Arthroereisis in flexible flatfoot in youths

Artroereza w stopach płasko-koślawych wiotkich u młodzieży

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Abstract

Flexible flatfoot is a common defect in children and adults. Up to about the age of 10, the longitudinal arch of the foot can be spontaneously reproduced and does not require treatment. After the age of 10 with the co-occurrence of pain, arthroereisis can be performed, i.e. limiting the excessive pronation by an implant located in the tarsal sinus region. This treatment is simple, without serious complications with very good outcomes.

Key words: flexible flatfoot, arthroereisis, children

Streszczenie


Słowa kluczowe: stopa płasko-koślawia wiotka, artroereza, dzieci
Introduction

Flatfoot deformity is often seen in orthopedic practice both in children, youths and adults. Even though this problem has been widely discussed in the recent literature it still does not offer a clear definition of this deformity. There is still no differentiation between physiological flatfoot – as a variant of the norm – not requiring treatment, and pathological deformation – requiring treatment. Flexible flatfoot, asymptomatic in children 3-8 y.o. are not a clinical problem and often resolves spontaneously [1,2].

The purpose of this paper is to attempt a classification of flatfeet into those requiring treatment and those not requiring orthopedic treatment as well as to present treatment using calcaneo-stop implant procedure.

One of the treatment methods is arthroereisis (Greek ar—joint, -eresis—support or prop up) – that is restriction of motion in subtarsal joint without its total blockage.

Anatomy, biomechanics and clinical aspects of flexible flatfoot

Flexible flatfoot is a multi-faceted defect and apart from the atrophy of the longitudinal arch of foot bearing weight, it also includes a plantar and medial deviation of the talus, plantar displacement and external rotation of the calcaneus in relation to the talus, dorsal-lateral displacement of the navicular bone and the abduction of the forefoot in relation to the hindfoot. The valgity of the hindfoot when the whole foot bears weight is a constant feature. The so-called calcaneal eversion is a wider concept than valgity and hyperpronation. Dorsal flexion of the foot is usually stopped by the contracture of the Achilles tendon whose force is released during weight bearing below the talus which increases foot deformation. Shortening of the Achilles tendon in children may worsen in adults and is asymptomatic. There is also a group of flexible flatfeet without the Achilles contracture [2,3,4].

Flexible flatfoot might occur due to different reasons, e.g. neuromuscular disorders such as cerebral palsy, myelomeningocele, muscle dystrophy. Rigid flatfoot, on the other hand, presents with definitive clinical manifestations and may be a result of a congenital tarsal coalition, rheumatoid conditions or post-traumatic lesions.

Flexible foot also occurs in healthy children, often accompanies with systemic flexibility.

Flexible flatfoot is often asymptomatic and resolves spontaneously around the age of 10. Harris reports 54% of such feet at 3 y.o. and 24% at 6 y.o. [5]. At that time the defect is physiological and temporary but still can worry the parents who notice changes in the foot shape, asymmetric damage to footwear and also changes to the skin: redness, hyperkeratosis, conflict with the shoe). Other periodical symptoms include foot pain, problems with walking, increased foot fatigue, no inclination for locomotor activity. The development from asymptomatic physiological flatfoot to symptomatic defect is often occult and slow. Pain may appear on the medial side of the calcaneus, in the tarsal sinus, in the fibula and tibia or upper parts of the limb [6,7].

Flexible flatfoot can be easily differentiated form the rigid flatfoot by standing on the phalanges which is manifested with the longitudinal arch of foot (spinning wheel mechanism of plantar fascia) or by the so-called Jack’s test (formation of the longitudinal arch of foot during passive dorsal flexion of the big toe). Another important symptom is the polydactylly symptom, which is connected with forefoot abduction [8].

The valgity of hindfoot often referred to as hyperpronation, forces excessive weight of the medial foot column, which may be caused by child’s overweight and turn leads to asymmetric weighing of the tarsal, knee and hip joints. The ammortization function of the foot disappears which affects upper joints and even the parenchymatous organs in the abdominal cavity. The disappearance of longitudinal arch of foot is more complex than its anatomical lowering; it is accompanied by the bulging of the medial feet contour while the whole foot may have deformities in opposing directions, e.g. hindfoot valgity and forefoot supination. The complexity of these anomalies lead Mosca to state that “foot is not only the joint”.

Treatment of flexible flatfoot

Flexible flatfoot asymptomatic does not require treatment regardless of age. If the above-mentioned symptoms occur at 10 y.o. physical therapy might be applied to strengthen short muscles of the foot and stretching the usually short Achilles tendon. In some patients physical therapy, muscle strengthening and even orthoses may be used, even though no evidence has been reported concerning their long-lasting beneficial effects. The defect may resolve spontaneously by the age of 10. Cases were reported when objectively diagnosed changes, e.g. during examination on podograph when the bulging contour of the foot (3rd grade in Meary classification) disappears at 7 y.o. and full longitudinal arch of foot visible on the podogram at 10 y.o. (1st Meary grade). Patients with foot insufficiency after the age of 10 may undergo various surgical procedures. The recommendations for surgery must be strictly followed – presence of pain and age over 10. Of course the extent of those procedures should not go further than the severity of the defect. Soft tissue duplication was described, as were lengthening of tendons, transpositions, osteotomy, arthrodesis and implants in the tarsal sinus region. Extreme arthrodesis in infancy is not recommended. The growth cartilages need protection, which limits the application of many osteotomies. Some authors recommend the procedure of lengthening the lateral column using calcaneal lengthening osteotomy. Calca-
neal osteotomy according to Evans/Mosca alters the anatomical conditions of the foot by reducing the hindfoot valgity and may be considered as an option in more anatomically and clinically cases of this defect [9,10].

The purposes of this paper is evaluation of a simple technique, arthroereisis, and its significance

Materials obtained in the department

Between 2014 and 2017, there were 82 children treated for flexible flatfoot, 156 LIMA calcaneo-stop implants were used. Children were aged 7 to 16, mean age 9.5 y.o. The majority of the children were boys. Observation period was 1 to 4 years. In 15 cases lengthening of the Achilles tendon using the Baker method was performed.

The idea of arthroereisis has been known for decades but the method of procedure is changing depending on the technological and material advancement of the implants.

Arthroereisis

The first person to get the idea to block the tarsal sinus with hyperpronation was Chambers in 1946. He used an autogenic graft between the calcaneus and the lateral process of the talus. Later, LeLievre (1970) further developed the method and called it “lateral arthroereisis”. Smith and Miller introduced polyethylene implant while Giannini further developed that idea in 1985 [11,12,13].

The method called calcaneo-stop consists in inserting the implant into the calcaneus and the protruding part of the screw blocks the hyperpronation of the talus.

The mechanism can be explained with the mechanical effect of the screw head on the talus and on the joints, which gives proprioception signals and also with the feedback mechanism, it is possible to regulate the muscle-tendon tension. The role of mechanoreceptors (Pacini bodies and Ruffini endings) from the tarsal sinus region is also described [14].

We recommend partial weighting of the operated foot on the second day, after 2 weeks of normal walking and after 1 month of participation in sports activities. We do not use gypsum, sometimes Walker orthosis is used in selected cases. The foot after the operation looks morphically well, the longitudinal arch of the foot appears, the excessive pronation of the tarsus disappears. The normalization of the anatomy of the foot is reflected in the podoscopic examination and the normalization of the axial angles in x-rays.

In some cases, up to 3 months after surgery, the inward-rotation gait and hypersupination of the foot are maintained. This is not considered as a complication, but a transient symptom. The complications so far described may include hematomas, exudative irritation, edema, pain in the tarsal sinus region and increased tension of the fibular muscles.

This type of surgery is not recommended in the rigid flatfoot, in the talocalcaneal coalition, in congenital vertical elevation of the talus.

Observations of the arthroereisis at our clinic are not long, about 5 years, and although the results seem to be very encouraging, they require more time. Adverse results include pain in the tarsal sinus region, exudation, excessive tarsal correction and faulty gait. In 3 patients we had to remove the implant prematurely for similar reasons.

Discussion

Discussion as to whether children with IFPP require treatment is ongoing and still no optimal standard for treatment yet exists [15,16]. Most authors admit that surgery is indicated when conservative treatments fail [14]. However, this algorithm is not always useful because decision to operate on a child with symptomatic flatfoot does not depend just on the knowledge and experience of the surgeon; it also depends on subjective aspects of medicine and surgery. There are numerous discussions about how best to treat a flexible flatfoot in either the adult or pediatric patient. Some authors indicate that surgery is very rarely indicated unless the pes planus is rigid [16]. We emphasise the fact that flexible flatfoot is generally a benign condition that rarely requires treatment especially in children under 10 years of age. However if flexible flatfoot continues into adolescence, a child may experience aching pain along the bottom of the foot. Therefore such patients requires surgery. So, persistence of flatfoot in children older than 10 years necessitates further assessment, despite the lack of symptoms. We have to notice that indication for this type of surgery still remains controversial in the literature. If surgical intervention is successful in producing a functional painless result, the child should be further treated by periodic observation and appropriate orthoses. If surgery fails, salvage through appropriate intraarticular or extraarticular arthrodesis is suitable [17]. Arthroereisis is a simple, minimally invasive procedure with-out any special risks or complications. After removal of the titanium implant after 2-3 years from the operation, the foot usually remains corrected. The biodegradable implant has the advantage over titanium in that it does not require surgery, anesthesia or stress [3]. Professor Giannini from Bologna currently almost exclusively uses soluble implants [15]. Despite the described complications, which are quite rare, we assume that arthroereisis in flexible flatfoot may be recommended as the least invasive, simple for the surgeon and also beneficial to the patient.

References