops and the like, as they suffer progressive wear because are made with a material not intended for this use, causes valgus deformity of the ankle and hindfoot that increases over time, becoming marked and incapacitating.

With all the above, it is necessary to call to reflection especially to adults about the need to protect the feet of our children, with special emphasis on the negative example given to the little ones with the permanent use of flip-flops in inappropriate places, both socially and labor, for the type of activity carried out. In this way, future studies should seek to show the worsening of the flat foot and the valgus deformity of the ankle related to the wear of modern shoes, flip-flops or other kind of incorrect shoes.

REFERENCES

1. Alves C, Lysenko M, Tomlinson GA, et al. Plantar flexion, dorsiflexion, range of movement and hindfoot deviation are important determinants of foot function in children. *J Child Orthop* [Internet]. 2019 Oct [cited 2021/06/12]; 13(5): 486-99. Available from: <https://journals.sagepub.com/doi/full/10.1302/1863-2548.13.190062>
2. Bogut I, Popovic Z, Tomac Z, et al. Prevalence of foot deformities in young school children in Slavonia. *Acta Clin Croat* [Internet]. 2019 Jun [cited 2021/06/12]; 58(2): 288-94. Available from: <https://hrcak.srce.hr/224449>
3. Su S, Mo Z, Guo J, et al. The effect of arch heigh and material hardness of personalized insole on correction and tissue of flatfoot. *J health Eng* [Internet]. 2017 Jun [cited 2021/06/12]. Available from: <https://www.hindawi.com/journals/jhe/2017/8614341/>
4. Pita-Fernández S, González-Martín C, Alonso-Tajes F, et al. Flatfoot in a random population and its impact on quality of life and functionality. *J Clin Diagn Res* [Internet]. 2017 Apr [cited 2021/06/12]; 11(4): LC22. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5449819/>
5. Zukauskas S, Barauskas V, Cekanauskas E. Comparison of multiple flatfoot indicators in 5-8-year-old children. *Open Med* [Internet]. 2021 Feb [cited 2021/06/12]; 16(1): 246-56. Available from: <https://www.degruyter.com/document/doi/10.1515/med-2021-0227/html>



6. Abich Y, Mihiret T, Akalu TY, et al. Flatfoot and associated factors among Ethiopian school children aged 11 to 15 years: a school – based study. PLoS One [Internet]. 2020 [cited 2021/06/12]; 15(8):e0238001. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0238001>
7. Chen KC, Chen YC, Yeh CJ, et al. The effect of insoles on symptomatic flatfoot in preschool aged children. Medicine [Internet]. 2019 [cited 2021/06/12]; 98(36). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6738981/>
8. Kim HY, Shin HS, Ko JH, et al. Gait Analysis of Symptomatic Flatfoot in Children: An Observational Study. Clin Orthop Surg [Internet]. 2017 [cited 2021/06/12]; 9(3): 363-73. Available from: <https://synapse.koreamed.org/upload/synapsedata/pdfdata/0157cios/cios-9-363.pdf>
9. Pourghasem M, Kamali N, Farsi M, et al. Prevalence of flatfoot among school students and its relationship with BMI. Acta Orthop Traumatol Turc [Internet]. 2016 Oct [cited 2021/06/12]; 50(5): 554-7. Available from: <https://www.sciencedirect.com/science/article/pii/S1017995X16301948>
10. Hsieh RL, Peng HL, Lee WC. Short-term effects of customized arch support insoles on symptomatic flexible flatfoot in children. Medicine [Internet]. 2018 May [cited 2021/06/12]; 97(20). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5976302/>
11. Jafamezhadgero A, Madadi-Shad M, Alavi-Mehr SM, et al. The long-term use of foot orthoses affects walking kinematics and kinetics of children with flexible flat feet: A randomized controlled trial. PLoS One [Internet]. 2018 Oct [cited 2021/06/12]; 13(10): e0205187. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0205187>
12. Holowka NB, Wallace IJ, Lieberman DE. Foot strength and stiffness are related to footwear use in a comparison of minimally – vs. conventionally – shod populations. Sci Rep [Internet]. 2018 Feb [cited 2021/06/12]; 8(1): 1-12. Available from: <https://www.nature.com/articles/s41598-018-21916-7>
13. Buldt AK, Menz HB. Incorrectly fitted footwear, foot pain and foot disorders: a systematic search and narrative review of the literature. J Foot Ankle Res [Internet]. 2018 Jul [cited 2021/06/12]; 11(1): 1-11. Available from: <https://jfootankleres.biomedcentral.com/articles/10.1186/s13047-018-0284-z>
14. López J, López D, López A. Influencia del calzado en el movimiento del pie durante la marcha y la carrera en niños y niñas de 6 y 7 años. Retos [Internet]. 2017 [cited 2021/06/12]; (31): 128-32. Available from: <https://recyt.fecyt.es/index.php/retos/article/view/47258>



Conflict of interest

The authors declare no conflict of interest.

CÓMO CITAR ESTE ARTÍCULO

García-Domínguez J de D, Díaz-Lima M. Flexible flatfoot in the childhood: negative influence of inappropriate footwear. Rev Méd Electrón [Internet]. 2023 Mar.-Abr. [citado: fecha de acceso]; 45(2). Disponible en:
<http://www.revmedicaelectronica.sld.cu/index.php/rme/article/view/4671/5584>

