

## Pediatric Developmental Problems

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The most common orthopaedic problems seen in toddlers are:

- in-toeing, due to femoral tension, internal tibial torsion, talar torsion (persistent medial deviation of the neck of the talus), or metatarsus adductus;
- genu valgus (bow-leg) and genu varus (knock-knee);
- pes valgus (flat feet).

In most cases these conditions will resolve spontaneously, as has been substantiated by a number of published studies. However, a small percentage of the disorders will persist if untreated. To prevent the deformity from becoming established and irreversible, treatment must begin while the patient is still young. The chiropractor needs objective criteria to select children whose deformity is likely to persist and thus require prompt management. If femoral torsion persists, it becomes fixed by the time the child is eight.

Gait training by augmented feedback methods may result in correcting by increasing the range of external rotation of the hip. Internal tibial torsion usually resolve spontaneously before the children is seven. In eight percent of cases, in-toeing persists.

Bleck<sup>1</sup> advises treatment in infants up to the age of 18 months if the medial deviation of the foot from the mid-sagittal plane is greater than 10 degrees.

Genu valgus and varus correct without treatment in the majority of patients. However, some cases of genu varus appear to develop into the progressive form of the disorder, Blount's disease. "Flat foot" (pes valgus) must be defined carefully by physical and radiographic examination. Treatment might be considered only for those feet classified as pes valgus with plantar flexed talus of 50 degrees or more. For children with this disorder between the ages of two and six years, a corrective molded (firm) shoe insert may help to improve the abnormal anatomy while natural ligamentous tightening occurs.

Gould<sup>2</sup> in 1989 published in a five-year study of the arch development of toddlers (11-14 months) up to five years of age. The children were placed into four groups of different shoe types.

At initial examination, all of the apparently normal toddlers had pes measurements. There were no cavus feet at that time or at five years of age. Arches developed regardless of the footwear worn, but development was faster during the first two years (until age three years) with arch support footwear. The rapidity of arch development until five years of age continued in those children who wore

longitudinal arch cookies.

Factors in ensuring a neutral foot include: 1) a strong, healthy posterior tibial tendon and muscle; 2) a firm, but not tight, plantar aponeurosis; 3) an adequate deltoid ligament; 4) an adequate, properly placed inferior calcaneonavicular ligament; 5) a neutrally placed, nonconstricted tendoachilles.

The study groups were: Group 1 (50 children), straight last shoes; Group 2 (25 children), straight last shoes plus longitudinal arch cookies; Group 3 (25 children), so-called orthopaedic shoes with long counters, solid shanks, Thomas heels, and 0.312 cm (1/8 inch) inside heel wedges as their main footwear; Group 4 (25 children), same shoes as Group 3, but with a supplemental thin longitudinal arch support.

Findings at First Year of Age -- in the first year study all children showed pes planus (flat feet). There were no cases of cavus foot.

Findings at Two Years of Age -- all children showed longitudinal arch improvement, regardless of what shoes were worn. Arch support footwear (Group 2, 3, and 4) seemed to aid in the more rapid development of the arch than did Group 1 (straight last shoes only).

Findings at Three Years of Age -- arch development occurred sooner when arch support footwear (Groups 2, 3, and 4) were used, particularly with Group 2, the straight last shoe with longitudinal arch cookie.

Findings at Five Years of Age:

Group 1 (25 children), normal arches 60 percent; pes planus 40 percent; hyperpronation 79 percent; genu valgum 88.4 percent;

Group 2 (10 children), normal arches 75 percent; pes planus 25 percent; hyperpronation 75 percent; genu valgum 95 percent;

Group 3 (7 children), normal arches 71.4 percent; pes planus 28.6 percent; hyperpronation 85 percent; genu valgum 93 percent;

Group 4 (10 children), normal arches 60 percent; pes planus 40 percent; hyperpronation 80 percent; and genu valgum 90 percent.

## Conclusions

The incidence of hyperpronation and valgus knees was found to be statistically similar in all groups. Overall, 92.3 percent of the children had valgus knees and 77.9 percent were hyperpronated at five years of age.

Findings in these 52 children suggest that ossification of the sustentaculum tali begins at about five years, but is not completed for probably another one to two years.

Arch support footwear in Group 2 only noticeably enhanced development during the first two years of age. Thereafter, arch development appeared to proceed at almost an equal pace with all footwear.

These findings demonstrated:

1. All toddlers at this early age have pes planus by all parameters (clinical x-ray, photography);
2. There were no cavus feet at any time in the study, even at five years of age;
3. Ossification of sustentaculum tali begins at about five years of age, but is not complete for at least another one to two years;
4. Hyperpronation was present in 77.9 percent of the age five-year -old children; it is apparently the norm regardless of sex;
5. Neutral arches developed regardless of the footwear worn, but were developed faster during the first two years with one type of arch support (Group 2 shoe, straight last plus longitudinal arch cookies). Arch development proceeded approximately equally regardless of the type of footwear worn;
6. Genu valgum was present in 92.3 percent of the five-year-olds, and is apparently the norm at this age regardless of sex.

Bleck<sup>3</sup> states that by seven or eight, the various torsions of the femur, tibia, and foot should spontaneously resolve. This suggests that pediatric patients seen that are older than age eight with abnormal lower extremity posture (genu valgum, flat feet) need attention. Orthotic prescription would be appropriate at this time.

#### Adolescent Flatfoot

Hypermobile flatfoot, by definition, is a foot that has a normal arch when weight is not being borne and a collapsed arch when weight is applied.<sup>4</sup>

The goal of treatment should be to achieve the best possible biomechanical alignment of the foot that will allow for the least amount of adaptive bony changes during growth, the premise being the closer to the ideal biomechanical alignment one can maintain for the foot, the more efficient that foot can function and the fewer deforming forces that will be placed on the structure as time goes by. There are many methods of treatments for the adolescent with idiopathic flexible flatfoot.

The history of biomechanical treatment of the adolescent flexible flatfoot is filled with different types of shoes, inserts, and shoe alterations. The current opinion is that the various types of shoe corrections and types of shoes have been proved to be effective for the correction of nothing more than minor cases of hypermobile flatfoot.<sup>5</sup>

Children with severe idiopathic flexible flatfoot will need to be treated with an in-shoe orthosis.

Generally speaking, the softer and more flexible the orthotic, the more sturdy the shoe needs to be. Without the help of a firm heel counter and a rigid shank in the shoe there will be a medial bulging of

the foot over the broken down inside counter of the heel.

Conversely, if an orthotic is constructed of a rigid material it will work well in a softer shoe, providing the sole material is not so soft as to lead to abnormally rapid compression of the medial aspect during heel strike. The primary goals of the orthotic device should be 1) to control the subtalar joint in a position as close to neutral as possible; 2) to be comfortable to wear during all activities; and 3) to be durable enough to last until the child outgrows them. A secondary goal should be for the orthotics to be affordable, both in the initial cost, the frequency of replacement, and the overall length of time needed to use the device. For example, from age six to 16, the child will change shoe sizes at least once a year. Doctors should not be callous to the total cost of treatment for a flatfooted child over an extended time period and should, when possible, substitute less expensive alternatives when it is doubtful that a different device would give significantly improved function. It is also important to have the orthotic device fit easily in the variety of shoes that would be socially acceptable to the child and parent.

The goals of conservative treatment of the adolescent flatfoot with in-shoe orthotic devices should be 1) reduction of pain and discomfort if present; 2) to increase the willingness of the patient to participate in activities; 3) reduction of abnormal shoe wear; and 4) a reduction in the amount of abnormal pronation that would be evidenced by less observed calcaneal eversion during gait.

#### Treatment Approach

Support with shoes is used in children one to three years of age. Complete clinical and roentgenographic examinations should be performed when the child is three years of age. If a painful or grossly abnormal flatfoot deformity is present, custom-molded inserts are used during the period of growth.

The treatment of idiopathic adolescent flatfoot in children after age three is divided into three age groups:

*Group 1: four to seven years;*

*Group 2: eight to 12 years;*

*Group 3: 13-16 years.*

In Group 3, commercial off-the-shelf supports are of little use when trying to gain the accurate control necessary in the active Group 3 child. Every foot is different and requires a custom orthosis constructed from a properly taken impression to capture the relationship between the forefoot and rearfoot.

These devices improve the child's ability to function. They reduce the amount of abnormal shoe wear: this we know from years of clinical experience. With adequate in-shoe orthosis, foot problems such as heel spur, bunions, Morton's neuromas, and so forth can be prevented.

Orthotic prescription is an appropriate treatment approach of the adolescent flatfoot.

#### References

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