Common orthopedic problems in adolescents

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Abstract

Objective: to review general concepts about scoliosis, osteochondritis, growing pains, back pain, and corrective shoes, since these problems are frequently reported by adolescents.

Sources: review articles, textbooks, Internet databases, and annals were used as source of information.

Summary of the findings: orthopedic problems in children and adolescents are frequently reported during visits to the pediatrician’s office. Five conditions were selected, and their relevant aspects in terms of clinical practice and practitioner’s experience were discussed.

Conclusions: the orthopedic problems discussed in this study are a reality in clinical practice. It is important that clinicians know how to inform parents and patients, and guide them throughout treatment procedures.


Spinal deformities in children and adolescents:
idiopathic scoliosis

Definition and terminology

The spinal column is structured into 25 bones (7 cervical, 12 thoracical, 5 lumbar, and 5 fused sacral vertebrae), which are literally stacked on top of each other, bound together by ligaments and joints; in terms of structure, the coccygeal vertebrae are not considered. The stacking of bones causes natural deviations of the spinal column. The anterior and posterior curves of concavity are part of the physiological position of the spinal column, and are represented by cervical lordosis, thoracic kyphosis, lumbar lordosis, and new sacral and coccygeal kyphosis. Considering the positive and negative values for these curves, the resulting value for their sum should be zero, since they should have similar values in order to null each other. This means that, despite all these curves, the spinal column should work mechanically as a straight and rigid axis to withstand stress, and should be functionally flexible in order to allow movement. This mix of opposite behaviors (rigidity and flexibility) is the result of a complex stabilization system formed by muscles that contract and relax harmonically and absorb any impact exerted on the spinal column structure.

The spinal column is the master axis of the whole muscular and skeletal system; all the other systems and tracts of the human body are organized around it. It is one of the first structures embryos develop, forming the appendices that, in their turn, give rise to the limbs and other body segments. Therefore, diseases that affect the spinal column structure and function may affect the whole body. Biomechanically speaking, the spinal column influences and is influenced by positioning and stress of the pelvic and scapular belts, and upper and lower limbs, respectively. The spinal column also distributes the nerves that command and coordinate body movements. It also houses the spinal cord,

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part of the central nervous system, which is essential for the sensitive and motor communication in all segments located below the skull. Postural deformities and alterations should not be evaluated only in terms of bone structure, but also in terms of the functional assembly represented by the spinal column.1

The term scoliosis refers to a lateral spinal curvature. It is technically represented by a deviation of the coronal plane which is not normal when the spinal column is at rest. In addition to the deviation found in this plane, there may be deformities in the axial plane (rotation) and in the sagittal plane (lordosis or kyphosis) associated with the curve. These deformities usually affect the thoracic and lumbar segments, either separately or as a whole, thus producing curves that arrange themselves to counterbalance stress or pressure. The thoracic segment is more commonly affected since it is more rigid than the lumbar segment. The lumbar segment tends to curve itself in a compensatory fashion. The curves are measured according to their angular disposition using a universally applied method developed by Cobb.1

Etiology

The spinal column of newborn infants is straight in all planes with a slight cervical lordosis caused by the volume/size/weight of the skull. Around the fourth month of life, when neurodevelopment allows for cervical balance, physiological curves begin to form. When newborns are able to sit down (around the seventh month), there is some cervical lordosis and a long thoracic and lumbar kyphosis.7 When newborns are able to stand up, lumbar lordosis is formed, and with its development, the body balance and support strategies are also formed, by means of position control of the body gravity center. In the sagittal plane, there are no physiological curves; their pathological development occurs at any stage of development. Figure 1 illustrates the spinal column curves.

Scoliosis is schematically grouped into primary and secondary scoliosis. Primary scoliosis results from intrinsic spinal column deformities, whereas secondary scoliosis originates from the position or disorders of external elements, for instance, lower limb length inequality. Primary scoliosis may also be classified into congenital and acquired scoliosis. Acquired scoliosis, in its turn, may be grouped into idiopathic, traumatic, infectious, neuromuscular, tumoral, and degenerative. Scoliosis can be further described as to the side of convexity of the curve, thus indicating its direction (Ex. right scoliosis has the convex side toward the right). The curves may also be nonstructural or structural, compensated or uncompensated. The latter case is related to an initial curve that can be later compensated for by a curve in the other direction, allowing head and shoulders to be leveled, hiding the effects of cosmetic and functional unbalance despite relative trunk shortening.3

Figure 1 - Spinal column curves
Idiopathic scoliosis

In our study, we paid special attention to primary, idiopathic scoliosis, which affects children and adolescents, and causes a series of deformities. These deformities are usually detected by the pediatrician, who should identify and refer them for specialized treatment. Idiopathic scoliosis is highly prevalent and has good prognosis in most cases. It is divided into infantile or early onset scoliosis (affecting children younger than 3 years of age), juvenile scoliosis (from 3 years of age to adolescence), and adolescent scoliosis. Nowadays, since juvenile scoliosis is very rare, and it is difficult to determine the actual age at which curves start to form, we consider only two types: infantile scoliosis, and adolescent scoliosis; the age of 5 is the dividing line between these types. The curves that occur in children younger than five years are mostly benign, and are resolved spontaneously in 90% of cases. The remaining 10%, however, may be progressive and lead to severe deformities, especially due to the worse prognosis obtained during the adolescent growth stage. These curves were carefully studied by Mehta, who devised a specific classification and guidelines for the prognosis.4 The scoliosis with onset between five years of age and adolescence is more prevalent and is usually more benign when it occurs at a later stage. Therefore, there is a narrow relationship between the severity of prognosis and the individual’s growth capacity.

Epidemiology

School screening was used for the detection of scoliosis in several regions worldwide. Approximately 15% of individuals between 10 and 14 years of age may show some kind of asymmetry that can be visually detected and then confirmed by x-ray examination.5 However, only 10% of these cases might show some progression, and only two in every 1,000 might have a magnitude higher than 20º. The sex ratio was 10/1 (female-male); we considered a female adolescent, age of onset between 10-12 years, with thoracic curve towards the right, as a classic case of scoliosis. Forty percent of those adolescents in which a scoliosis of five degrees or higher was diagnosed had nonstructural curves associated with pelvic disorders which, in their turn, revealed lower limb length inequality. The remaining 50% presented slight thoracolumbar curves with spontaneous resolution. The term “scoliosis” was used to describe these adolescents; the term is related to probable variations of normality that do not require specific treatment due to their good prognosis.6

No inheritance pattern was established; however, the risk is considerably increased by family history. This fact is considered when trying to infer on the progression estimation.1

Diagnosis

Scoliosis is usually detected by family members, physical education teachers, pediatricians, and orthopedists on routine examination. One of the usually observed aspects is the asymmetry of shoulder height or dorsal asymmetry, which occurs when the curves become apparent and show a degree higher than five. Since the condition presents a slow progression in the beginning, most patients seek an orthopedist several months after their family’s first detection of the deformity. Pain is not frequent in idiopathic scoliosis; when this happens, the etiology might be associated with tumor or compression.

It is highly recommended that screening tests be carried out in routine school physical examination for early detection, referral for treatment, and staging of scoliosis. The semiology of scoliosis consists of a simple series of exams, which begin with body observation, and analysis of spinal column symmetry. In these examinations, we have to pay attention to shoulder height, the angle formed between arms and trunk in the axillary region, and the position of the head in relation to the trunk. A classic examination is the Adam’s test, described in 1865, in which the patient bends forward with his/her arms loosely extended and the palms held together, without flexing the lower limbs. From a tangent view, the spinal column alignment and possible asymmetry of the paravertebral region may be perfectly observed. The discrepancy of lower limbs and pelvic misalignments that may cause scoliosis should be assessed.7 Another important aspect is the identification of clinical signs that can help to obtain a syndromic diagnosis, which may be etiologically related to the deformity (Marfan’s syndrome, neurofibromatosis).

If there is clinical suspicion of scoliosis, standing PA (posteroanterior) and lateral x-rays of the spine should be performed; in this case, the whole spinal column, or at least the thoracolumbar segment should be exposed.3 The deformities of the spinal column are measured in degrees, according to Cobb method. This method consists in checking the angulation between the line that touches the upper vertebra cranial border and the tangent to the lower vertebra of the curves. Anteroposterior x-rays in prone position, with maximum lateral inclination, may be used to check the flexibility of the vertebrae. A regular wrist x-ray for bone age should be carried out to assess the prognosis of skeletal development, which is estimated by Greulich-Pyle standards.8 Another parameter used to estimate maturity is the Risser sign,9 ranging between 0 and 5 according to the ossification of iliac crests. This ossification follows a chronological pattern from anterior to posterior, and is a good parameter for the estimation of skeletal development.

Magnetic resonance should be performed on a regular basis3 in patients who have curves that do not follow usual standards (Ex.: Adolescent with curves toward the left), that is, adolescents with slightly progressive curves, and pain
Tumor and structural alterations of the spinal column such as syringomyelia may initially present themselves as scoliosis.

**Treatment**

When the diagnosis of scoliosis is established, there are some questions that need to be asked in order to organize therapeutic guidelines. The following considerations are only general guidelines; each patient should be assessed individually and privately. After detecting idiopathic scoliosis, ask the following questions:

- What is the intensity and pattern of the curve?
- How old is the patient, what is the possible time for evolution of the deformity, and how is it expected to grow?
- What is the degree of flexibility or structuration of the curve?
- Is it definitely a case of idiopathic scoliosis?

The first question is pertinent since curves of less than five degrees should be only observed, with occasional photographic documentation, and follow-up every four months in order to monitor their progression. Curves of 5º to 20º require investigation and regular x-ray examination (every three months); should there be progression of these curves in the meantime, postural and corrective exercises should be initiated. Curves of 20º to 40º require the use of braces (orthoses) or braces. Curves of more than 40º should be referred to surgical treatment, considering their potential for progression, their location, and their compensatory incapacity. King classified the patterns of manifestation of these curves into five types, relating them to prognosis, and indicating the levels of surgical treatment. It is known that curves of 50º compromise the respiratory activity to some extent; however, the respiration activity is more severely hindered when curves present more than 60º, which reinforces the necessity for correction.

The second question is related to the association between growth potential and poor prognosis for the progression of scoliosis established by Winter. From the skeletal development standpoint, the younger the individual and the faster the progression of the curve, the worse the probable evolution will be.

The third question is related to the fact that the more flexible and more nonstructural the curves are, the better the prognosis will be. Curves of low intensity (<20º) and great flexibility may have spontaneous resolution. Rigid curves and those of high intensity (>40º) have a poorer prognosis.

The fourth question is related to the fact that the etiology of scoliosis has not been identified yet and thus the condition would not fit into the reported patterns; in this case, treatment should center around the cause, and not necessarily on the deformity resulting from this cause. After the advent of magnetic resonance, syringomyelia is an increasingly frequent condition. Syringomyelias are expansive intramedullary cavities, usually congenital, which, after being treated and after having their pressure reduced through drainage, may help resolution of secondary scoliosis. If syringomyelias are not treated through the surgical treatment of scoliosis, there may be definitive medullar injury.

The answers to these questions can help establish a treatment protocol that may range from simple observation to the use of braces, or surgical intervention.

**Observation**

Observation is extremely important for determining the treatment protocol. For mild curves, the observation should include serial reassessments every two or four months during one year. If no progression is detected, after family counseling, a follow-up can be made firstly every six months and then once a year until maturity is reached. Proportionally to the poor prognosis expectation, the follow-up may be made every month. After initial x-ray examination for curves of less than 20º, photographic documentation may be used in order to reduce exposure to radiation. This documentation is also necessary in case of more severe curves for registering the clinical and esthetic aspects of the deformities. A progressive curve with a good prognosis should be assessed every two months and x-rayed every four months until skeletal stability or maturity is reached. Less severe scoliosis may not present significant symptoms and is usually accepted from an esthetic standpoint.

**Braces (Orthosis)**

Braces, from fixed plaster models to continuous use orthosis, have been used for the treatment of scoliosis for over a century now. A varied number of models are available, among which the most commonly used are the Milwaukee and the TLSO-Boston braces. The braces apply external corrective forces on the apex and extremes of the curves, stimulating the positioning and contraction of the muscles in the opposite direction to the deformity. It is of paramount importance that patients follow the proposed treatment protocol, that is, they have to wear the braces 23 hours a day until the curve is stabilized and skeletal maturity is achieved. Brace treatment is aimed at deterring the progression of the deformity; the complete correction of the curve is very rare.

The indication of braces for the treatment of scoliosis is based on the criteria established by Blount, who determined four parameters for its application:

1. Curves between 20º and 40º, with a current tendency towards 30º and 40º
2. Skeletal immaturity with Risser sign less than or equal to 3
3. Curves with flexibility of 40% of their value
4. Scoliosis has to be actually idiopathic

If these criteria are followed, it is possible to obtain great results from the use of braces.

**Surgery**

The surgical treatment of scoliosis aims to correct the deformities, that is, reduce their intensity. A correction of 40% is considered a good surgical result, however, the complete remission of the curve is preferable, since this can avert the chances of complications. The surgical principle is based on arthrodesis (surgical fusion of a joint). The curves are therefore corrected by stabilizing them in a single bone structure that will no longer be deformed. The corrections are obtained through the fixation of steel or titanium metal rods to the vertebrae, which are molded according to the desired direction. Possible complications of this surgery are: unsatisfactory correction, non-consolidation oarthrodesis, infection, neurological injury, and hypovolemia (each surgically treated level may correspond to a blood loss of 50 to 100 ml).

**Conclusion**

The considerations outlined here are general knowledge that should be shared by all health-care providers who work with children and adolescents. Nowadays, due to recent ethical issues on the actual benefits of these relatively aggressive methods, the minimum values for indication of brace treatment and surgical treatment have been stretched to 30º and 60º, respectively. The concepts of brace treatment have been questioned since there are no clinical assays that allow determining its efficacy. The question is whether braces are really effective or whether they are effective in curves whose natural progression would not occur. An argument in favor of this is that few patients actually use braces all the time as recommended. Lastly, all the concepts described here were elaborated by collecting data about other study populations apart from Brazilians; therefore, the application of such studies to the Brazilian reality may be put in check.

**Growing pains**

**Definition**

Growing pains affect children aged 4 to 10 years. This type of pain usually occurs during the night, and is often associated with physical effort. The pain is totally resolved after some sleep and rest.

**History**

1823 - Duchamp uses the term “growing pains”.
1925 - Polack writes that children may have muscle pain during their developmental stage, especially during the night, and that the pain would resolve spontaneously by the morning.

1960 - Brenning studied 676 children with growing pains, establishing patterns for their manifestation and differential diagnosis.

**Etiology**: Growing pains are believed to be caused by muscle fatigue which, similarly to what happens to adults, appears after excessive physical effort.

**Incidence**: growing pains affect both males and females, regardless of race or social status, at the same frequency, but they are more prevalent in sedentary children.

**Clinical signs**: growing pains usually affect the lower limbs bilaterally. The most commonly affected regions are: one third of anterior thigh region, popliteal region, and calf. Children are not able to indicate the aching point precisely. Orthopedic, neurological, and vascular examination is absolutely normal, and there is no joint movement restriction of hips, knees, ankles, or feet. There are no gait alterations, and static inspection, clinical examination, x-rays, and lab exams have normal results. However, due to differential diagnoses, some tests for the detection of systemic infection, muscle enzyme levels, metabolic and electrolytic profile, and in-depth blood analysis must be performed.

**Differential diagnosis**: growing pain is a diagnosis of exclusion, in other words, it can only be diagnosed after ruling out rheumatic, hematologic, and lymphoproliferative diseases, bone tumors, osteoarticular infections, Legg-Calve-Perthes disease, transitory synovitis of the hip, and myopathies. The hypermobility syndrome is characterized by excessive joint laxity, which is frequently associated with pains that are similar to growing pains.

**Treatment**: the use of medication must be avoided, except in cases of intense and recurrent pain. In these cases, moderate painkillers such as paracetamol and AAS can be used. Physical activity must be encouraged in order to provide better conditioning and avoid new crises.

**Prognosis**: growing pains have a benign prognosis and spontaneous resolution with maturation of the musculoskeletal system.

**Back pain in children and adolescents**

**Introduction**: back pain is extremely frequent in adults and is related to mechanical and postural problems, with a high somatization level. Back pain in a growing patient is...
rare, and requires careful investigation since it may be associated with relatively severe conditions.\textsuperscript{23}

**Clinical history**: information about the progression of pain with recording of crises and etiological agents, as well as of the presence or absence of trauma, length of pain, fever, weight loss, weakness, and sensitive and sphincteral alterations must be collected.

**Physical examination**: an orthopedic examination was performed by carefully palpating the whole spinal column and dorsum with the aim of identifying location points. Anomalous curves (scoliosis) or exacerbation of normal curves (kyphosis and lordosis), muscle contracture, and points of cutaneous hyperalgia. A careful neurological examination must be also performed in order to evaluate gait, motor and sensitive functions, root tension tests (Lasegue, Bragard), assessment of normal and pathological reflexes (Babinski).

**Criteria for detailed clinical evaluation according to Thompson\textsuperscript{19}**
- Continuous or progressive pain.
- Systemic symptoms such as fever, malaise, and weight loss.
- Neurological signs and symptoms.
- Intestinal and urinary dysfunction.
- Age less than four years, when one should suspect of tumors.
- Left convex thoracic scoliosis and pain.

**Diagnosis**

*Spondylolysis and spondylolisthesis*: spondylolysis refers to a defect in the pars interarticularis, which may cause instability in the vertebra. Spondylolisthesis is the anterior or posterior slipping of a vertebra on its lower counterpart. The symptoms include progressive lumbosacral pain associated with muscle strain, usually in early adolescence. Plain x-rays are often sufficient for diagnosis. The treatment initially consists of rehabilitation but, depending on the deviation, surgical intervention is required.

*Scheuermann’s disease*: usually affects the thoracic vertebrae, but it may also affect the lumbar region. It is often associated with round back deformity, and biomechanical factors are usually involved in its etiology and progression. The treatment consists of postural correction.

*Herniated disc*: a rare condition commonly associated with traumatic events such as, fall from heights. The diagnosis is made by computerized CAT scan and magnetic resonance imaging.

*Spondylodiscitis*: tuberculosis is the most frequent cause of subacute vertebral discitis in our environment. Infectious spondylodiscitis is usually more acute, and can be treated with antibiotics. An indicating sign of spondylodiscitis is localized pain with or without infectious systemic symptoms. The diagnosis can be early established by MRI. Drug treatment must be implemented as early as possible, and in cases of abscess or medullar compression, surgical intervention might be necessary.

**Bone tumors**: usually present in painful scoliosis, especially in cases in which the curves do not follow the normal pattern. Pain often results from strain, but may be present at rest as well. The most frequent types of tumor include osteoblastoma, osteoid osteoma and aneurysmal bone cyst.

**Medullary tissue tumors**: the presence of pain with continuous muscle contracture and progressive neurological alterations require investigation of the medullary tissue. Due to the slow progression of these lesions, the medullary tissue normally accommodates itself in such a way that large tumor masses can result in a discreet neurological exam. MRI must be performed even if the results of the neurological examination are normal.\textsuperscript{24} Syringomyelia is often associated with spondiosis and pain events.

**Psychosomatic causes**: less frequent events used as diagnosis of exclusion. Psychosomatic causes are more commonly found in adolescence, and are usually associated with psychological stress. They are refractory to drug and physical treatment and may require adjuvant psychotherapy.

**Considerations**: if children and adolescents report back pain, more complex exams (MRI) should be carried out, especially if there is consistent clinical suspicion. Such exams help the differential diagnosis of back pain.

**Common osteochondritis in adolescents**

**Osgood-Schlatter disease**

*Definition*: simultaneously described by Osgood\textsuperscript{25} and Schalater\textsuperscript{26} in 1908, this condition consists of an inflammation (apophysitis) of the anterior tibial tuberosity, at the insertion of the patellar ligament.

*Incidence*: it is more common in boys aged 12-14 years who practice intensive physical and sometimes athletic activities.

*Etiology*: still undefined; on the other hand, it is largely known that an overload on the patellar ligament, at its tibial insertion, provokes microfractures and fragmentation of the growth cartilage.

*Clinical status*: anterior knee pain, in the region of the anterior tibial tuberosity, right at the insertion of the patellar ligament. The pain worsens with physical exercises, especially after running or jumping, or in the event of
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Compression and slight traumas. Children may complain of swelling, heat (calor) and redness (rubor) in the affected area. The pain does not produce functional restriction, and usually improves with rest.

*Radiographic examination*: important for the diagnosis and prognosis of the disease. Antero-posterior images and a profile image for comparison with the contralateral plane must be made. The fragmentation of the tuberosity and its collapse may be observed.

*Treatment*: basically conservative, including only physical activities during the periods of intense pain. Local cryotherapy and use of nonhormonal anti-inflammatory drugs for a short period produce significant relief of symptoms.27

*Prognosis*: symptoms tend to disappear over time, with the cessation of the growth stage, leaving no sequels. Symptoms may persist; however, local volume may occur.

**Sever’s disease**

*Definition*: inflammation of the growth plate of the calcaneus that largely affects children and adolescents causing a lot of heel pain.

*Incidence*: appears between the ages of 5 and 12 years, especially in boys.

*Clinical status*: talalgia or heel pain is associated with overuse, causing a restriction on functional performance. There is an association with obesity and the beginning of sports activities. The reduced thickness of the calcaneal fat pad and of the corneal layer is associated with the development of the disease. This probably occurs due to low stimulation of the heel caused by continuous shoe-wearing and sedentariness, with shortening of the tricipital muscle. The fragmentation of the growth center may be viewed radiographically, however this may occur in the absence of clinical symptoms.

*Treatment*: use of padded insoles for protection of the calcaneus in addition to local cryotherapy. Nonhormonal anti-inflammatory drugs may be used during pain attacks, and sports activities may be suspended.

*Prognosis*: spontaneous resolution after ossification of the epiphysis.

**Köhler’s syndrome**

*Definition*: avascular necrosis of the navicular bone.

*Incidence*: appears between the ages of 4-6 years, but its onset occurs a bit later in girls. It is bilateral in 20% of patients, and is six times more frequent among boys.

*Clinical status*: pain and a discreet edema on the medial and dorsal face of the foot, with limping and functional involvement. Radiographic examination usually shows increased density of the navicular bone, with irregularities in the ossification center. However, 30% of boys and 20% of girls may present radiographic alterations without any clinical repercussion.

*Treatment*: Williams and Cowell showed that the use of ankle-foot orthosis until remission of symptoms decreased the time of evolution of the disease from 15 months to two months.28 Mild pain attacks may be treated with local observation and care.

*Prognosis*: resolution is complete, without sequels in the adult phase.

**Freiberg’s disease**

*History*: this disease discovered and described by A.H. Freiberg in 1914 was initially defined as a “fracture without deviation of the second metatarsal”.29 Freiberg’s disease is a lesion that normally affects the head of the second metatarsus, but may affect the third and fourth metatarsal bones as well.

*Incidence*: more frequent in girls than in boys (3:1 ratio); usually occurs in the second decade of life; affects preferably the head of the second metatarsus, followed by the epiphysis of the third metatarsus; usually unilateral and symmetric.

*Etiology*: since the second toe is longer and the second radius is less flexible, excessive pressure on the metatarsal head, due to weight bearing, may cause repeated microfractures, deficient blood irrigation to the subchondral bone, collapse of the trabecular bone, and cartilage deformity (impingement lesion, as proposed by McMaster). Today, the trauma alone is believed to produce the alterations observed in Freiberg’s disease. The multifactorial etiology of the disease is widely accepted, including repeated microtraumas, deficient metaphysseal-epiphysial circulation of the metatarsal and the development of osteochondral microfractures.

*Classification*: Smillie 30 showed different developmental stages of Freiberg’s disease, including the normal aspect of the metatarsus from the initial stage up to the final stage, with flattening, degeneration, and loss of joint function.

*Conservative treatment*: depending on the stage of the disease, the relief of body weight pressure on the affected metatarsal heads is recommended.

*Surgical treatment*: includes curettage with bone grafting (Smillie), osteotomy (Gauthier and Elbaz) and shortening of the metatarsal (Smith et al.).3

**Legg-Calve-Perthes disease**

*Definition*: hip disorder caused by necrosis of the capital femoral epiphysis.

*Incidence*: symptoms appear between the ages of two and twelve years, but is more prevalent between the ages of
four and eight years. The male/female ratio is 4:1. Caucasian children are predominantly affected, and in 20% of the cases, there is familial predisposition to the disease.

**Etiology:** still unknown; however, several hypotheses point to interruption of blood supply to the capital femoral epiphysis. The possible causes include endocrine disorders, trauma, inflammation, inadequate nutrition, and genetic factors. The most popular theory is that of interruption of blood supply to the epiphysis, with multiple episodes of bone infarction.

**Clinical status:** limping is usually present and, sometimes, combines with pain, affecting gait. The onset is often insidious, and symptoms worsen with effort. The pain normally occurs in the inguinal region and spreads into the antero-medial region of the thigh; knee pain is usually reported as well. Hip movement is restricted first in terms of rotation and then in terms of abduction. There is thigh atrophy and atrophy of the calf on the affected side; leg length inequality may occur due to the collapse of the capital femoral epiphysis and because of growth cartilage fusion.

**Differential diagnosis:** hypothyroidism, multiple epiphyseal dysplasia, slipped femoral epiphysis, hemoglobinopathies (sickle cell anemia), tumors (osteoid osteoma, lymphomas, eosinophilic granuloma, pigmented villonodular synovitis, and chondroblastoma), Gaucher disease, infections, rheumatological diseases, tuberculosis, and transient synovitis of the hip (toxic synovitis, irritated hip syndrome).

**Radiological examination:** three stage can be seen by plain x-ray: smaller femoral head epiphysis and widening of articular space on affected side; subchondral fracture; and increased radiolucency within the femoral head epiphysis, characteristic of avascular necrosis. Multiple radiographic classification systems exist, among which the most common are Catterall and Salter and Thompson. Scintigraphy and MRI should be used for early diagnosis.

**Treatment:** the main objective is to maintain range of motion, since this allows containment of femoral head deformity.

**Conservative treatment:** physical activity restriction, observation, intermittent symptom control, Petrie cast, and physical therapy.

**Surgical treatment:** it is still controversial, and should be considered for cases that present clinical, radiographic, or scintigraphic alterations showing poor prognosis. Surgical correction of gross deformities of the femoral head may be necessary.

**Complications:** in skeletally mature patients who had Perthes disease, there are four deformity patterns: coxa magna, coxa brevis, coxa valga and osteochondritis dissecans. In Perthes disease, these four patterns occur in 58%, 21%, 18% and 3% of the cases, respectively. Pain and early degenerative alteration may be present.

**Prognosis:** evidence of poor prognosis includes female children older than seven years with impaired range of motion, obesity, increased epiphyseal injury, involvement of the lateral pillar, two or more signs of femoral head at risk and scintigraphy without revascularization of the lateral pillar. The probability of sequels is enhanced in adolescence since plastic reformulation of the lesion is not possible.

**Corrective shoes**

**Introduction**

Orthopedic corrective shoes are a common practice, and are traditionally regarded as necessary for the normal development of the feet and lower limbs in children. Nevertheless, from a scientific standpoint, there is no evidence that justifies such practice, and besides, the available information shows inefficacy of special shoes for the treatment of certain irregularities of the lower limbs in individuals who are still growing up. One positive aspect may be their placebo effect or parents’ satisfaction. We must remember that the prescription of unnecessary treatments goes against the basic principles of bioethics - nonmalificence. Having to wear shoes that “deform” the feet and result in calluses leads to stigmatization and restricts the freedom of choice; this is only acceptable because, in our society, children cannot defend themselves against it. Most children disapprove of corrective shoes and, quite naturally, quit wearing them. Parents have mixed feelings of connivance and guilt as their children refuse to submit themselves to such “necessary” treatment. Other children simply accept it, and submit themselves to the treatment. On the other hand, this treatment would not be tolerated or accepted by an autonomous adult without complaint; in fact, adults would not bear wearing corrective shoes for one single day. On top of that, the price of corrective shoes is prohibitive; they cost much more than high-tech sports shoes, for example.

**Literature**

Morley published an article in 1957 on the physiological pattern and natural evolution of genu valgum and of flat foot in 1,000 children, which revealed that 97% had flat foot in the eighteenth month of life, and that only 4% continued to have flat foot (mostly without any symptoms) at the age of twelve. Twenty-two percent of the children aged 3-3.5 years had genu valgum; the rate reduced to 1 or 2 % at the age of seven.

Fixen and Lloyd Roberts report that the presence of pes cavus is abnormal before the age of 2-3 years, but deserves careful investigation in case it appears.

Bleck and Berzins, in 1977, conducted a controlled study and concluded that special shoes did not influence the correction of flat foot.
Wenger et al., in 1989, carried out a prospective study with children aged 1-6 years, during three years, and concluded that flexible valgo flat foot have spontaneous correction during the growth process.34

**Discussion**

Children are born with genu varum, which persists up to the first year of life. After that, they present alignment and later valgum deviation until 3.8 years of age, when adult patterns (age of eight) begin to form.35 Evidence shows that the use of corrective shoes is not justified for the treatment of flat foot and physiological genu valgum.

**References**