Flat feet in Children: When should they be treated?

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Citation

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Abstract

Objective: Review paper on when flatfeet in children should be treated.
Methods: A thorough review of the literature on flat foot was undertaken. In addition, illustrations are used to indicate the differences between flexible flat foot, congenital vertical talus and tarsal coalition
Results: This review has sought to clarify the differences between physiological and pathological flat foot. The indications for treatment are clearly stated.
Conclusion: Flat foot is a common condition in paediatric orthopaedic practice. Most children will have flexible, painless flat foot that requires no treatment. It is imperative that rigid flat foot be evaluated to ascertain the presence of congenital vertical talus, tarsal coalition or skew-foot, all of which usually require surgical treatment. The author recommends some practical points as guidelines for good practice.

INTRODUCTION

Flat foot or pes planus is one of the most common conditions seen in paediatric orthopaedic practice. Most children who present for evaluation of flat feet will have flexible flat feet that do not require treatment. However, it is imperative that other conditions that do require treatment, such as congenital vertical talus, tarsal coalition, skew-foot and neuromuscular foot be ruled-out. The first principle, therefore, in evaluating childhood flat feet is to separate those which are physiological from those which are pathological. Physiological flat feet, including calcaneovalgus deformity and flexible flat foot, is a normal variation, causes no disability and tends to improve with time. Pathological flat foot which includes congenital vertical talus, tarsal coalition, skew-foot, neuromuscular and hypermobile flat foot with a tight heel cord shows some degree of stiffness, often causes disability and usually requires treatment. Adults may develop painful flat feet after loss of posterior tibialis function.

FLEXIBLE FLAT FOOT

The flexible or physiological flat foot is present in nearly all infants, many children and approximately 15% of adults. The flatness of infant feet is often due to the thick subcutaneous plantar fat pad and joint laxity. The arch is not present at birth, but slowly becomes established at about five years of age. Flat feet are often hereditary; and are also common in individuals who wore shoes as children, are obese and possess joint laxity. Rao and Joseph demonstrated a higher prevalence of flat feet among children who wore shoes compared with those who were unshod [1]. The authors observed that closed-toe shoes inhibited the development of the arch of the foot more than slippers or sandals. Flexible flat foot represents the largest group; these children are often brought by their parents, and sometimes grandparents, who are concerned with the appearance of the feet, and with the perception that flat feet can be associated with pain in adulthood but may be corrected.

EVALUATION

The examination should begin by observing general limb alignment, foot progression angle, and the degree of bow leg or knock knee exhibited while the child is walking with the parent. On standing, the foot appears flat and the heel may show mild valgus [Fig.1].

Figure 1

Figure 1: Bilateral flatfeet (pes planus) with mild heel valgus.

When the child is asked to stand on tip-toe, the arch usually reconstitutes, and the heel goes into mild varus [Fig. 2].

Figure 2

Figure 2: The arches are reconstructed and the heels go into mild varus when the child is on tip-toes.

The ability to stand on the heel demonstrates that the heel cord is not excessively tight. Heel cord tightness should also be evaluated by first ‘locking' the talonavicular joint in inversion and then passively dorsiflexing the foot. Subtalar and ankle motions are full in flexible flat feet. Evaluation of subtalar motion does not consist of simple medial-to-lateral rocking of the calcaneus; this is a common but misleading method of assessing subtalar motion, and only produces tilting in the lax ankle mortice. Instead, the forefoot should be rotated through a range of pronation and supination. Evaluation of the flexible flat foot should also include assessment for ligamentous laxity around the knees, elbows and wrist joints.

The shoes should also be examined. Ordinarily, there is heel wear on the lateral side. Shoes without heel wear may indicate a tight Achilles tendon. Radiographs are rarely indicated for flexible asymptomatic flat feet.

TREATMENT

The flexible painless flat foot requires no treatment. Treatment should not be imposed on a child to satisfy the parents. The parents and grandparents should be reassured that the flexible, painless flat foot is a common, benign condition and a variation of normal. They should be informed that shoe modifications or inserts are expensive and may adversely affect the child's self image. In addition, such measures do not influence the course of flexible flat foot. In cases of severe, but flexible, flat foot the medial sole and counter of the shoe can be worn-away and destroyed within a week or two of purchasing new shoes. In such children, one might consider either corrective shoes or shoes with an orthotic insert. If the family insists that something must be done, encourage the use of flexible shoes, limitation of excess weight and a healthy lifestyle for the child. However, because of a cultural tendency to favour corrective shoe wear, the psychological need for parents to provide ‘the best' for their child, and the placebo effect observed when special shoes are prescribed, this rather expensive but probably harmless practice will continue.

It is a commonly held belief that the prophylactic use of rigid orthotics for young athletes with flat feet decreases the risks of injury in this population. Studies have been performed examining the relationship between flat feet and athletic injuries in the lower extremities and the data revealed that the existence of flat-footedness did not predispose the athlete to lower extremity injuries [$_2$]. Therefore, there is no scientific evidence to support the prophylactic use of orthotics for flat-footed athletes, to prevent future injury.

Flexible flat foot is considered pathological when pain is present in the arch and persists despite proper conservative method. In addition, callosities and abnormal shoe wear are sometimes indications for surgery. Rarely, should surgery be performed before skeletal maturity. A variety of tendon transfers and reconstructive procedures have been advocated, but none have proven uniformly successful. Operative intervention to create an arch by blocking subtalar movement may establish an arch but may damage the subtalar joint and cause degenerative arthritis in adult life. Fusion of the subtalar joint alone or a more extensive

procedure, such as a triple arthrodesis, is indicated for severe persistent pain.

CALCANEOVALGUS DEFORMITY

This congenital deformity is thought to result from intrauterine positioning. Between 30% and 50% of all neonates have calcaneovalgus deformity of both feet [3]. There is no abnormality of the bones or joints.

EVALUATION

The examination varies according to the age of the child. For the first four to five days after birth, the foot lies in an acutely dorsiflexed position with the top of the foot in contact with the anterolateral surface of the leg. The heel is in dorsiflexion, and the forefoot is markedly abducted. When the foot is plantar-flexed, a concavity appears in the sinus tarsi area with the overlying skin becoming taut with attempted plantar-flexion. In more severe cases, the foot cannot initially be plantar-flexed much beyond neutral. Overall, however, the foot is flexible and both the heel and the forefoot can be passively corrected into varus.

It is imperative to distinguish between a calcaneovalgus deformity and congenital vertical talus, and this should be achieved in the first few months of life. The rigid, fixed congenital vertical talus also presents with the foot folded anterolaterally against the tibia, but the heel cord is extremely tight and the hindfoot is in equinus.

TREATMENT

The deformity generally resolves spontaneously. Only very rarely is corrective casting necessary. Surgery in the form of extraarticular arthrodesis may be needed in persistent cases, at three years of age.

CONGENITAL VERTICAL TALUS

Congenital vertical talus is the most serious pathological flat foot. The diagnosis must be established as soon after birth as possible, and often requires surgical treatment. Congenital vertical talus may occur in association with other congenital anomalies, such as myelomeningocele, arthrogryposis, and developmental dysplasia of the hip. It may also occur in motor neuron disorders [4].

EVALUATION

The deformity reveals a rigid flat foot. The heel is in equino-valgus with contracture of the triceps surae muscles. The forefoot is dorsiflexed and everted; the arch is convex, because the head of the talus projects into the plantar aspect of the foot [Fig. 3].

Figure 3

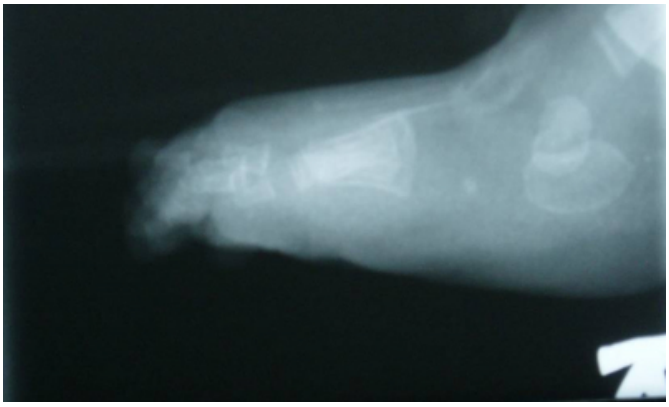
Figure 3: Two month old child with congenital vertical talus. The foot is dorsiflexed and the arch is convex.

The foot is stiff and uncorrectable. Some cases are dramatically obvious, but others are easily overlooked. Congenital vertical talus may be confused with flexible oblique talus, a different condition.

Plain radiographs assist in confirmation of the diagnosis. A lateral radiograph in maximum plantar-flexion will, in congenital vertical talus, show the vertical orientation of the talus [Fig. 4].

Figure 4

Figure 4: Lateral radiograph of the foot in maximum plantar-flexion shows the vertical orientation of the talus.



A lateral radiograph in maximum dorsiflexion will show no change in the position of the talus [Fig. 5, Fig. 6].

Figure 5

Figure 5: Lateral radiograph of the foot in maximum dorsiflexion shows no change in the position of the talus.

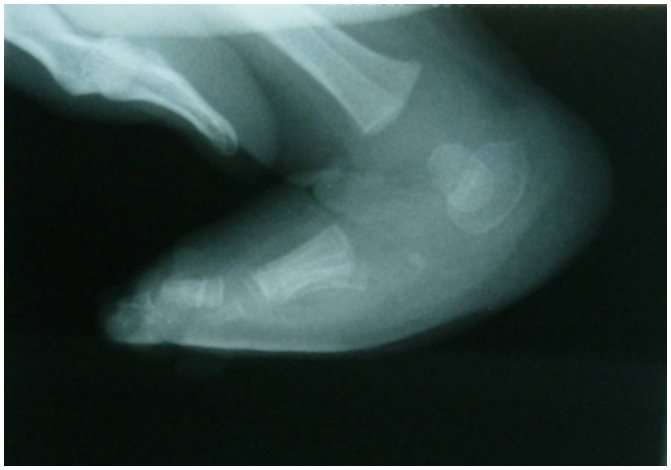
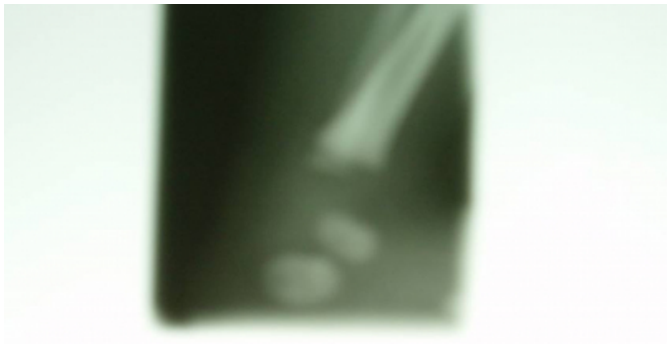


Figure 6

Figure 6: Lateral radiograph of the normal foot in this two month old child. The talus is normally oriented.



In the innocent, correctable, oblique talus, the bone lines up normally with the metatarsals when the foot is placed in maximum plantar-flexion.

TREATMENT

Congenital vertical talus, in contrast to flexible flat foot, requires early surgical correction. A single-stage procedure late in the first year of life is recommended. In patients with motor neuron disorders, treatment involves genetic and multidisciplinary management approaches. Untreated, patients develop an awkward gait due to a painful rigid foot, as well as callosities under the midfoot.

TARSAL COALITION

Tarsal coalition is a bony or fibrocartilaginous connection of two or more tarsal bones. The cause is unknown, but it has been established that the condition results from failure of differentiation and segmentation of primitive mesenchyme [5]. In infancy and early childhood, the condition is usually asymptomatic and is seldom recognized. Symptoms and signs usually tend to appear during the second decade of life, when stress and strain on the tarsus are increased by greater body weight and strenuous physical activities such as sports. The history is often one of vague pain in the mid-tarsal region, usually associated with activity. There may be an increased incidence of ankle sprains. The pain is worse with activity, relieved by rest and is thought to be due to microfractures in the coalition. Spasm of the peroneal muscles may occur intermittently or may be present continuously in varying severity. Two forms of coalition are common, calcaneonavicular and talocalcaneal, the former being more common. Calcaneonavicular coalitions are bilateral in approximately 60% of cases, and talocalcaneal coalitions are bilateral in about 50% [6]. Other coalitions may occur at the talonavicular and naviculocuneiform joints.

EVALUATION

Physical findings include pain on palpation over the subtalar joint, limited subtalar movement and at times pes planus and ankle valgus. The peroneal muscles may be tight and resist inversion (peroneal spastic flat foot). Plain radiographs, especially the 45° oblique view, usually demonstrate the calcaneonavicular coalition and other less common coalitions, such as a calcaneocuboid [Fig. 7].

Figure 7

Figure 7: Calcaneonavicular coalition is demonstrated on the 45? oblique view of the subtalar joint.

The talocalcaneal coalition is difficult to visualize on plain radiography, but secondary changes, which may suggest the need for other studies include talar beaking, broadening or

prolongation of the lateral process of the calcaneus [anteater sign] and narrowing of the subtalar joint. Special views [e.g. Harris-Beath], scintigraphy, plain tomography and arthrography have been used to demonstrate these coalitions. Computed tomography, [CT] is the method of choice for the diagnosis of tarsal coalitions. Magnetic resonance imaging [MRI] provides the advantage of demonstrating fibrous coalitions, but it is a more costly technique.

TREATMENT

The initial treatment of these conditions should include conservative measures aimed at relieving the pain. These include casting for four weeks and the use of various shoe inserts and orthotics. The main indication for surgical resection is persistent pain. For calcaneonavicular coalition, resection of the bar with interposition of the extensor digitorum brevis is usually associated with good results [7]. Talocalcaneal coalition is more difficult to recognize and its surgical management is less certain [8].

The management of these coalitions is still controversial. However, patients with persistent symptoms who do not have degenerative changes have the option of continued conservative care, resection of the coalition or arthrodesis. Resection is likely to fail if coalitions exceed 50% of the middle facet of the subtalar joint.

SKEW-FOOT

The term skew-foot, Z-foot, and serpentine foot refers to the complex developmental deformity in a young child which is characterized by a flat foot with hindfoot valgus and forefoot varus. The Achilles tendon is also shortened. The aetiology and natural history of this rare condition are unknown. It is seen in children with myelodysplasia and may occur in some children after cast treatment for metatarsus adductus or clubfoot [9].

EVALUATION

The predominant radiographic findings are forefoot adduction with lateral subluxation of the navicular on the talus and heel valgus. Children present with pain, intractable callosities and abnormal shoe wear.

TREATMENT

Non-operative treatment is rarely successful and with serial casting there is a danger of increasing the heel valgus [10]. Surgical stabilization of the hind foot with heel cord lengthening and realignment of the bones of the forefoot are necessary [11].

NEUROMUSCULAR FLAT FOOT

Flat feet may be associated with neuromuscular conditions such as cerebral palsy, Duchenne muscular dystrophy, and polio. In most cases, the heel cords are tight with secondary heel valgus and forefoot abduction. These flat feet may require operative stabilization to provide more stability in walking [12].

IDIOPATHIC TIGHT HEEL CORDS

Heel-cord contracture can cause heel valgus, altered tarsal motion, lateral column shortening, and a painful flat foot. The child is usually in the second decade of life and presents with vague activity-related foot pain. The foot cannot be dorsiflexed beyond neutral with the knee extended. Radiographs often show excessive plantar-flexion of the talus. Treatment involves lengthening of the contracture of the triceps surae and in many cases lateral column lengthening.

CONCLUSION

Flat foot is a common condition in paediatric orthopaedic practice. Most children will have flexible, painless flat feet that require no treatment. It is imperative that rigid flat foot be evaluated to ascertain the presence of congenital vertical talus, tarsal coalition, or skew-foot, all of which usually require surgical treatment. The following practical points are guidelines for good practice in the treatment of flat feet in children [Table 1].

Table 1: Practical points

1. Most children who present with flat feet have flexible flat feet that do not require treatment.
2. Pathological causes of flat feet, such as congenital vertical talus, tarsal coalition, neuromuscular foot, skew-foot, flat feet with tight heel cords must be ruled-out.
3. It is important to distinguish between calcaneovalgus deformity and congenital vertical talus.
4. Congenital vertical talus is the most serious cause of flat foot, and the diagnosis must be made as soon after birth as possible.
5. Symptoms of tarsal coalition usually present during early adolescence. There may be an increased incidence of ankle sprains.

6. CT is indicated for all patients suspected of having tarsal coalition.

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