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Research Article

Toes Flexions Test to Recognize the Functional Status of the Foot: Examples of Pathology: Knowledge from 1971

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Abstract

In children, various deformities of the feet can be found congenital, neurological, post trauma. In adults, foot deformities and pain syndromes can be a result of a changed anatomy of the foot and restricted movement of foot joints. In this article, we present the deficit of toes flexion in metatarsal-phalange joint and results of this pathology. The problem was discovered in 1971 and its many cases have been observed throughout long years of author's professional activity.

Keywords

Foot; Foot Anatomy; Foot Pathology; Toes Flexion in Metatarsal-Phalange Joint

Introduction

Feet-a part of the human body are important in standing, walking, running, jumping, everyday activities, work, sport. Thanks to a specific anatomical bone construction of the feet and full range of movements in all part of foot, we can function without any troubles, in every situation and at every stage of our lives.

Functional Anatomy of Feet

We can ask: Why are there so many bones in the foot? The answer: To enable better adaptation and stabilization in our various activities. During walking, running, jumping the feet must adapt fully to all kinds of surface, which may be uneven. In order to adapt, we need proper movement in all these joints. It is important even when the movement is in some joints minimal.

Some movements of the feet are bigger for example in the ankle joint - plantar flexion till 80 or 90 degree and smaller in dorsal flexion to 20 or 30 degree, in sub-talar joints (between talus and calcaneus bone) supination is bigger, pronation smaller. Other "bone joints" as mentioned above, have minimal movements, but which are very important in walking, running, jumping, climbing, dancing, sport etc. So many joints between so many foot bones give very good adaptation and stabilization to the ground in this various activities.

From the clinical point of view two parts and two joints play very important role in pathology of feet.

In the ankle joint, please remember it is hinge joint not only flexion is important in other words "plantar flexion" 40-60 degree but also extension other words "dorsal flexion" minimum 15-20 degree. The rotation movement in this joint is pathological and we described this problem in an article published in the USA, India, Czech Republic [1-9].

Other important joints in the feet are: metatarsal phalanges joints of all toes. Proper range of plantar flexion in these joints is very important and this problem is the subject of the paper.

Description of the Toes Flexion Test

We have devoted two publications to this problem: in Polish Journal in 1971 and in German Journal in 1985 [8-16]. We have found, that toe flexion in other words "plantar flexion" of toes in metatarsal-phalange joints is different in children (Fig. 1,2), in youth and in adults (Fig. 3). We present the range of the movement in connection to the age in the Table 1 and Fig. 4.

In children, plantar flexion of toes varies from 50-80 degrees, in youth and some adults it is 20-30 degrees. This range of movement we see as physiological. But in some adults, seldom in younger persons, the range of flexion is limited to 0 degree or even toes are in hyperextension position in metatarsal-phalange joints and these feet are painful and mostly deformed (Fig. 5-8).

In the paper, we present also two other forms of feet pathology connected with limitation of plantar flexion of toes. It is the Friedreich Syndrome (Fig. 10,11) and the other group consists of patients with the Köhler II disease. It is an aseptic necrosis of metatarsal bones heads mostly second, and mostly connected with using of improper shoes (Fig. 12-17) [17-19].

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Figure 1: Child-1 month old. Physiological position of the toes in both feet.

Figure 2: The same child- 1 month old. Physiological flexion movement of toes in right foot. Extension position of toes in the left foot. At this age - physiological.

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Figure 3: Female, 19. Full active flexion of toes both feet. Physiology. No problems with walking and with daily activities.

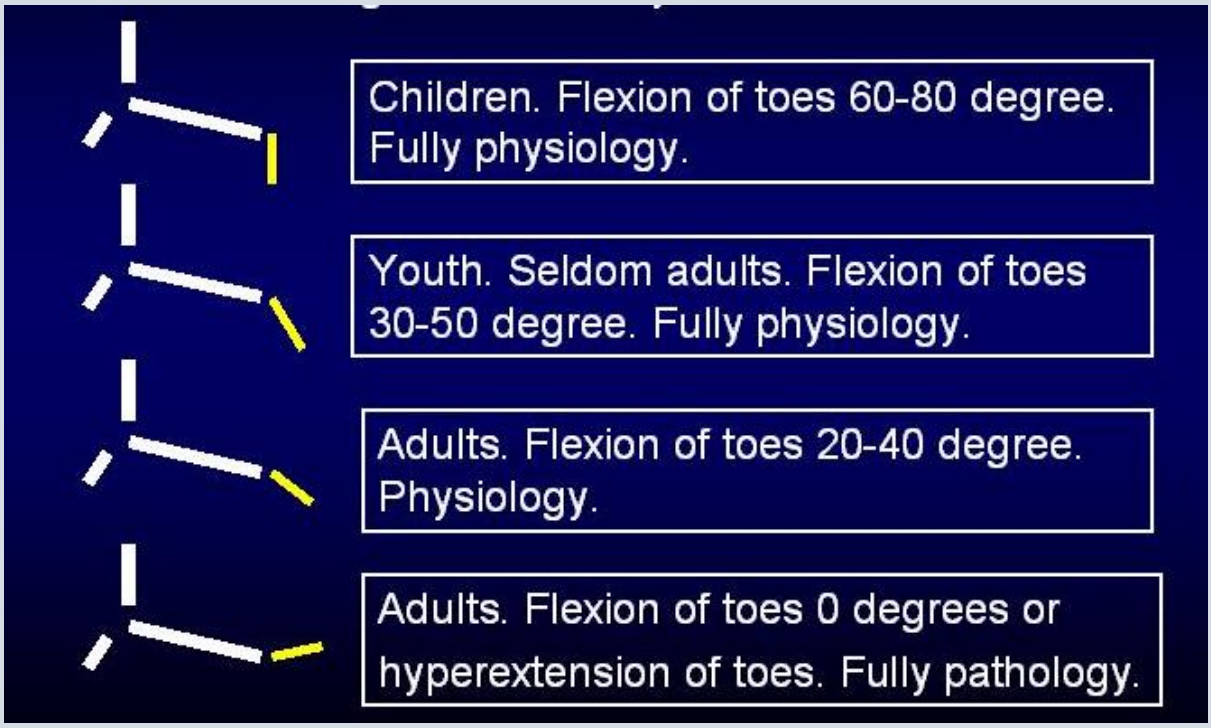

Figure 4: Flexion of toes in metatarsal-phalange joints. Connection with age and anatomy of feet.

Figure 5: Flexion test. Female, 65. Pain in feet, more in the right foot. Problems with walking. Smaller range of flexion of toes right foot. Additionally scoliosis 1st type with lumbar left and thoracic right convex curve. Spine deformity connection with permanent standing 'at ease' on the right foot and with the gait.

Figure 6: Flexion test. Female, 54. Pain in feet. Problem with walking. Range of flexion of toes in metatarsal-phalange joints limited. It means functional pathology. Additionally degenerative scoliosis lumbar left convex- 2nd type. Arthrosis in right hip. Cause of spine deformity- permanent standing 'at ease' on the right leg.

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Figure 7: Flexion test. Man, 66. Pain in feet. Problem with walking. Range of flexion of toes in metatarsal-phalange joints limited full pathology. Additionally scoliosis 3rd type, without visible curves. Cause of spine deformity walking.

Figure 8: Flexion test. Female, 69. Pain in feet. Problems with walking. Range of flexion of toes in metatarsal-phalange joints pathology. Skin changes in result of over stress and no proper function of toes.

Figure 9: Female, 70. Flexion test. Extensive pain in feet, fully unable to walk. Range of flexion of toes in metatarsal-phalange joints maximal pathology. The cause of hallux valgus deformity both sides and fully extension position of toes wearing improper shoes in the youth.

Figure 10: Male, 18. (A) Friedreich Syndrome. Big deformity of feet since birth. (B) Normal walking impossible pain. (C) Changes of skin in plantar surface of feet. Maximal pathological flexion toes test. In plan surgery.

Figure 11: Male, 16. Friedreich Syndrome. Big deformity of feet. Unable to walk normally. Pain in feet. Maximal pathological flexion of toes. (A)-Before surgery. (B)-After surgery. Long-time physiotherapy to obtain toes flexion. Result after 6 months - no pain, better walking.

Figure 12: Female, 17. Typical symptoms of Köhler II disease in the right foot. She used only narrow shoes what excluded the plantar flexion of toes. In result aseptic necrosis of second metatarsal bone head. Pain. Swelling (arrow). Flexion test-hinge movement of this toes, irregular surface of the metatarsal second bone head (arrow).

Figure 13: Female, 17. Köhler II disease of right foot. X-ray picture of frontal parts of both feet. The changes in the head of the II-nd metatarsal bone are distinctive (arrow). The head no circle shape, structural changes in the bone.

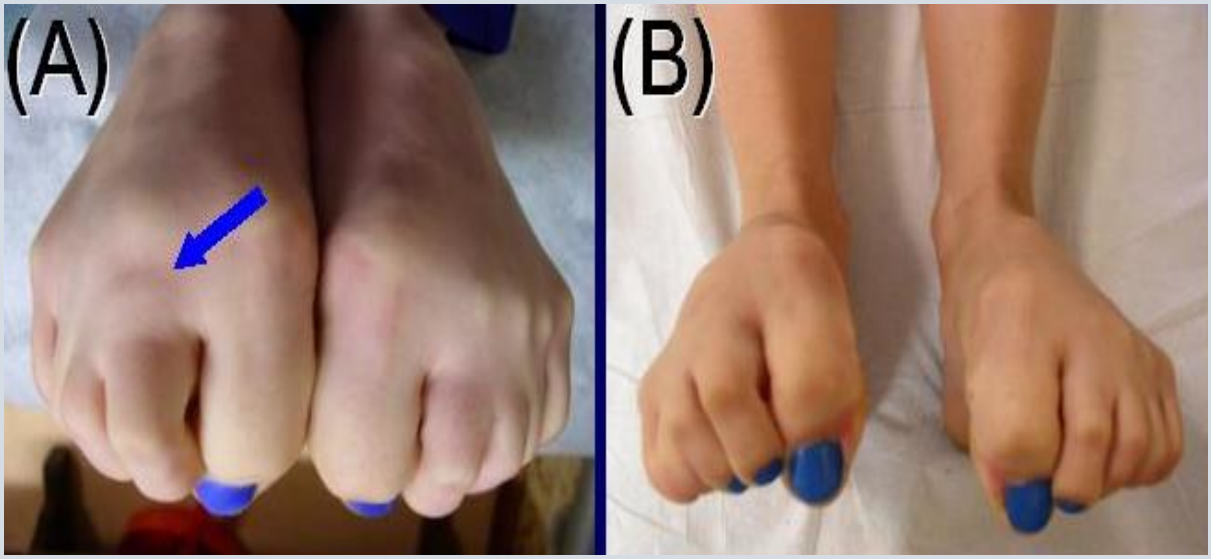

Figure 14: Female, 17. (A) Typical symptoms of Köhler II disease in the right foot. (B) After three (3) months of therapy flexion exercises of the feet in warm water and without water, every day. She obtained symmetrical flexion of toes of both feet. No more pain. Normal walking. Happy.

Figure 15: Female, 20 with Köhler II disease in the left foot (arrow). She used improper, fully incorrect shoes (Fig. 15a), too narrow in front part with heels too high. In such shoes, toes flexion is impossible. Destroyed blood circulation - in result Köhler II disease. Such shoes should only be used occasionally and over very short periods of time.

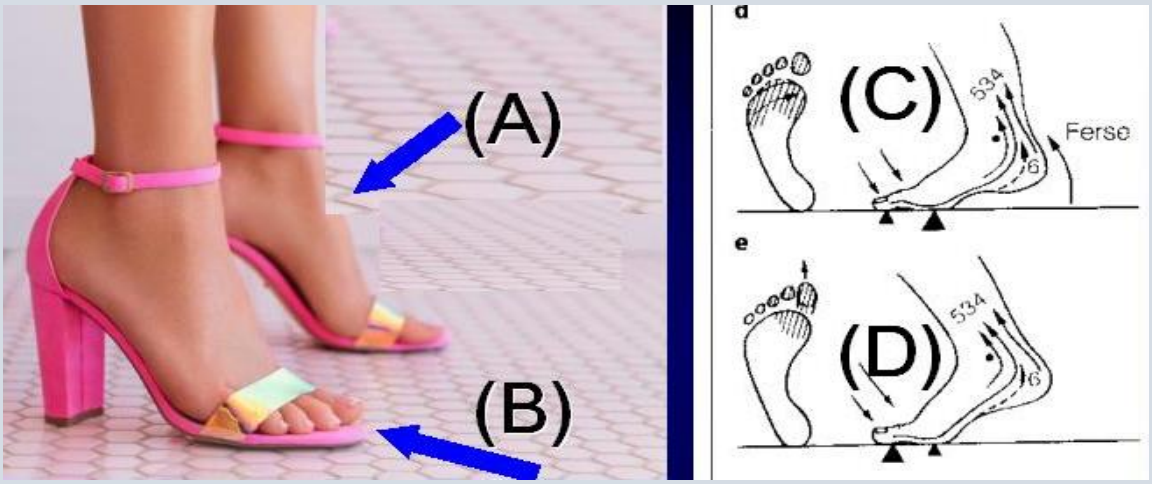

Figure 16: Improper shoes (Fig 16a - picture taken from the Internet). Heels too high. (A) Feet in plantar flexion. With the time limited dorsal flexion. (B) Toes in dorsal flexion. No possible proper gait. (Fig. 16b - picture taken from Prof. Günter Wellmitz's Book, Germany). (C) Not possible propulsion, disturbed walking. (D) Not possible propulsion, disturbed walking.

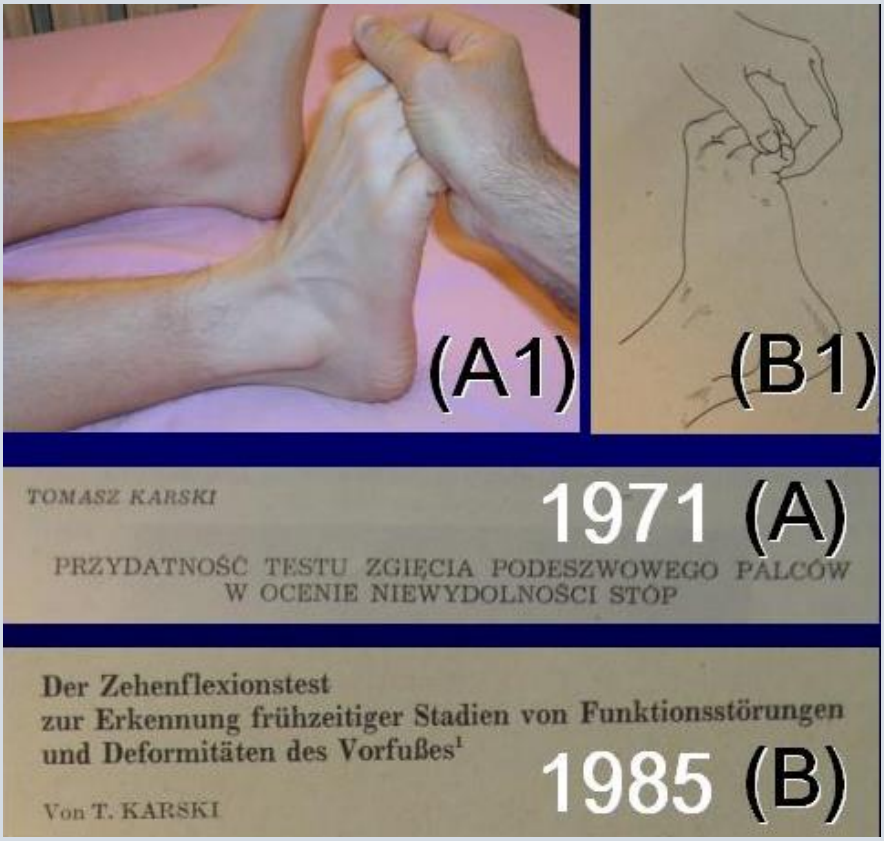

Figure 17: Methods of exercises in therapy of painful feet. (A) Publications in Poland (1971). (B) Publication in Germany (1885 help by publication Dr F. Lettow, Neuruppin). (A1) Example of exercises by physiotherapist. (B1) Example of exercises by physiotherapist.

Age of patients	Range of plantar flexion of toes in metatarsal – phalange joints	Clinical status Primary character of feet
Children	60 – 80 degrees	No feet problems
Youth persons	30 – 50 degrees	No feet problems
Adults healthy	20 – 40 degrees	No feet problems
Adults with feet problems	0 degrees or hyperextension of toes	Deformities of feet and toes. Pain. Difficulties with walking

Table 1: Situation of feet in connection to age and to plantar flexion of toes.

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Material

In our orthopedic activity, T. Karski since 1961 and J. Karski since 1989 we have treated many thousands of people of various age children, youth and adults with feet problems. We present many examples of cases (Fig. 5-17) of feet with limited toe flexion and describe the form of pathology of feet. In some cases we inform also about accompanying deformities in other parts of the body, but in connection to the feet function.

Examples of Pathology

In anatomy and in function. Causes. The causes of pathology in the anatomy and in the range of flexion movements of toes are connected, in the first place, with using not proper shoes too narrow in the front or/and with high heels (Fig. 6,15). Secondly, feet deformities are connected with pathology of anatomy of bones and joints, and with not proper properties of collagen which cause "the laxity of joints" and laxity enables deformation to develop easily.

Physiotherapy (Fig. 17). In situation when the pain of feet appears in the front part, we should check the range of plantar flexion of toes. When this movement is limited we should advice the kinesiotherapy exercises in warm water and without water. The exercises should be passive, made with the help of physiotherapists and active by patient himself or herself over a long time, even many months. The therapy is especially efficient when associated with thermotherapy before or during the exercises. Physiotherapist should also inform the patients about proper shoes. The treatment is long, it may take months or years, but a positive effect could be seen in a very large group of patients. Good results have been observed in patients whose deformity, like hallux valgus, "hammer toes", valgus of the feet was not fixed or not extremely big.

Discussion

People suffer, most of all, because of pain syndromes of spine, of hips and knees. Nonetheless, many suffer because of feet deformations mostly because of toes flexion limitation in metatarsal-phalange joints what disturb walking and other forms of daily activity (Fig. 16) [1,19-30]. In every form of deformity like hallux valgus the pain is, in the first place, caused by limited plantar flexion of the toes.

Conclusion

For proper, healthy and not limited functioning of our body, we need proper anatomical bones, muscles and joints, also good blood circulation and nerve function. Every limitation of joint movement is the cause of pain syndromes. It causes low back pain syndromes, arthrosis of hips

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and knees, as well as feet problems. The problem of instability of ankle joints and pain syndromes has been described in many articles in the USA, India, Czech Republic (2017 - 2021). The limited plantar flexion movement in metatarsal - phalange joints of feet is the cause of heavy pain, disturbing walking and other activities. The deformations of feet - like hallux valgus, “hammer toes” and limitation of plantar flexion of toes appears mostly in women and this pathology is mostly connected with wearing of too “narrow improper shoes”.

In the paper we present the “toes flexion test”, examples of pathology of suffered patients and we give advices for physiotherapy.

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