Pediatric Pes Planus: A State-of-the-Art Review

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abstract

Flatfoot (pes planus) is common in infants and children and often resolves by adolescence. Thus, flatfoot is described as physiologic because it is usually flexible, painless, and of no functional consequence. In rare instances, flatfoot can become painful or rigid, which may be a sign of underlying foot pathology, including arthritis or tarsal coalition. Despite its prevalence, there is no standard definition for pediatric flatfoot. Furthermore, there are no large, prospective studies that compare the natural history of idiopathic, flexible flat feet throughout development in response to various treatments. The available literature does not elucidate which patients are at risk for developing pain and disability as young adults. Current evidence suggests that it is safe and appropriate to simply observe an asymptomatic child with flat feet. Painful flexible flatfoot may benefit from orthopedic intervention, such as physical therapy, bracing, or even a surgical procedure. Orthotics, although generally unproven to alter the course of flexible flatfoot, may provide relief of pain when present. Surgical procedures include Achilles tendon lengthening, bone-cutting procedures that rearrange the alignment of the foot (osteotomies), fusion of joints (arthrodesis), or insertion of a silicone or metal cap into the sinus tarsi to establish a medial foot arch (arthroereisis). It is important for a general pediatrician to know when a referral to an orthopedic specialist is indicated and which treatments may be offered to the patient. Updated awareness of the current evidence regarding pediatric flatfoot helps the provider confidently and appropriately counsel patients and families.

The development of the medial longitudinal foot arch can occur over several years with a broad spectrum of normal variations. The presence of pes planus (flat feet) in older children and adults lies within the acceptable range of normal development. Pediatric pes planus can be empirically divided into flexible flatfoot and rigid flatfoot. A medial longitudinal foot arch that is present while sitting yet disappears with weight bearing is considered a flexible flat foot. Flexible flatfoot is physiologic and comprises ~95% of cases. Rigid flatfoot is defined by significant restriction of subtalar joint motion. It is nonphysiologic and is often associated with pain and a more serious underlying pathology, such as tarsal coalition or a neuromuscular process. The vast majority of patients with neuromuscular flatfoot will have rigid flatfoot. Management of neuromuscular flatfoot differs from management of idiopathic, flexible flatfoot because neuromuscular flatfoot merits prompt orthopedic referral. Patients with pes cavus (high arched feet) also merit a neuromuscular workup and an orthopedic referral. Although less common, patients with painless, idiopathic rigid flat feet should be treated with reassurance, just like other patients who do not have foot pain. The main focus of this article is

the diagnosis, treatment, and current trends in management of pediatric non-neuromuscular, flexible flatfoot.

Despite widespread prevalence, pes planus is often a misunderstood topic. Lack of high-level evidence to guide indications for treatment perpetuates some confusion. Furthermore, there is no universally accepted classification system or definition of pediatric flatfoot. Various studies have suggested a definition based on footprints,[1–4] heel-to-arch width ratio,[5] subjective assessment,[6,7] or radiographic measurements.[8–10] Classically, the diagnosis of flatfoot is assigned to patients who appear to have a collapsed medial arch, yet this is a subjective measure that neglects etiology or specific anatomic considerations. Therefore, parental concern and physician preference tend to drive the evaluation and subsequent management of flatfoot.[11] This can lead to unnecessary treatment and spending for a condition that usually does not need intervention.[2]

Occasionally patients with previously pain-free flat feet become symptomatic. Their pain can be persistent and debilitating, limiting participation in sports, recreation, and even normal daily activities. These patients often benefit from an orthopedic referral. We review the potential risk factors for flat feet, physical examination findings, and current nonsurgical and surgical options for treatment of symptomatic, flexible flat feet.

DEVELOPMENT

Infants are usually born with flexible flat feet. At the time of birth, a fat pad is the dominant visible structure in the region of the medial plantar arch. During the first decade of life, the medial longitudinal arch develops along with the bones, muscles, and ligaments within the foot. By the age of 2, a child usually develops a medial arch that is visible when sitting. This arch may collapse with weight bearing, producing the appearance of flat feet. Flexible flatfoot usually resolves by the age of 10, yet in some patients it persists into adolescence and adulthood. It is uncertain whether this should be considered a normal variant or a deformity that may lead to future pathology. In the absence of symptoms, most authors agree that flatfoot is a normal variant foot shape throughout life.[3,12]

EPIDEMIOLOGY

Cross-sectional epidemiologic studies have shown that flatfoot is the normal foot shape in the first few years of life. In children 2 years or younger, Morley[5] found a 97% prevalence of flatfoot, as defined by the heel-to-arch width ratio. The prevalence drastically decreased with age so that only 4% of patients had flat feet by the age of 10. This supports the belief that most pediatric flatfoot resolves spontaneously throughout the first decade of development. In a study analyzing footprints in >800 patients, Staheli et al[3] found a similar trend with 54% of 3-year-old children having flat feet. The prevalence decreased to only 26% of 6-year-old patients, suggesting that ages 3 to 6 years may be a critical time period for the development of the medial longitudinal arch.[3] This same study also analyzed footprints in patients up to 80 years old and discovered that flatfoot is within normal limits for adults.

Recent articles have analyzed factors that may predispose children to the development and persistence of flatfoot. A study by Chen et al[6] discovered that higher joint laxity, W-sitting, male gender, obesity, and younger age were all associated with a higher risk of having flatfoot in preschool children aged 3 to 6 years. Similarly, Chang et al[1] found that male gender and obesity were also associated with a higher risk of having flatfoot in children aged 7 to 8 years. Other studies confirm that obesity is associated with the persistence of flat feet in older children.[13–16] There are no studies that have investigated which factors increase the risk of developing symptomatic flatfoot, and this is a potential area of future research.

PATHOGENESIS

No single factor has been identified as the root cause of pediatric flexible flatfoot. Two classic theories have been described for its etiology. One theory suggests that flexible flatfoot is the result of decreased foot muscle strength.[17–19] Another theory proposes that the arch is mainly created by the shape and strength of the osseous-ligamentous complex.[20–23] The latter is supported by the observation that incompetence of the spring ligament is a common link in the loss of a normal medial arch during weight bearing.

Current opinion generally accepts that the osseous and ligamentous structures are most important in maintaining the medial foot arch, although this is still a debated topic. The intrinsic muscles of the foot contribute more to strength, stabilization of the foot during ambulation, and protection of the ligamentous structures, rather than the actual shape of the foot.[20,21] Mann and Inman[24] demonstrated that individuals with flat feet require greater intrinsic muscle activity during ambulation to stabilize the foot. This may be an explanation for muscle pain experienced in symptomatic flatfoot.

In support of the muscle weakness theory, Vittore et al[25] recently investigated activation of the extensor muscle groups in patients with flexible flatfoot. They used superficial electromyographic testing to discover that patients with flexible flatfoot demonstrate

poor extensor muscle activity during the heel-contact phase of the gait cycle. Weakness was also present in patients with flatfoot when at rest compared with patients without flatfoot. Furthermore, the amount of extensor muscle weakness was directly proportional to the severity of medial arch collapse. The authors suggest that extensor muscle weakness causes an overall imbalance among the foot muscles. They propose that this is the sentinel event leading to the development and persistence of flatfoot.

Another recent study by Singh et al[26] analyzed rotational bony alignment in children with flexible flat feet. They found that increased tibial torsion and increased hindfoot malalignment, as measured by the foot-bimalleolar angle, were directly correlated with the presence and severity of medial arch collapse. Patients with more severe bony malalignment were also less likely to respond favorably to conservative treatments. Benedetti et al[27] also analyzed limb alignment in 53 patients with flexible flatfoot. They discovered that internal knee rotation was the most common limb malalignment in this population, as seen in 43.6% of patients. The presence of internal knee rotation significantly correlated with the presence of foot symptoms, further linking positional limb abnormalities with the development of symptomatic flat feet.

The development of flatfoot is certainly multifactorial. The relationship between bones, ligaments and muscles of the foot, along with overall limb alignment and comorbid medical conditions, all play a role in the development of flatfoot.

CLINICAL FEATURES

Flat feet are usually painless, and most children present for evaluation because of parental concern.[11] It is often useful to inquire about a family
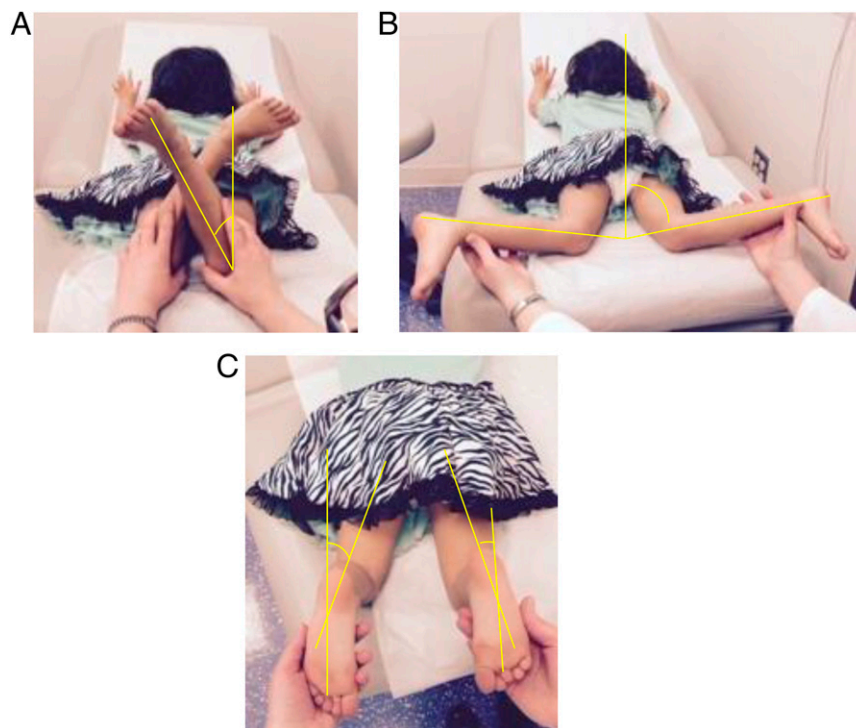

FIGURE 1
Rotational profile of the pediatric hips. External and internal hip rotation is best measured with the patient prone. The legs can be used as a goniometer relative to a vertical line. A, Assessment of external rotation. B, Assessment of internal rotation. C, Assessment of thigh foot angle.

history of painful feet or special shoe wear, as several studies suggest that pes planus may have a familial link.[28,29] Obtaining a developmental and previous medical history may give clues to the presence of syndromes with musculoskeletal manifestations.

The physical examination starts with a generalized musculoskeletal examination, which should always include rotational profiles of the legs. This is best assessed by measuring internal and external rotation of the hips along with the thigh-foot angle while the patient is prone (Fig 1). An examination for generalized laxity using the 9-point Beighton score is also useful in detecting hypermobility. A score ≥5 may indicate a hypermobility disorder in children >5 years old.[30] The presence of generalized ligamentous laxity or external tibial torsion, especially if coupled with excessive femoral anteversion (sometimes referred

to as "miserable malalignment") warrants ongoing surveillance due to potential risk of developing symptomatic flat feet.

The shape of the foot is the sum of multiple interactions among a variety of joints, muscles, ligaments, and tendons. The hindfoot, midfoot, and forefoot are interrelated and affect the overall position of the foot. Patients with flat feet often have a valgus hindfoot, dorsiflexed and abducted midfoot, and pronated or externally rotated forefoot (Fig 2). This combination in sum leads to loss of the medial foot arch.

Examination should include inspection of the feet in both the standing and sitting positions and during gait. The physician should examine the feet from the front and the rear while the patient stands. The rear view may reveal a valgus heel, or "too many toes" sign. Normally the examiner should be able to see only the fifth and half of the fourth toe
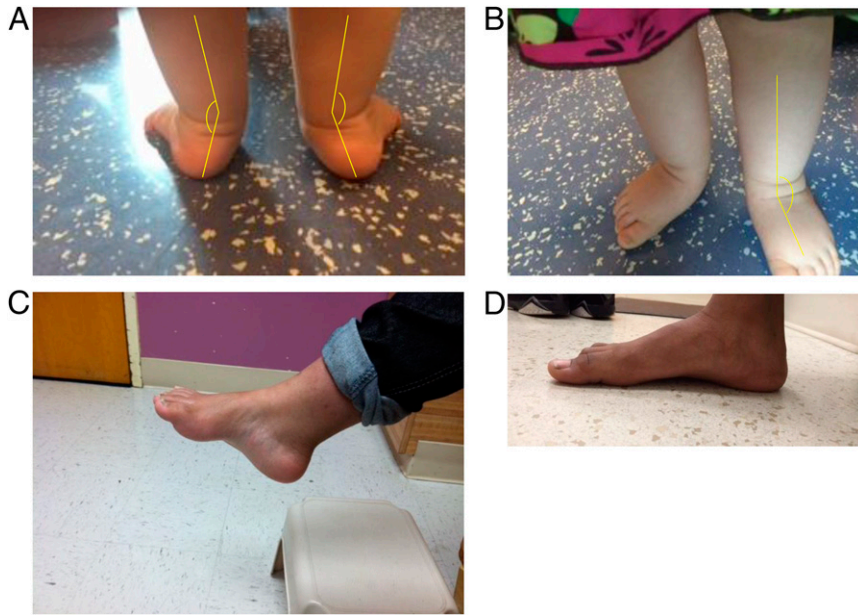
FIGURE 2

Examples of common foot characteristics seen in pediatric feet. A, Pediatric pes planus results in hindfoot valgus, as defined by the angle formed by the leg and heel. B, Abduction of the midfoot and pronation of the forefoot is also seen with inward collapse of the ankle joint, resulting in rotation of the forefoot away from the center axis. C, Pes cavus results in a high medial longitudinal arch, best seen from the sagittal view. D, Normal pediatric foot with maintained medial longitudinal arch while standing.

FIGURE 3

Characteristic physical examination findings of a patient with physiologic, flexible flatfoot. A, Rear view examination of the heel revealing a valgus alignment and "too many toes" sign. B, Reconstitution of the medial foot arch is seen on toe raise. C, Reconstitution of the medial arch is also seen with forced dorsiflexion of the great toe during the "jack test."

when the standing patient is viewed from the rear, including during gait. In the presence of flatfoot, more toes are seen due to the global external rotation and abduction in the flat foot (Fig 3). It is easy to use the number of toes seen from behind as an objective measure to document progression or resolution of flatfoot. Angular or rotational deformities at the hips, knees, ankles, or feet may appear worse during gait and this can help explain the presence of painful symptoms. Documenting the foot progression angle during gait is another way to track change over time (Fig 4).

A medial longitudinal foot arch that is present while sitting yet disappears with weight bearing is characteristic of a flexible flat foot. The medial arch should also reform when a patient goes from standing to tip-toe standing (Fig 3). Observation of the foot position in single leg stance may reveal arch collapse that is not seen in 2-leg standing and is more indicative of the foot position during ambulation. The arch also may be reconstituted in flexible flatfoot by the "toe raising test," in which the examiner dorsiflexes the great toe while the patient stands, allowing the plantar fascia to tighten and secondarily reconstitute an arch (Fig 3). Each of these simple tests can be quite reassuring when shown to a concerned parent. If these findings are not present, the patient has a rigid flat foot, which remains flat during sitting, tip-toe standing, and the toe raise test due to the relative immobility of the subtalar joint.

It is important to determine the location of any foot pain. Usually the pain is in the medial midfoot from localized pressure on the collapsed talar head where callus formation may be evident. Pain also can be located in the lateral foot at the sinus tarsi due to impingement from excessive subtalar joint eversion. Pain that has a sudden onset, is worse at night, or is associated with a fever should prompt a workup for other, more urgent causes of foot pain, such as infection or neoplasm.

Last, it is important to examine the Achilles tendon complex when assessing a child with flatfoot because this may have important implications for treatment.[28,31] This is best assessed using the Silverskiold test. With the knee held in flexion, the foot is held in an inverted position and then dorsiflexed. The amount of dorsiflexion is measured between the lateral border of the foot and the anterior border of the
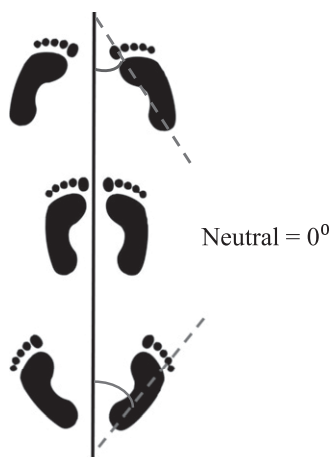
CARR et al

FIGURE 4
Foot progression angle (FPA) is a rough measurement obtained during gait by observing the angle of the foot off of the line of progression. By convention, in-toeing is a negative value (eg, −20°) and out-toeing is a positive value (eg, +20°).

Neutral = 0⁰

distal tibia. This is then performed with the knee held out in extension. Less than 10 degrees of dorsiflexion above plantigrade with both the knee flexed and extended implies that the entire Achilles tendon is tightened. Less than 10 degrees of dorsiflexion with the knee extended only implies isolated gastrocnemius tightness. This is an important distinction for an orthopedic surgeon when developing a treatment plan.

TREATMENT

The decision to simply observe versus treat a child with pes planus is based on the patient's symptoms and physical examination findings. Lack of flexibility is often a sign of underlying foot pathology, and referral for further workup is indicated. These conditions often require operative intervention. For patients with pain-free, flexible flat feet, there is no concrete evidence that any available intervention can alter the natural course of foot shape development. Observation is the best course. Referral to an orthopedist is encouraged for patients with pain, fatigue, or concerns regarding malalignment.

Treatment options for symptomatic patients include physical therapy, shoe wear modification, orthotics, and, occasionally, surgery.

Asymptomatic Flexible Flatfoot

In the absence of pain, neither operative nor nonoperative management is superior to observing the patient. In fact, a recent meta-analysis in 2012 concluded that there is a lack of quality evidence to guide management of pediatric flatfoot.[32] Physicians must be mindful of this when they are making management decisions for patients with flatfoot.

A major debate in the management of patients with asymptomatic flexible flatfoot has been the role of accessory shoe supports and orthotics. A variety of supportive devices have been investigated, including heel cups, heel wedges, silicone shoe inserts, and custom shoe orthotics.[33–36] A prospective study performed by Wenger et al[37] studied the efficacy of shoe modifications in altering the development of the longitudinal arch of the foot in 129 patients aged 3 to 5 years. They were unable to show any significant difference in foot development between patients with shoe wear modifications compared with healthy controls after at least 3 years of follow-up. Whitford and Esterman[38] compared generic orthoses, custom orthoses, and a control group in children aged 7 to 11 with flat feet. There were no significant differences between the groups in reported pain, gross motor proficiency, self-perception, or exercise efficiency.

There are a few studies that have reported correction of flatfoot with the use of over-the-counter arch supports, heel wedges, and orthotics[33,34]; however, these studies were greatly limited by the absence of matched controls. Any correction may be due to the natural history of resolution with age. A recent study investigated radiographic features in children with flexible flatfoot

who were >6 years old (mean age 10) and were treated with custom rigid foot orthoses. After 2-year follow-up, multiple radiographic measurements had improved, suggesting development of the medial longitudinal arch.[39] However, this study lacked both a control group and clinical assessments to evaluate any improved function of the feet. It still remains to be proven whether orthotic use can change the natural course of flatfoot in any pediatric age group.

Overall, unnecessary treatment of asymptomatic pediatric flat foot can be expensive, with no evidence of change in the patient's outcome.[11] A study by Pfeiffer et al[14] found that nearly 10% of patients with pediatric flatfoot wear some form of orthotics, despite only 2% reporting pain. Many physicians justify orthotic use in asymptomatic children by assuming that there is no harm. However, studies have suggested that unnecessary orthotic use can lead to dependency on orthotics[36] and even long-term negative psychological effects as an adult.[40]

A notable area of concern is whether persistent pediatric flatfoot predisposes patients to chronic foot pain or other pathology as an adult. If a patient has painless flexible flatfoot, then it is generally believed that there is a low likelihood the condition will evolve into painful flatfoot. However, Kosashvili et al[41] discovered that adolescents with moderate to severe flatfoot had nearly double the rate of anterior knee pain and intermittent low-back pain. The authors suggested that prophylactic treatment of severe, persistent flatfoot deformity may prevent future joint pain, although this has not been proven. As of now, further evidence is necessary before prophylactic treatment of asymptomatic flexible flatfoot can be recommended.

TABLE 1 Surgical Treatment Options for the Management of Pediatric Flexible Flatfoot With Their Associated Descriptions, Pros and Cons

Procedure	Description	Pros	Cons
1. Soft tissue procedures	Achilles lengthening to improve ankle range of motion Tendon transfers to realign muscular forces across the foot	May be used as adjunct with other procedures	Less efficacy when performed in isolation
2. Osteotomy	Cutting and realigning bones to correct pathologic alignment	A powerful surgery that offers large corrective capabilities	Relies on bone healing to maintain correction
		Reliable outcomes when performed correctly	Possibility of overcorrection
3. Arthrodesis	Fusion of joint to reduce motion and maintain joint alignment	Provides definitive correction	Irreversible elimination of joint movement
		Very powerful correction	Degeneration of adjacent joints
			Only used as last resort for children with physiologic flatfoot
4. Arthroereisis	Insertion of metal, silicone, or biodegradable implant into talocalcaneal joint	Minimally invasive	True long-term corrective ability unknown
		Implant may be removed	
		Does not alter bony or muscle anatomy	

Symptomatic Flatfoot

The hindfoot in normal foot mechanics inverts and provides a rigid lever arm for propulsion during push-off in gait. In flexible flatfoot, especially with associated Achilles tendon contracture, the hindfoot may lack the necessary inversion needed to create a rigid lever arm for propulsion. Inefficient push-off during gait may lead to lower-leg pain and foot muscle fatigue.

Symptomatic flatfoot includes a constellation of complaints, such as activity-related pain, fatigue of the foot muscles, calluses to the medial foot, and rapid shoe breakdown. Patients may also experience recurrent ankle sprains, especially while wearing shoes or inserts that provide substantial arch support. This is because the ankle has a tendency to invert with less contact between the foot and the ground as the heel is neutralized by the special inserts. In the presence of these symptoms, a referral to an orthopedic surgeon is recommended.

The initial treatment of painful-but-flexible flatfoot is nonoperative. Conservative treatment modalities, such as rest, activity modification, icing, massage, and nonsteroidal anti-inflammatory medication, are the initial interventions for pain reduction. In patients with a tight heel cord, the talus remains plantar-flexed, and orthotics may increase pain due to pressure against the talar head.[28] A home physical therapy program consisting of Achilles tendon stretching and calf muscle strengthening should be the initial recommendation. A recent study by Blitz et al[42] showed that stretching of the Achilles tendon may help counteract an equinus deformity, but there is still no definitive evidence to prove that physical therapy alters the clinical symptoms or structure of flat feet. Nonetheless, it is a reasonable starting point for management.

When a patient has symptomatic flatfoot without a tight heel cord, the physician may consider orthotics as the initial treatment of choice. Contrary to asymptomatic flexible flatfoot, generic orthotic use can reduce pain in symptomatic flexible flat feet for some patients.[33,34,43] Custom orthotics have not been proven to be superior to over-the-counter orthotics, so it is logical to recommend the least expensive orthotic first.[44] Only 1 study has quantitatively proven pain reduction with the use of custom-made orthoses in patients who had concomitant chronic juvenile arthritis and flatfoot.[45]

Surgery is rarely indicated in flexible flatfoot except in the presence of persistent pain despite a period of observation and nonsurgical management. The general goal of surgery is to provide durable reduction of symptoms throughout the child's growth into adulthood. There are several surgical methods to achieve this broad goal of altering foot mechanics and shape. These include soft tissue reconstruction (eg, tendon transfers), realignment osteotomies, and nonfusion motion-limiting techniques (eg, arthroereisis) (Table 1).

Isolated soft tissue surgical options include medial foot capsular-tightening procedures, peroneus brevis lengthening, or Achilles tendon lengthening. In general, these have had very poor results with high failure rates because the underlying structural anatomy of the foot is not altered.[31] Therefore, these procedures are usually performed in conjunction with osteotomies, which entail cutting bones and repositioning them in a more anatomic position to help restore normal foot anatomy.

Although a mainstay in treatment of painful adult flatfoot deformity, fusion of selected joints in the foot is not recommended in the pediatric population unless a neuromuscular

foot deformity is present. Fusion is irreversible and ultimately leads to increased stress in the adjacent midfoot and ankle joints due to lack of mobility of the fused joints.[46,47] It is best to preserve as much functional range of motion as possible in a pediatric patient, so fusion is generally avoided in the treatment of the common, flexible flatfoot. However, in adolescents or adult patients with neuromuscular flatfoot, fusion is a viable option, as it can provide definitive treatment with reliable results in patients who are minimally ambulatory at baseline.

Osteotomies address the underlying deformities in flexible flatfoot. These surgeries include the medial displacement calcaneal osteotomy, the lateral calcaneal lengthening osteotomy (eg, modified Evans osteotomy), and the Triple-C (calcaneus, medial cuneiform, cuboid) osteotomy. The medial displacement calcaneal osteotomy effectively compensates for a valgus heel by shifting the heel medially, allowing for a more medial and inversion-producing vector of the Achilles tendon.[48] Postsurgical series have demonstrated significant improvement of foot shape along with improvements in fatigue symptoms in 89.5% of patients studied after medial displacement calcaneal osteotomy.[49] The lateral calcaneal lengthening osteotomy is a powerful osteotomy that lengthens the anterior process of the calcaneus, and simultaneously can correct hindfoot valgus and forefoot abduction. Mosca[50] demonstrated a good or excellent clinical result in 93.5% of cases. After lateral calcaneal lengthening osteotomy, patients demonstrated significant biomechanical plantar pressure measurement improvements as well.[51] The postsurgical results of a Triple-C osteotomy also have been overall favorable from a clinical and radiographic evaluation, although these results have been observational
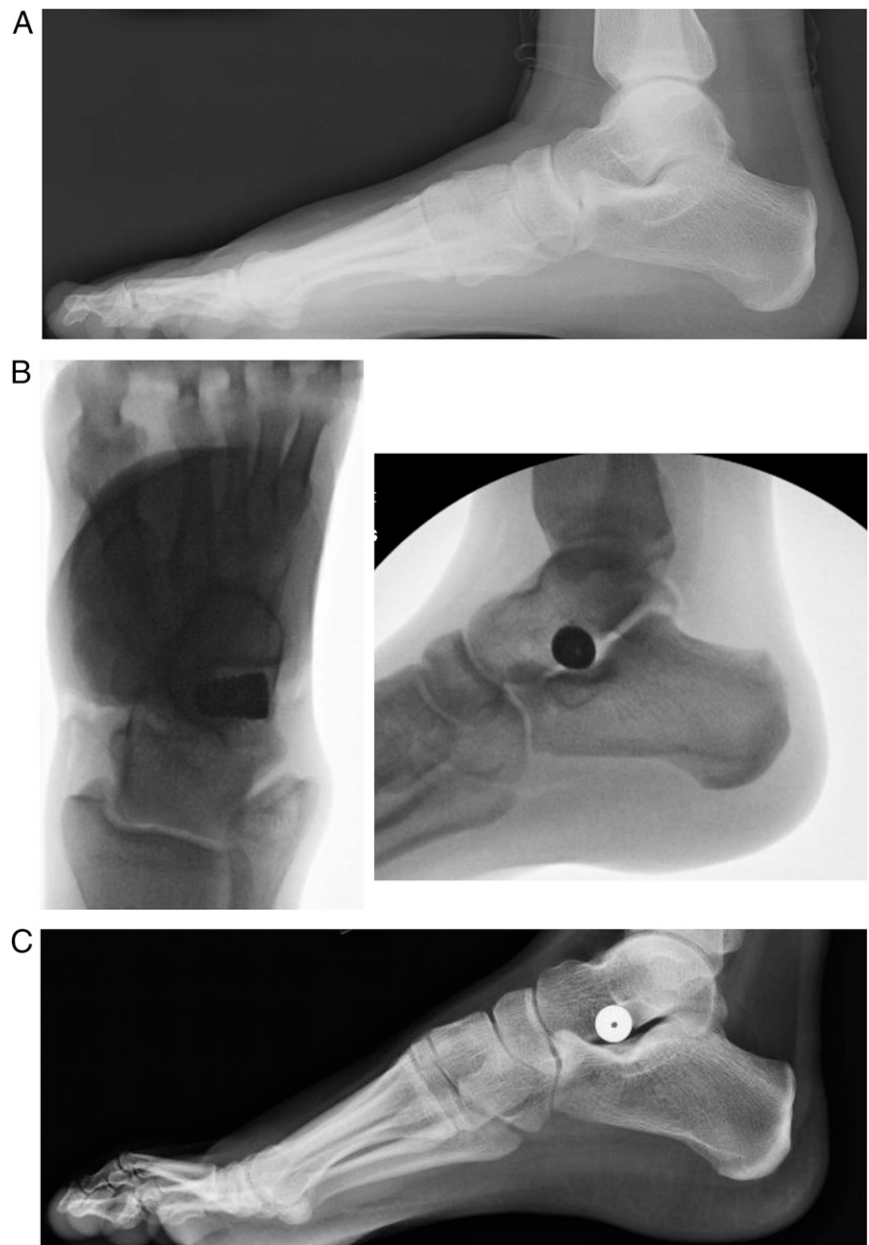

FIGURE 5
A, Preoperative lateral radiograph of an adolescent patient with severe right flatfoot. B, Intraoperative fluoroscopic radiograph after insertion of arthroereisis capsule, anteroposterior and lateral views. C, Postoperative lateral radiograph revealing stable placement of arthroereisis capsule and improved medial foot arch

without the support of a control group.[52,53]

Overall, positive outcomes after surgical management are possible when performed on the appropriate patient. A recent study by Oh et al[54] demonstrated a significantly increased mean American Orthopedic Foot and Ankle Society clinical

outcome score at mean 5.2 years after certain osteotomy procedures. Importantly, a return to sport activities was accomplished in 15 of 16 patients, and all patients were satisfied that they underwent the procedure. Akimau and Flowers[55] also demonstrated favorable patient outcome scores in children with flexible flatfoot after mean 5.6 years

of surgical follow-up. In summary, osteotomies appear to provide reliable improvement in pain and symptoms. More research is needed regarding long-term outcomes into adulthood.

Arthroereisis is a nonfusion type of procedure in which the motion of a joint is restricted though not fully eliminated. First introduced in the mid-1900s, this procedure entails placing a metal or bio-absorbable implant into the sinus tarsi of the foot (Fig 5). This blocks excessive eversion of the subtalar joint, subsequently preventing arch collapse. Some find this procedure attractive because it is less invasive as no osteotomy is involved. In addition to pain relief, the goal of this procedure is to prevent loss of posterior tibial tendon function, thereby minimizing the need for future reconstructive foot surgery. Studies have demonstrated increased ankle dorsiflexion, decreased foot pain, improvement of radiographic features, and even improvement in foot printing after this procedure.[56–59] A recent case series has also demonstrated the potential for maintenance of the foot in a corrected position even after subsequent implant removal.[60]

One of the main concerns regarding this procedure is its high reported complication rate in 4% to 18% of cases in a recent literature review.[57] Frequently reported complications include malpositioning of the implant, improper correction of the deformity, extrusion of the implant from the sinus tarsi, foreign body reaction to the implant, peroneal spasm, and persistent foot pain. These complications are generally managed by implant removal. More serious complications include talar neck fracture and the development of subtalar fusion.[61,62] Although most of the available case series on arthroereisis provide favorable radiographic results and improved foot alignment,[57,60] the complication rate is high and long-term results into adulthood are lacking.

CONCLUSIONS AND FUTURE DIRECTIONS

Based on current literature, treatment of flexible pes planus in children is indicated only for those who have painful symptoms. Both orthotic and surgical treatments can improve pain levels and function, although the literature clearly lacks rigorous comparative studies for each intervention. An improved understanding of the natural history of asymptomatic flatfoot into adulthood needs to be elucidated. It is well known that there is a subset of adults with pes planus who develop disabling pain, posterior tibial tendon dysfunction, and subsequent progressive arthritis of the ankle and subtalar joint. It is not clear whether there is a link between pediatric flexible flatfoot and the development of posterior tibial tendon dysfunction in adults or whether the altered biomechanics of the pediatric flatfoot predisposes to tendon failure.

Prophylactic treatment of an asymptomatic, painless flatfoot with expensive orthotics or surgery is not justified until the natural history of flatfoot is more thoroughly investigated. A validated outcomes measure for pediatric foot and ankle conditions needs to be standardized so that reported outcomes on all interventions for symptomatic flatfoot can be more clearly and objectively understood.

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CARR et al

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