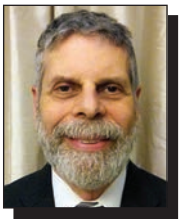
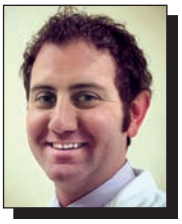

Stanley Beekman, DPM


Joseph D'Amico, DPM


Mark Caselli, DPM


Louis DeCaro, DPM


Patrick DeHeer, DPM


Nicholas Pagano, DPM


Mitzi L. Williams, DPM

Pediatrics and Podiatric Medicine

Our experts discuss the latest trends in this area.

BY MARC HASPEL, DPM

The practice of pediatrics within the specialty of podiatric medicine could be one of the best-kept secrets of the profession. Simply by offering a wide range of services to the youngest in the population, a podiatric practice could benefit in untold ways. Once a podiatric physician gains the confidence of those seeking care for their children, the rest of the family will very often trust its care with that same doctor. Savvy practitioners also recognize that the opposite is true. Often presenting pedal structural complaints of adults can also be identified in their children, giving podiatric physicians an opportunity to treat many more patients. The result could be an exponential growth in the podiatric practice. Of course, the desire to practice pediatrics in podiatric medicine demands strong knowledge and skill in many medical disciplines including biomechanics, neurologic development, dermatology, and surgery. In addition, a warm welcoming professional demeanor is usually necessary to receive and treat young patients.

Recognizing the potent role that pediatrics can play within the practice of podiatric medicine, *Podiatry Management* has invited several leading practitioners in that field to participate in a lively roundtable discussion on a few select topics in pediatrics. They have shared their insights on problematic childhood pedal conditions, and offered recommendations on growing a pediatric following within a practice of podiatric medicine.

Joining this roundtable panel are:

Stanley Beekman, DPM, was first Fellow of Orthopedics and Biomechanics at the New York College of Podiatric Medicine. He served as assistant professor in the Department of Clinical services at the Ohio College of Podiatric Medicine, where he supervised the students in the podo-pediatric department.

Joseph D'Amico, DPM is professor of Orthopedics & Pediatrics, and past chairman in the Division of Orthopedic Sciences at the New York College of Podiatric Medicine. He is past director of the Department of Biomechanics at the California College of Podiatric Medicine. He currently is in private practice, limited to gait-related disorders, in New York, New York.

Mark Caselli, DPM is an adjunct professor, Department of Orthopedics, at the New York College of Podiatric Medicine; he is adjunct Professor, Ramapo College of New Jersey. Dr. Caselli is a fellow, American College of Foot and Ankle Pediatrics. He is former chair, Department of Orthopedics and Director of Pediatrics, at the New York College of Podiatric Medicine.

Louis DeCaro, DPM specializes in pediatrics, sports medicine, and biomechanics. Dr. DeCaro is president and fellow of the American College of Foot & Ankle Pediatrics. He is board certified by the American Board of Multiple Specialties in podiatry. In 2018, he was granted fellowship in the Royal College of Physicians & Surgeons of Glasgow. Dr. DeCaro is an international lecturer on the topics of podo-pediatrics and

Continued on page 92

Simply by offering a wide range of services to the youngest in the population, a podiatric practice could benefit in untold ways.

Pediatrics (from page 91)

biomechanics, and runs a specialty gait evaluation clinic for some of his most challenging pediatric cases.

Patrick DeHeer, DPM is in private practice in Indianapolis, Indiana. He is a trustee for the American Podiatric Medical Association, and serves as residency director of St. Vincent Hospital in Indianapolis. Dr. DeHeer is board certified by the American Board of Foot and Ankle Surgeons in Foot Surgery, and Reconstructive Rearfoot and Ankle Surgery. Dr. DeHeer is a fellow of the American College of Foot and Ankle Pediatrics. He lists as potential conflicts of interest that he is the owner of IQ Medical and inventor of The Equinus Brace. He is speaker for Paragon 28 and serves as consultant for Flower Orthopedics and Wishbone Orthopedics.

Nicholas Pagano, DPM is in private practice at Barking Dogs Foot and Ankle Care in Plymouth Meeting, PA. He is course director of Pediatric Foot and Ankle Orthopedics at Temple University School of Podiatric Medicine. He is the Vice President of ACFAP and an on-air expert For Spenco Medical Corporation on QVC.

Mitzi L. Williams, DPM is an attending surgeon at Kaiser Permanente Foundation Hospitals in Oakland, CA. She is an attending surgeon at the San Francisco Bay Area Foot and Ankle Residency Program. She is a member of the Podiatry Institute and fellow of both the American College of Foot and Ankle Surgeons and the American College of Foot and Ankle Pediatrics. She is an instructor for the American Academy of Foot and Ankle Osteosynthesis.

PM: *How do you handle juvenile hallux valgus?*

D'Amico: I believe that no child is born with hallux abductovalgus. The deformity is primarily acquired through mechanical dysfunction of the foot and limb. Factors contributing to its age of appearance, severity, and progression include: the degree of congenital structural imperfections present, ligamentous laxity, equinus influences, family history, improper footwear, presence of metatarsus adductus, obesity, et al.

Treatment is based on identification and neutralization of structural imperfections to prevent progression and encourage resolution. If the deforming forces can be controlled with the proper orthotic device, and maintained during developmental years some measure of success can be anticipated. In essence, this approach is similar to that of orthodontics. If an improperly aligned skeletal segment can be held in its corrected position, and the forces that were responsible for its inception negated, then, according to Wolf's Law of Bone and Davis' Law of Soft Tissue, improvement should be achievable.

As far as the use of HAV night splints in younger children, I have found them to be of little value. This is due to the fact that most of these patients have ligamentous laxity, which makes the benefit of a hallux-abducting splint less likely. In older children, or in those cases with normal joint motion, I do augment treatment with splints.

In individuals with metatarsus adductus, I find that there is a predisposition to hallux abductovalgus formation because of footwear. Therefore, along with the appropriate conservative management, counseling on the appropriate straight last type footwear is essential in preventing further hallux abduction forces. Of course, any accompanying pathomechanical deficiencies must be identified and neutralized as well.

Posterior group contractures that have contributed to hallux valgus production should be given both passive and, depending on the age of the child, active stretching exercises. If this is ineffective, or impractical, physical therapy referral is warranted. The use of a posterior night splint with the foot and leg held at least at 90 degrees to prevent perpetuation of the deformity due to sleep-induced plantarflexion is often indicated and beneficial. While a below-knee splint prevents plantarflexion of the foot on the leg, the opportunity for knee flexion is still present so ideally an above-knee splint would be advantageous.

Williams: The earlier a deformity presents, the more important it is for the clinician to determine why faulty mechanics exist. There tends to be a proximal driving force. For example, young children often present with JHAV and co-existing hind foot valgus. Hence, early biomechanical control of the foot either from an orthotic or SMO is important. Despite all efforts, many children with JHAV at an early age will progress toward the development of pain and/or fatigue.

"Not one combination of procedures is right for every child presenting with JHAV."—Williams

Upon failure of conservative modalities, taking available growth into account, surgery may be suggested.

Surgery is specific to the child and the individual deformity. This is important to understand. No one combination of procedures is right for every child presenting with JHAV. The hindfoot position followed by 1st ray position needs to be evaluated. Medial column instability is generally noted. It is the exception that the child does not have some component of equinus if hind foot valgus is present.

In the presence of equinus, a gastrocnemius recession may be performed. With open growth plates in the presence of hind foot valgus often a lateral calcaneal osteotomy is performed followed by evaluation of any forefoot supinatus. If this exists with open growth plates, then an opening medial cuneiform osteotomy remains an option followed by evaluation of the JHAV deformity. At times, a proximal 1st metatarsal osteotomy with or without a distal 1st metatarsal osteotomy is an option. It is always easier when the growth plates are near closure, as the Lapidus arthrodesis becomes a viable option for medial column correction.

Hence, it is important to attempt conservative biomechanical control for JHAV until the child nears growth plate closure, as recurrence rates remain high. Unilateral JHAV without

Continued on page 94

Pediatrics *(from page 92)*

familial history should prompt evaluation for other causes. Physical therapy is very helpful with transitioning these children back to regular footgear and activities.

Caselli: There are two major considerations when treating a child or adolescent presenting with a hallux valgus deformity. The first is addressing the immediate problem. This includes concern about the cosmetic appearance of the overall deformity, especially by parents, problems with shoe fit, pain from pressure on the head of the first metatarsal, or less commonly first metatarsal phalangeal joint pain. The second is discussing future treatment options. If the only concern is the cosmetic appearance, and fear of the deformity getting worse, especially if there is a positive family history, then my approach is to address the child's structural and musculoskeletal deviations that might contribute to the hallux valgus deformity. These might include ligamentous laxity, faulty foot biomechanics, ankle equinus, superstructural transverse plane deviations (in toe/out toe), and leg length discrepancy.

When discussing shoe fit, it is important to clearly define what type of shoes are being discussed: dress, casual, or athletic. If the only problem is with an occasionally worn stylish dress shoe, a small piece of adhesive felt employed as a dispersion pad could be used. For other types of shoes, recommending wider shoes, different styles, or men's athletic shoes for adolescent girls might help.

If the patient is functioning well in a specific type of athletic shoe, but it is too tight in the forefoot, then stretching the shoe or using either a temporary pad applied daily, or a removable dispersion device, is advised. This is practical when the shoe is only worn for short periods of time, as only during competitions. The use of foot orthoses should be considered with caution, since they will usually exacerbate the problem in an already tight shoe, though they are usually helpful when joint pain alone is the problem.

Future treatment options depend on the severity of the hallux valgus deformity and the patient's activities. Although surgery is often a good option for a severe deformity, it should be carefully considered in high functioning athletes, such as dancers.

DeCaro: I agree that the first rule is to always find the biomechanical cause of the deformity. Regardless of whether one chooses to correct the deformity, I believe that it is important that one must make sure that the etiology is also corrected, not only before, but after the procedure too. I recommend paying close attention to making sure that limb length discrepancy is also properly screened. Clearly, unilateral deformities are significant. In general, children should not be developing hallux abductovalgus deformities. If so, then one must understand that there are indeed accelerated biomechanical factors at work that need to be identified and treated to prevent recurrence.

Pagano: I think the two most important items for handling juvenile hallux valgus are a good history of the deformity, including the family history with a predisposition for hallux valgus, and proper radiographic studies to evaluate for an underlying cause. I initially will treat the condition of juvenile hallux valgus with conservative measures like orthoses and shoe adjustments. In the presence of significant deformity that is affecting a child's daily activities, coupled with a strong family history of the deformity, I would discuss surgical intervention with the patient's family. Importantly, most surgical intervention needs to avoid open growth plates.

DeHeer: In patients with juvenile hallux valgus, there are multiple considerations that must be taken into account. I believe in the tri-planar concepts of hallux abductovalgus, and the emerging literature continues to support this paradigm shift. This means translational osteotomies do not fully correct the deformity, and recurrence is almost inevitable. If one takes a deep dive into the literature, it is pretty clear that the Lapidus, minimal incision Bosch, or proximal rotational metatarsal osteotomy procedures are optimal choices as they allow for tri-planar correction. As for which one of these three procedures I choose, it depends on the individual patient's clinical and radiological examination. Most of the literature does suggest waiting until the growth plate has closed. I agree with this recommendation.

"When discussing shoe fit, it is important to clearly define what type of shoes are being discussed: dress, casual, or athletic."—Caselli

Beekman: I have always preferred the Ellis procedure. This was a very innocuous procedure that yielded great results. If I found that the patient was not of the appropriate age, however, I would make a pair of leather orthoses with a bunion flare (to off-load the first metatarsal head), and a post under the metatarsals from two-to-five to allow the first metatarsal to plantar-flex and abduct towards the second metatarsal.

Q ***PM:*** *What is your preferred treatment for clubfoot (e.g., serial immobilization casting, Ponseti Method, other surgical intervention)? (*****Note:*** *see the sidebar on 96 for Dr. DeHeer's explication of the Ponseti method)*

Williams: With the Ponseti Method, infants undergoing aggressive posterior medial releases have drastically been reduced. Unfortunately, I see a great number of parents who themselves had large releases and surgeries at an early age. They eagerly bring their infants in for a less invasive approach. What we learned is that surgery produced very rigid, non-supple feet that required multiple surgeries to achieve

Continued on page 96

Pediatrics (from page 94)

a stable tripod. We learned that operating on these children led to retracting fibrosis. Now with the Ponseti method, the majority of infants can achieve a supple, pain-free, functional foot with gentle manipulation and serial casting. Over 90% of these children will require an Achilles tenotomy just prior to their final cast. Some will require repeated tenotomies and/or an anterior tibial tendon transfer. These procedures are much less invasive in comparison. Stretching protocols and bracing compliance are keys to ongoing success.

Recurrence of the deformity may be addressed with serial casting. Often, casting provides stretching while it also minimizes procedures needed in the future. This question highlights the breakthrough reverse Ponseti approach developed by Dr. Matthew Dobbs for the treatment of congenital vertical talus. With many of these congenital deformities, it is important to understand their pathogenesis.

If the clinician does not perform the Ponseti method as described, then a complex clubfoot may develop. This foot is often edematous, short, and stumpy. The foot can be painful. The child may need a cast vacation followed by the complex maneuver as described by Dr. Ponseti.

Beekman: Most clubfeet are identified in the pediatric wards. That being said, I would try to determine if the foot I was seeing had an intrinsic or extrinsic clubfoot. Extrinsic clubfeet respond well to serial casting, while intrinsic clubfeet will not. A British orthopedic surgeon, Alan Appley, gave a talk about this back in 1977. He would window chicken eggs and bound the chicks' feet to the legs. The chicks' feet that were bound in position for a longer time would tend to result in a non-self-correcting club foot. Once identified as an intrinsic club foot, I believe surgery should be performed as soon as possible.

D'Amico: In my career, I have been able to obtain correction of talipes equinovarus deformities using the Ponseti method of serial plaster immobilization with very few patients requiring full surgical intervention.

The Ponseti Method Explained

By Patrick DeHeer, DPM

The Ponseti method of clubfoot management involves serial casting to treat clubfoot with a ninety-five-percent success rate. The method consists of manipulation and casting using an abductory force against a stabilized talus. Gentle manipulation is recommended prior to casting to stretch contracted structures and evaluate the flexibility of the deformity. Above-the-knee serial casting is performed using a well-molded cast with thin padding. Application of the first cast requires supination of the forefoot to align the forefoot with the rear foot, reducing the cavus deformity. It is critical to never pronate the foot during casting. With subsequent casts, the foot is abducted against the stabilized talus, correcting the adduction and varus deformities. The thumb is used as counter pressure against the talus, with care to avoid applying pressure to the calcaneus, preventing deformity correction.

The equinus component of the deformity is not corrected until the foot is in at least sixty degrees of abduction to the frontal plane to the tibia and the calcaneus is in neutral to slight valgus position. Typically, four to six casts changed weekly are required to reach this point of the therapy, with more rigid deformities requiring more casts. Approximately eighty percent of patients require an Achilles tenotomy to correct the equinus component. The final cast is applied immediately after the tenotomy and left in place for three weeks. Post-cast bracing is critical to prevent recurrence, typically lasting until the age of four. •

Pagano: I always try the Ponseti method, and have had success with that procedure in children up until three years of age. If their clubfeet are flexible, I would consider treating them up to seven years old. I have to stress that surgical intervention will usually include a percutaneous tendo-Achilles lengthening after they reached the last position of the Ponseti technique to completely eliminate the equinus.

DeHeer: I too am a big Ponseti advocate. I believe in the method. I think following the Ponseti protocols without deviation is important to optimal outcomes.

Q ***PM:*** *What concerns do you have when treating the feet of children with Down syndrome?*

Caselli: The primary concern when treating the feet of children with Down syndrome is to follow the philosophy that ambulation for patients is a predictor of their survival. Their disturbed gait kinematics from joint laxity and muscle hypotonia results in reduced exercise capacity. Children with Down syndrome participate in less physical activity, leading to obesity, increased risk of joint pain, decreased endurance, and diabetes. Treatment should be directed towards promoting ambulation and encouraging walking, dancing, playing ball, biking, aerobics, and training programs.

These goals are accomplished by: promoting independent stance and walking, reducing out toe and genu-valgum, and decreasing the effects of pedal structural disorders. Early detection and treatment of congenital foot deformities can reduce the severity of other orthopedic problems. Since corrective modalities often require longer periods of time, modalities that impede ambulation

Continued on page 97

Pediatrics (from page 96)

should be avoided in children over eighteen months of age. Modified open-toed straight-last shoes are ideal for the follow-up treatment of metatarsus adductus and clubfoot since they also improve foot and ankle stability and encourage ambulation in first walkers. Their function can also be enhanced with the inclusion of a foot orthosis. For independent ambulators, high-top athletic shoes or boots with foot orthoses are also helpful. Stability of shoes can also be enhanced by adding external medial buttresses to the shoes. In more severe cases, supramalleolar ankle-foot orthoses can be prescribed.

When treating children with Down syndrome, podiatric physicians must be aware of, and address, the conditions of atlanto-axial subluxation, scoliosis, acetabular dysplasia, hip subluxation/dislocation, and slipped femoral epiphysis since these represent common Down syndrome-related orthopedic pathologies.

Pagano: The major complaints of Down syndrome children seen in my practice involve flexible pes planus and halluxabducto valgus. Their feet are often wider in structure and these issues can be treated successfully with conservative measures like UCBL orthotics and appropriate-fitting shoes. It is the flexibility of the deformities of the Down syndrome patient that causes their problems, so protecting them is the key to effective treatment as well as cultivating a great relationship with physical therapists who specialize in patients with Down syndrome.

Williams: Ligamentous laxity, associated with Down syndrome, predisposes this population to pes plano valgus, JHAV, or valgus ankle deformities. Likewise, these children also present with complaints of foot gear irritation often due to a wide foot type. The need for biomechanical control is often present. If laxity is too great at the level of the ankle joint despite a deep heel cup, medial skive, and flanges, then a supramalleolar orthotic (SMO) may be needed. Down syndrome children

Continued on page 98

"The major complaints of Down syndrome children seen in my practice involve flexible pes planus and halluxabducto valgus."—Pagano

Pediatrics *(from page 97)*

benefit from physical therapy because of both laxity and hypotonia. If the deformity progresses with age and the foot is no longer brace-able, or the pain interferes with function, then surgery is evaluated on an individual basis.

DeCaro: Individuals with Down syndrome typically have problems with collagen, which is the major protein that makes up ligaments, tendons, cartilage, bone, and the support structure of the skin. This creates significant laxity from the feet up, thus beginning at a young age the life-long destruction of the kinetic chain. The resulting effect in a very high percentage of the Down syndrome population is hypotonia, ligamentous laxity, and/or hyper-mobility of the joints. The combination of this ligamentous laxity and low muscle tone contribute to a lifetime of orthopedic problems.

Orthoses need to be specifically designed to improve coordination, balance, pain, posture, and strength, and to aid in the development of a more stable and functional gait. Early orthotic intervention is critical. These orthoses should be comprised of a deep heel cup, a medial heel skive, and high medial and lateral sidewall flanges. Control of the subtalar joint is paramount. Often, kids are overbraced with ankle foot orthoses due to lack of foot control. By providing adequate foot control, supramalleolar orthoses and ankle foot orthoses are oftentimes not necessary. Many children are prescribed braces unnecessarily, and as a consequence lack necessary joint movements and muscle development vital for normal growth and maturity.

D'Amico: One of the primary concerns I have when treating the feet of children with Down syndrome is what steps must be taken to be able to control and stabilize their feet and ankles because they characteristically present with high degrees of joint laxity as well as neuro-motor imperfections, rendering efficient gait difficult. This can lead to an inordinate fall history and accompanying

Continued on page 99

The combination of this ligamentous laxity and low muscle tone contribute to a lifetime of orthopedic problems.—DeCaro

Pediatrics (from page 98)

structural deficiencies. I am also concerned about the weight of these children.

Once this information has been obtained, the appropriate orthoses can be prescribed. For the most part, and in most cases, the devices are full-foot comprised of a non-compressible rigid to semi-rigid shell and a deepened heel seat. The prescription of appropriate rear and forefoot posting extended to the sulcus for increased forefoot activity and stability is beneficial. The addition of a soft tissue supplement to the toes prevents the device from movement in the shoe. Additional motion controlling considerations may include: a lateral clip or flange, high medial flange, Kirby skive or Blake inverted cast modification, et al. Additional correction, if necessary, may be incorporated into the shoes. Stabilizing but forefoot flexible footwear with minimal longitudinal motion that can comfortably incorporate the orthotic devices, is essential to ensure compliance and success.

Q ***PM:*** *At what point would you order oral anti-fungal medication in pediatric patients with onychomycosis?*

Beekman: As per its product label, oral terbinifine has not been evaluated for use in pediatric patients. Moreover, I wouldn't take the risk of having a side-effect with an off label use. I prefer to provide palliative treatment until the child ages, and then put the child on the oral medication.

"As per its product label, oral terbinifine has not been evaluated for use in pediatric patients."—Beekman

D'Amico: I also do not prescribe oral anti-fungal agents for children. In the relatively few cases of pediatric onychomycosis that I see in practice, however, I begin with a non-prescription, physician-only-dispensed, antifungal solution applied twice daily. The area of clear nail is measured and if no improvement is seen in three months, I recommend laser treatment. If the nail or nails are hypertrophic, then periodic reduction is also performed. An antifungal shoe spray is suggested to eliminate the possibility of continued recontamination. The caveat here is that unless the parents are going to monitor application of the topical solution, I've found the kids to be less than ideally dependable in terms of applying the medication as directed.

DeCaro: I also do not prescribe oral anti-fungal medication in pediatric patients with onychomycosis. There are several reasons. First, I believe that most dystrophic toenail cases are caused by biomechanics. Until those issues are

Continued on page 100

Pediatrics *(from page 99)*

addressed, feeding patients with possibly dangerous orals, just for them to fail, is a bad and dangerous plan. The issue will simply return. In my office, patients use an over-the-counter topical anti-fungal medication and a fungal blocker-like agent together, while addressing the biomechanics with orthoses to stop the process of infiltration/micro-trauma. Similarly, if I feel that the fungal nails are not biomechanically induced, then the same over-the-counter treatment is done. It is also important to note that shoes need to be fungal-free, socks need to be changed often, and the affected nails need to be kept short and debrided.

DeHeer: I use oral Lamisil in teenagers with laboratory confirmation of onychomycosis. I do believe it is important to discuss with the parents that the use in pediatric patients is off-label. It is also critical to treat onychomycosis until it has completely resolved, meaning that after oral therapy, I will prescribe a topical medication until the nails have completely cleared clinically.

Williams: Many children are treated for presumed onychomycosis, which is in essence secondary to micro-repetitive trauma or associated with a systemic condition. With this being said, it is important to first confirm a fungal etiology for the dystrophic nail changes. Topical medications are generally attempted with proper hygiene. Then, if there is failure I collaborate with the pediatrician and/or pediatric dermatologist on the safest oral agent for the child.

Q ***PM:*** *What is your feeling about the effectiveness of splinting to manage foot deformities once children become early ambulators?*

Beekman: I used the Dennis-Browne bar with high top shoes attached, essentially the way I was taught by Herman Tax, DPM. The length of the bar should equal the width of the shoulders. I start children at rectus to get them used to wearing the shoes and bars at night. I would re-appoint every two weeks, and gradually increase the angulation by the smallest amount the attachment mechanism would allow. The maximum correction I would obtain would be when each shoe is pointed outwards at forty-five degrees. Also it is important to remember to bend the bars so that both feet are inverted. This prevents pronation of the feet, which results in the abductory force being transmitted upwards. This works very well for tibial torsion, with resolution in several months. The orthopedic literature questions its efficacy; however, the literature also says that those who don't spontaneously resolve require surgery. The bars can only be utilized until

Continued on page 101

Pediatrics (from page 100)

three years of age, as children of that age learn to untie double knots.

D'Amico: Splinting or serial plaster immobilization of foot deformities has been shown to be effective even after children have begun ambulating. I say this with specific reference to gastroc/soleus equinus contractures, which would benefit from at least the night-time use of a posterior splint ankle foot orthosis, set at least ninety degrees to prevent foot and ankle contracture during sleep.

R. Paul Jordan, DPM, in his management of pediatric cerebral palsy patients, routinely employs below knee or above knee plaster casts to prevent further contracture,

"In toe-walkers, splinting can make a significant difference."—DeHeer

and facilitate an improved gait post-cessation of therapy. It is worth remembering that James V. Ganley, DPM, one of the pioneers in the management of pediatric lower limb disorders, advocated splints and casts prior to ambulation since he felt these modalities were particularly effective in this age group.

Pagano: I think appliances like the Wheaton brace and tibial torsion braces can be very effective in treating flexible deformities. The literature says that serial casting will not affect the intrinsic unwinding of the bones. If deformities are not reducible in the office, and there are underlying bony abnormalities, I think that splinting would prove to be ineffective in the long run.

DeHeer: In toe-walkers, splinting can make a significant difference. Lack of tibial torsion causing in-toeing often resolves with normal development, and does not require active treatment. I may use a type C heel stabilizer to encourage a more straight-line gait pattern, but the tibial torsion deformity resolves with normal growth the vast majority of the time. Metatarsus adductus deformity responds very well to serial casting and splinting.

Williams: I am an advocate of splinting and/or casting to improve a deformity and to hopefully decrease the child's risk toward a more aggressive surgery. I find this specifically helpful with recurrent talipes equinovarus, metatarsus adductus, and congenital vertical talus. While surgery may be needed, the surgical procedures may be influenced by some correction of the deformity via casting.

Caselli: Splinting can be very effective in managing many foot deformities once children become ambulatory, and should be used post-operatively and post-casting

Continued on page 104

Pediatrics *(from page 101)*

for talipes equinovarus or metatarsus adductus correction. Splinting can be utilized well into their early ambulatory period to maintain correction. Open-toed straight last, or abducted last shoes can be used for most hours of the day and night. These shoes can be modified with felt bars extending from the bases of the first metatarsal to the distal end of the shoes in order to provide a snug fit and maintain feet in rectus alignment. The shoes can be used as the initial treatment in the early ambulators with a flexible metatarsus adductus, or in children with residual adductus deformities after other forms of treatment for talipes equinovarus or metatarsus adductus.

Open-toed straight last shoes are made in sizes to accommodate two to three-year-old children. They should be worn nearly twenty-four hours a day to be effective. I often prescribe two pairs of shoes, one for daytime ambulatory use and one "clean pair" for bedtime use. I often get better compliance from the parents by doing this. Children's feet should be evaluated while weight-bearing monthly, and the shoes re-modified to ensure that the feet are in corrected position while in the shoes. This should be continued until the feet remain corrected for at least four to six months. I then recommend the shoes be worn at bedtime until they no longer fit.

Night splints or ankle foot orthoses should be used at naptime, and at bedtime, following ankle equinus correction in early ambulators for at least four to six months after the equinus is resolved.

PM: *Discuss diagnostic and treatment concerns you have when seeing a patient with a pes cavus deformity?*

DeHeer: Of utmost importance in the evaluation of a pediatric cavus deformity is the determination of any underlying neuromuscular component (e.g., Charcot Marie Tooth). Much like pediatric flatfoot, treatment is based on pain and/or deformity. The presence of a neuromuscular disease must be taken into account with both conservative and surgical treatment. Conservatively, custom orthoses can be of significant benefit. Surgically, cavus feet require treatment of each of the specific components of the deformity with the core principles of deformity correction to remove any deforming forces of the leg onto the foot, get the rear foot perpendicular to ground, and get the forefoot parallel to the rear foot.

Pagano: I, too, am also always concerned about a neurological underlying cause to a pediatric cavus deformity. Until the age of seven, I expect to see a flexible pes planus foot type. When I do see a cavus foot type, I always get a good developmental history, and consider the possibility of referral to neurology.

"When I do see a cavus foot type, I always get a good developmental history, and consider the possibility of referral to neurology."—Pagano

Williams: Children presenting with pes cavus or varus deformities should be evaluated for hereditary motor sensory neuropathies (CMT). If concerns exist, the child should be referred to pediatric neurology. With such progressive deformities, it is important to educate families and children on what to expect long-term. Likewise, from a surgeon's perspective, it is key to understand how the progressive deformity may change despite surgical positioning. On the other hand, pes cavus may present in association with non-progressive neuromuscular conditions such as cerebral palsy.

Conservative bracing and or orthoses can be helpful, while surgery can play a role in the older symptomatic child closer to skeletal maturity. After exclusion of neuromuscular involvement, one must determine if there is a rigid hind foot varus or if the deformity is secondary to a plantarflexed 1st ray. Both may be present. The Coleman block test is useful in evaluation. Osteotomies dependent on the individual deformity may include the: calcaneus, medial cuneiform, midfoot, 1st metatarsal and/or proximal phalanx. Physical therapy, gait training, and bracing remain important in this patient group especially if neuromuscular involvement is present.

Beekman: In cases of cavus feet in children, it is extremely important to perform a neurologic exam. I advise looking at the gait, and examine the feet and legs looking for weakness, spasticity, or lack of balance. During my time at the Children's Foot Clinic at the Ohio College of Podiatric Medicine, we had a case of cavus which was eventually diagnosed as a result of diastatomyelia, and was treated by spinal surgery. Other conditions that can result in pes cavus, include the other spinal dysraphisms (Spina bifida and spina bifida occulta), Charcot Marie Tooth, poliomyelitis, cerebral palsy and others. The key is starting with a neurologic exam, and if positive, consulting with specialists in pediatric neurology.

D'Amico: A rigid pes cavus deformity, which is not associated with neurological impairment, is infrequently found in the average pediatric patient population. My concerns for this rigid foot type include a limitation of shock absorption, claw toe deformities, plantarflexed first rays with apparent one-through-five forefoot valgus deformities, and accompanying discrete tripod weight-bearing segments. Conservative management includes increasing the weight-bearing surface through the prescription of custom foot orthoses with significantly cut out first met head regions and the appropriate forefoot valgus posting, improving shock absorption via appropriate

Continued on page 106

Pediatrics *(from page 104)*

footwear, and the avoidance of barefoot walking.

On the other hand, what is a commonly occurring condition in the pediatric population is the collapsible cavus foot. This is a flexible type of cavus foot that in essence collapses or fails upon weight-bearing. Again, I believe controlling the underlying pathomechanical forces is tantamount in its conservative management.

Q ***PM:*** *How do you treat plantar warts in children?*

DeCaro: I base my choice of treatment on the level of pain experienced by the children. If the warts are not painful, then I do not subject the children to painful treatments. I find that duct tape therapy is super effective both in kids who have painful warts and kids with non-painful warts, where either they, or the parents, want them gone. I have a very large practice, and proper use of duct tape has proven amazing. I think it is still important to make sure that the patients adhere to proper protocols and compliance in order to ensure duct tape success. I have also often used cimetidine, which I find highly effective and pain-free.

Caselli: In children, there are many factors determining susceptibility to developing and resolving wart infections, including the immune system and the condition of skin. This often leads to a great variation in the time involved in the treatment and success of any type of treatment. It has also been my experience that most treatments over a period of time result in success. Because of this, I select a treatment plan with two main goals. First, in order to do no harm, I do not use any treatment that can result in scarring of the skin, especially the plantar surface. Secondly, I attempt to cause minimal to no discomfort.

I employ gentle sharp debridement to pinpoint bleeding. With good technique, children should experience minimal discomfort. I stop as soon as they complain of pain. I then cauterize the bleeding with silver nitrate. If that stings, I immediately dab the area with cool water. If their skin is hyperhydrotic, I have parents apply a drying agent. If the skin is excessively dry, then a moisturizing agent is used. This appears to help resolve the infection.

If the wart is painful, I initially apply a felt aperture dispersion pad with forty to sixty percent salicylic acid ointment.

For young children, weekly visits are often initially necessary. Patience is vital, on the part of children, the parents, and any treating doctors.

D'Amico: When children are amenable, debridement of the lesions would be the first step. I follow this by N2O cryosurgery twelve to fifteen seconds at 128 degrees F. I then use forty percent salicylic acid plaster, placed over the site with a one-eighth inch dispersion pad applied. Patients are instructed to keep the area covered with duct tape. This treatment is repeated at bi-weekly intervals until resolution is achieved.

In more widespread or resistant cases, patients are dispensed Verucide solution to be applied daily. In children with accompanying hyperhidrosis, ten percent formalin solution is dispensed, and applied once daily to the affected sites. I avoid the use of strong vesicants, such as those preparations containing cantharidin, in younger children.

Beekman: I agree that one of the factors for the development of verruca is hyperhydrosis and its alkaline effect on the skin. Therefore, my preferred method is the application of mono-chloracetic acid, and the use of formalin. If this fails to have an effect, I would then progress to curettage.

Pagano: I always tell children to say, "stop," immediately, when the debridement begins to bother them. I find this helps to build their trust. I then use cantharidin under occlusion for four to six hours, and then, immediately remove it followed by washing the feet. I also send the patients home with formalin to apply to the areas every three days. I also instruct them to use Aldara cream three times a week. This will sometimes require two to three treatment visits over the next two months.

DeHeer: I have found most treatments for plantar warts to be mediocre. Combination therapy does seem to have slightly better outcomes. I use a combination of cryotherapy and acid therapy. Recently, I have started using microwave therapy with the Swift system. I am excited about the literature on this treatment, as it appears to have significantly better outcomes.

"In children, there are many factors determining susceptibility to developing and resolving wart infections, including the immune system and the condition of skin."—Caselli

"Not all pediatric flatfeet are pathologically functioning feet."—D'Amico

Q ***PM:*** *Please discuss whether or not you recommend treatment in the asymptomatic pediatric flatfoot? If you do decide upon treatment, what are your preferred methods?*

D'Amico: Not all pediatric flatfeet are pathologically functioning feet. The height of the arch is not a

Continued on page 108

Pediatrics *(from page 106)*

criterion to determine the type and amount of pathology present. Both the high and the low arched foot may function well. The real question that should be asked is whether or not the asymptomatic excessively pronated foot should be treated in the pediatric patient, and the answer is an unequivocal yes. Justin Greisberg, MD, in his chapter on Adult Acquired Flatfoot stated, "Perhaps the most important treatment for the adult acquired flatfoot is prevention. If the at-risk foot could be identified early, intervention might prevent the deformity."

Excessive pronation is a poor postural position that sets the stage for future dysfunction and deformity and is abnormal at any age, but is especially more significant and potentially more damaging in the developing child. Doctor Tax, the "Father of podopediatrics," used to add "and if you can see it, it is excessive."

Treatment is aimed at identification of the underlying pathomechanical deficiencies creating the excessive pronation, and then neutralizing its compensatory effects. This can be achieved via serial plaster immobilization especially if the condition can be identified prior to weight-bearing. The most commonly occurring structural imperfection causing excessive pronation in the child that must be identified is compensated forefoot varus. A recent study, presented at the annual 2018 Richard O Schuster, DPM, biomechanics seminar, of the biomechanical examinations of one hundred randomly selected pediatric patient charts from three to twelve years of age revealed the incidence of forefoot varus to be ninety-two percent. This was in line with a previous study of adult forefoot varus, which revealed its incidence to be eighty-seven percent.

Additionally, and as part of that same pediatric study, the incidence of flexible forefoot valgus was found to be eight percent. The incidence of rigid, or true, forefoot valgus was zero percent, and the incidence of gastrocnemius/soleus equinus as evidenced by a limitation of ankle dorsiflexion (less than 10 degrees) with the foot held on the supinatory side of neutral was also zero percent. This finding does not negate the fact that some children may still exhibit equinus-like function or symptomatology, but this would then be attributed to forefoot or metatarsal equinus deficiencies, hamstring or iliopsoas contractures, or hereditary or functional type equinus influences.

The use of custom foot orthoses that are individually designed to act as exoskeleton retainers to re-align the osseous and soft tissue segments, promote normal function, and encourage ideal development is the gold standard for management of excessively pronated pediatric flatfeet. Ideally, a neutral subtalar position plaster cast should be obtained from which positive plaster models can be created, and the appropriate devices fabricated. Corrective orthotic modifications to be considered in this foot type are similar to those described for Down's syndrome patients and include: three-quarter to one inch deep heel seats, aggressive rear foot control, appropriate forefoot posting extended to the sulcus, and semi-rigid, flexurally forgiving, non-compressible shells. In some children with a collapsible cavus foot type or an identifiable equinus influence, one-eighth to one quarter inch heel raises may be added. Additional control enhancing modifications include: Kirby skive, high medial and long lateral flange, and the Blake Inverted Cast Technique.

Since no two feet are the same from person to person, and also from left to right, I do not prescribe prefabricated orthotics. Another reason is there is no built-in correction for the forefoot deformities present in the majority of children in off-the-shelf devices. In essence what is actually being dispensed are generic arch supports with heel cups and minimally posted, if at all, rear foot posts. With that being said, the over-the-counter devices available today are superior in design to those of prior generations.

Of course, any orthotic device is only as good as its connection to the ground. Therefore, the appropriate stabilizing-type footwear is essential to ensure success. One final point—I encourage the parents to not allow children to walk barefoot at home, and to have their children wear shoes, with or without orthotic devices, in the house.

DeHeer: Pediatric flatfoot is a controversial topic. The decision to treat for me is based on pain or deformity. I employ conservative care prior to any surgical intervention. Often, these patients have a concurrent equinus deformity that must be addressed prior to orthotic therapy. The distal compensation for equinus makes orthotic therapy challenging. Addressing the equinus first allows the foot to tolerate the external support it requires. Surgically, I believe in deformity correction principles. The principles are again removing any deforming force of the leg onto the foot, getting the hind foot perpendicular to the ground, and getting the forefoot parallel to the rear foot. Typically, this means a Baumann Gastroc recession, Evans osteotomy, plus or minus a Cotton osteotomy.

"I think pain is never the only reason to treat pediatric flat foot."—DeCaro

DeCaro: I think pain is never the only reason to treat pediatric flatfoot. In the pediatric population, flat feet will ultimately cause orthopedic problems. In most cases, flat feet are hereditary. Feet apples don't fall far from their feet trees. In other words, one can blame their parents and grandparents for them. Those parents and grandparents can be a terrific future prognosticator for orthopedic ailments that are passed from generation to generation. If parents have flat feet and have had grave shin splints and knee pain, it's likely their four-year-old children will experience the same. Therefore, I am not treating based on pain; rather, I am treat-

Continued on page 110

Pediatrics (from page 108)

ing to prevent pain. In other words, prevention begets correction.

The real answer to the question revolves around the age of the children and the position of the heel. Children typically begin walking when they are between ten and fourteen months old. At this point in their development, the heels are tilted in a six-degree position of eversion, which puts children in a flat-footed position. At ten to fourteen months this is normal. As children grow and mature each year, those everted heel positions reduce by one degree each year until age six, at which point, their heels should be neutral (not tilting into a flat-footed position). In other words, in children up to six years of age, it can be normal to have a flat foot. If children, however, have flat feet at age four, which is coupled with tripping, falling, and lack of coordination, this can be a sign even earlier than age six that the flatness of the feet may indeed be worrisome. From age six to thirteen, children's feet continue to mature to the point at which they should tilt outward about four degrees and have a normal arch.

If children continue with a flat foot appearance beyond the age of six, this is a problem and should be addressed by foot specialists to avoid the foot deformities and lower extremity pains that can ensue.

As such, I have created a rating scale to determine when to, or not, treat asymptomatic flatfeet in one to four-year-olds. I advise using the following three criteria, which can make the decision easier: a) How flat are the feet?; b) Who else in the family has foot problems from whom my children may have inherited this condition?; c) Does the "flat-footedness" seem to be impairing the child, and do the parents sense something isn't right? (For instance, if a particular child never wants to play outside because his or her feet hurt, or is constantly falling and tripping, or is constantly asking the parent to be carried).

Q ***PM:*** *What tips do you have for creating a welcoming environment for children in the office?*

Pagano: I think my staff is very important because the welcoming environment begins the second that children enter the office. In my office, there are toys for the kids to play with, as well as the *Foot Book* by Dr. Seuss. If all else fails, I turn to, just like any other current practicing parent in this world of technology, hand-held digital devices.

DeCaro: In my office, we have a section of the waiting room that features lots of toys and activity mats for kids. After the children are seen, they get to pick from the treasure box. Many kids love coming to the office simply because they know they will be getting a toy at the end. This is highly effective to keep them happy. I also have several fish tanks, and fun pictures on the wall that I have taken of animals from around the world. I also never leave sharp instruments or needles showing. I do not wear a white lab coat because that may scare children.

"I believe engaging children directly is critically important, and reassuring them during the examination by explaining what is to be done before doing it."—DeHeer

DeHeer: I am not sure having pediatric-specific office modifications makes that much difference. I believe engaging children directly is critically important, and reassuring them during the examination by explaining what is to be done before doing it.

Williams: To answer this question, one has to think like a child or envision their own child's interests. The office itself should appear fun with various wall decals, toy machines, toy boxes, and music available to soothe. Likewise, the office should cater to parents by providing kid-friendly waiting rooms and necessities if needed. It can be quite stressful for a parent to bring a child to the office, as many parents are concerned about how their child will cooperate, but also what information will be provided. Support staff needs to be welcoming and motivated in working with children.

D'Amico: I provide pediatric patients and siblings with crayons, paper, and a clipboard to draw. Some of these children create a picture, which I'll hang up in the reception area at the time of their next visit. A few of the drawings I've collected over the years I've had framed, and exhibited at the front desk, so adult patients will inquire about them and often remark, "I didn't know you treated children. What type of problems do you treat?" This gives me a chance to explain to the mom or dad, grandma or grandpa that over twenty-five percent of my practice is children.

I also try not to have children wait to be seen. This is easier said than done since parents are, through no fault of their own, unable to get their young patients, along with their brothers or sisters, friends or family all together, and in on time. Then there's the question of whether or not children are receptive to being seen, not to mention being examined. What all of this means is a good deal of flexibility has to be built into the schedule.

Q ***PM:*** *What are your recommendations for DPMs looking to expand the pediatric portion of their practices?*

D'Amico: I recommend to any practitioner wishing to build a pediatric practice being knowledge-

Continued on page 111

Pediatrics *(from page 110)*

able and being available. Parents can sense whether or not a doctor has the ability, and facility, in handling the pediatric patient. This is intuited by their observation of the doctor's examination skills, and interaction with the children.

As far as availability is concerned I believe it is imperative to be available Saturdays during the school year at least in the morning. Seeing children after school is not as easy as it used to be due to unavailability of the parents, or because of an increasing participation in sports and other academic and social programs. Many times I'll see children before school at 6:45 am so they won't miss any classes.

Children are not miniature adults. They have their own set of special circumstances and needs. What is normal for a one-year may not be normal for a two-year or four-year old. Developmental parameters change rapidly as children grow; so familiarity with normal values is essential to be able to ensure successful outcomes. One must remember that children born today have the opportunity to live one hundred years or more, and what will determine their quality of life when they are sixty or seventy is the ability to walk without pain, and that starts with the feet. It is therefore essential that anything that can be done to improve alignment and function in developing children will produce major health benefits later in life.

"Parents can sense whether or not a doctor has the ability, and facility, in handling the pediatric patient."—D'Amico

Williams: Be available. Parents are often more concerned about their children as compared to themselves. The provider must be able to answer questions to alleviate any parental anxiety. Medicine is ever-changing so it is essential to stay up-to-date on advances in the field.

Caselli: The two major recommendations that I have for expanding the pediatric portion of a practice are: heavily marketing the areas of pediatric podiatry that the podiatric physician would like

Continued on page 112

Pediatrics *(from page 111)*

to pursue, and acquiring as much knowledge and clinical training in those areas as possible in order to provide the best care to the children presenting to the office.

Marketing the pediatric part of a practice may include podiatrists presenting themselves to local children's shoe stores. I recommend speaking to the owners, asking to leave business cards, and offering to set up times to give talks on children's foot problems at the shoe store. Contacting key individuals involved in the local children's sports teams, and offering to give talks to the parents on foot health and safety can also be useful. Both local and private schools should also be approached. In addition, podiatrists should contact local physical therapy groups, or early childhood intervention centers that work with children with neurological, or myopathic, diseases such as cerebral palsy, Down syndrome, or muscular dystrophy. Many of these children require foot orthoses as well as other podiatric foot care. Moreover, podiatrists should introduce themselves to the local pediatricians. After treating children in the office, podiatrists should send letters to their pediatricians with their clinical findings and treatment plans. Lastly, podiatrists should not forget to mention in their advertising that they treat children's foot and walking conditions.

DeHeer: I recommend visiting pediatricians in one's area to inform them that children with foot conditions can be treated. Additionally, when seeing adult patients, if these patients have a deformity with a congenital component, I recommend asking them if they have children. Indeed, their children may have similar foot deformities. This is an excellent way to increase one's pediatric patient base.

DeCaro: In addition to all of the above fine recommendations, I have to add joining organizations like the American College of Foot & Ankle Pediatrics, which is a non-profit affiliate of the APMA. It strives to disseminate new and advanced information on the latest techniques in pediatric foot and ankle care. This is done through participation in seminars, lectures, publications and digital media. **PM**

Dr. Haspel is senior editor of this magazine and past-president of the New Jersey Podiatric Medical Society. He is a member of the American Academy of Podiatric Practice Management.