Deformities of the Child’s Foot

- Deformities of the child’s foot are common:
  - Surgeons at the University of Washington Department of Orthopaedics and Sports Medicine have been discovering and applying effective methods for managing these deformities to optimize the chances for the child to develop a more normal foot.
  - Foot deformities may be congenital (genetically programmed and present at birth) or developmental (caused by nerve or muscle disorders and develop over time).
  - Sometimes the foot appears to be deformed, but the ‘abnormal’ appearance is only an anatomic variation that corrects spontaneously as the child matures. Identifying these variations is important to avoid over-treatment.
  - If surgery is required to manage the deformity, the distortions in each segment of the foot must be carefully defined and the treatment based on sound biological and biomechanical principles.

- Clubfoot is the most common congenital foot deformity:
  - Until very recently, the standard approach to clubfoot deformity correction was the application of a series of partially effective stretching casts, followed by extensive surgery in the infant. This treatment resulted in a foot that was stiff and became painful over time.
  - The present international standard treatment approach - the Ponsetti Method - is a series of 4-8 casts followed by simple, minimally invasive release of the Achilles tendon. This method results in a flexible, strong, well corrected foot that remains comfortable and functional for decades.

- Flexible flatfoot (FFF) is the normal shape of the foot in most babies and at least 20% of adults. It rarely, if ever, causes pain or functional disability and should, therefore, be considered an anatomic variation rather than a deformity:
  - The longitudinal arch of the foot increases in height spontaneously in most children during the first 10-12 years of life.
  - There is no evidence that special ‘orthopaedic’ shoes, orthotics, or any other intervention can create or elevate the arch in a child’s foot.
  - FFF with a short, or contracted, Achilles tendon accounts for approximately 25% of FFF in adolescents and adults. This combination of deformities can cause pain and functional disability.
  - Joint preserving surgery that corrects the flatfoot shape and lengthens the Achilles tendon is used to relieve the pain and improve function.

- Cavus foot deformity refers to a longitudinal arch that is higher than normal. It frequently causes pain and functional disability:
  - Cavus is the result of a nerve or muscle disorder in almost all cases and is, therefore, often progressive (gets worse with time).
The height of the longitudinal arch of the foot has been a concern for parents and grandparents for generations. The presumed association of a flatfoot and pain has been implied rather than proven, yet this fear has generated an industry for treating what we now know to be an anatomic variation in foot shape. Lynn Staheli of the Department of Orthopaedics and Sports Medicine at the University of Washington School of Medicine and at Children’s Hospital and Regional Medical Center, produced clinical and radiographic analyses of foot shapes in normal children, adolescents, and adults. He showed that the average (and normal range of) arch height is lower in babies than in older children and adolescents, the arch height increases spontaneously in most children, and flatfoot is in the normal range of arch heights for individuals of all ages. This normative data was used by others to show that special shoes and orthotics do not have an effect on the development of the longitudinal arch of the foot. Staheli showed that money could, therefore, be saved and negative long term psychologic impact could be avoided by resisting the temptation to use ineffective special shoe wear for normal anatomic variations.

It has been reported that approximately 20% of adults have flexible flatfeet and these should be considered the normal shape of strong, stable feet. They do not cause pain or functional disability and do not need surgery. Some flexible flatfeet in adolescents and adults are associated with contracture, or shortening, of the Achilles tendon. Many of these will cause pain and disability. Surgery is indicated to treat these symptomatic feet. Many surgical procedures have been reported to treat flatfeet, but most reports do not provide strict indications for surgery or critical evaluation of the results over time. Lengthening of the lateral column of the foot by means of osteotomy of the anterior calcaneus was reported by a Welshman named Evans, in 1975, as a way to correct flatfoot deformity. Indications were not reported and the surgical description was terse, which often led to poor results by those who attempted the procedure. However, a long term follow-up article on Evans’ patients indicated that the concept was correct. Vincent Mosca from the Department of Orthopaedics & Sports Medicine at the University of Washington School of Medicine and at Children’s Hospital and Regional Medical Center, studied Evans’ concept in the laboratory as well as in his patients. He developed the concept into a defined technique, reported his early clinical results, and has published clear and detailed descriptions of his interpretation of the technique for reliable outcomes by those who follow the outlined steps. Since Mosca’s initial publication in 1995, the calcaneal lengthening osteotomy has become the standard for surgical correction of flatfoot deformity in the USA and in many parts of the world. His recognition of the need to surgically address the Achilles tendon contracture and the forefoot supination deformity concurrently has improved surgical outcomes for the treatment of flatfoot.


children. Reports from other centers around the world have confirmed the efficacy of his approach.

Vince Mosca has expanded the understanding and clarification of flatfoot deformity to an understanding and clarification of all deformities of the child’s foot. His editorial in the Journal of Pediatric Orthopedics (JPO) on “The Child’s Foot: Principles of Management” has become the foundation and reference for orthopedic surgeons to begin their own understanding of these principles. His subsequent JPO editorial on “The Cavus Foot” set the stage for understanding the principles for evaluation and management of this most complex foot deformity in children.

Mosca reported the first successful treatment for a rare, and occasionally symptomatic, deformity called skewfoot that is based on his principles of management. His soon to be published report on calcaneal lengthening for management of advanced rigid flatfoot deformity (due to tarsal coalition) describes an important change in the paradigm for managing this condition. His principle-based treatment of the acquired dorsal bunion deformity will also soon be published.

Clubfoot is the most common congenital foot deformity. The etiology is most likely multi-factorial, meaning that both genetic and environmental factors determine the development of the deformity. Elucidation of these factors is important. Vince Mosca and epidemiologists at the University of Washington reported a higher incidence of clubfoot in mothers who smoked cigarettes during their pregnancy than matched controls who did not smoke. Even more significant was the fact that there was a dose effect, with higher risk directly related to a greater number of cigarettes smoked per day. The same team of investigators found and reported a higher incidence of clubfoot in families with greater than average ligament laxity. Finally, Dr. Mosca and colleagues are completing a study that shows a consistently greater degree of femoral anteversion in a limb with a clubfoot than in a limb with a normal foot. The significance of this finding is forthcoming, but includes normative information about other parts of a limb with a clubfoot, and might include a genetic association that relates to the etiology of clubfoot deformity.

Future Work

Led by Dr. Mosca, the pediatric foot team of the Department of Orthopaedics and Sports Medicine at the University of Washington School of Medicine and at Children’s Hospital and Regional Medical Center continues to discover and implement principles-based evaluation and management...
of foot deformities in children. His forthcoming book will describe these principles and the relevant surgical procedures.

**Recommended Reading**


