COMMON GAIT MANIFESTATIONS OF PEDIATRIC CONDITIONS

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It is the intention of this paper to provide a simplified overview of commonly occurring pediatric conditions and their typical gait manifestations as well as a simplified approach to treatment.

Historically, gait analysis in the pediatric setting has been utilized to study pathologic gait conditions. The setting is usually a research-quality gait laboratory, with multiple methods of analysis, including: electromyography (EMG), 2-D and 3-D kinematics, force plate analysis, and video tape recording. The goal in this particular setting is to assess patients preoperatively, to aid in the selection of various surgical procedures, from tendon transfer to tendon lengthening. There are numerous texts available detailing pathologic gait patterns, however, little attention has been given to the more commonly occurring structural deformities.

The normal developmental milestones for locomotion and gait in a child are as follows: sitting, at age 6 months; crawling at 9 months; cruising and walking with assistance at 12 months; walking independently at 15 months; and running at 18 months. These represent the average developmental milestones, which may vary based on patient gender.

An interesting fact about pediatric gait is that by age two, the angular rotations in the sagittal plane closely approximate that of an adult. In addition, the child assumes an adult type pattern of gait at 3 to 5 years.

There are many gait-altering conditions that present in children (in the absence of an underlying neurologic abnormality). The conditions can be divided into two major categories: those which manifest as in-toeing, and those which present as out-toeing. Several variables will alter these pediatric conditions, including the presence of an equinus, limb length discrepancy, or obesity.

Conditions which manifest as in-toeing include: congenital hallux varus, metatarsus adductus, talipes equinovarus, internal tibial torsion, internal knee position, and internal femoral position (secondary to hip position or femoral deformity). In these circumstances, whether the deformity is unilateral or bilateral, the structural condition sets up a situation of abnormal foot mechanics. In general, these children will have functional hallux limitus, hence during their step at the time of heel lift, the great toe joint locks, and their only method of compensation is to further toe inward. This constant intoeing sets up a cycle of intoeing to avoid the problem, all the while making the problem worse.

Out-toeing conditions generally include the following: hallux valgus, collapsed pes valgus, calcaneal valgus with external tibial torsion, and external femoral position. A similar scenario exists for these conditions as well. The individual most often has functional hallux limitus, which combined with a deformity that is externally directed, further increases the abductor nature of the step.

These previously described conditions will not only affect foot and leg function, but they also have postural implications. The variables mentioned will markedly influence the onset of symptoms in a child, as well as the severity of the problem. One condition not yet mentioned is that

of calcaneal apophysitis. This condition most often results in a combination of functional hallux limitus combined with severe impact shock in the very early period of heel contact. This condition must be treated with not only a motion enhancement type of orthotic, but also a non-deforming shock absorber. The majority of conditions that are seen in adults are also seen in children, and are the result of underlying biomechanical faults combined with poor overall conditioning.

The treatment for in-toe and out-toe problems is almost identical. Since both sets of conditions have at fault the problem of functional hallux limitus, correction of that problem is the mainstay of treatment. The use of an orthotic with a first ray cutout, in combination with forefoot and rearfoot posting, eliminates the FHL and protects and stabilizes the deformity. In many cases, the use of a heel lift for the correction of an underlying limb length will be even more effective. If Wolf and Davis were correct, then with time, growth and developmental correctional changes will take place. This does, however, vary with the severity of the deformity and the onset of treatment.

BIBLIOGRAPHY

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